THE HISTORY OF THE LOWBUSH BLUEBERRY
INDUSTRY IN NOVA SCOTIA 1950-1990

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PREFACE

The North American lowbush blueberry is a very special commodity. It is special in that it provides revenue from abandoned farm land or land that in many instances would otherwise be unproductive; it is special in the unique way it is managed as a crop; and it is special in the way that it is the basis for a single industry that straddles the international border between Canada and the United States.

Blueberries have always been a prized fruit in Nova Scotia and formerly it was only those living near the wild lowbush blueberry-producing areas who were able to enjoy the fresh fruit. Nova Scotia developed a commercial wild lowbush blueberry industry, from 1880 to 1950, with fresh hand-picked berries shipped to New York, Boston, Toronto and Montreal. The development through this period was recorded in The History of the Lowbush Blueberry Industry in Nova Scotia 1880–1950 by the author.

There are only six areas in the world where lowbush blueberries are grown commercially — the five eastern Canadian provinces and the state of Maine. Lowbush blueberry plants are part of our provincial heritage and vegetation; however, it wasn't until the late 1940's that serious consideration was given, by the provincial and federal Departments of Agriculture and the blueberry growers, to further province-wide commercial development of the lowbush blueberry industry.

It was recognized that, if this industry was to be commercially developed, we had to become pioneers in the research and extension work as this information wasn't available anywhere else in the world. The cultivation and management of the lowbush blueberry industry took a lengthy learning process in order to economically produce the highest yields per acre of pest-free blueberries.

In 1951, the provincial lowbush blueberry production was 1,050,000 pounds with a farm value of $115,000. In 1990, Nova Scotia lowbush blueberry production was 27,974,286 pounds with a farm value of $13,997,000.

The development of this industry is a dramatic achievement of Agriculture Canada and the Nova Scotia Department of Agriculture and Marketing working in co-operation with the growers, grower organization and processors. Indeed, the farming of this crop is an exact science.

Within the past 40 years, the introduction of excellent cultural and management techniques, and improvements in processing and shipping and marketing, have introduced Nova Scotia wild lowbush blueberries to over 20 countries throughout the world. This industry has been in a process of tremendous expansion during these years.

An unknown author wrote,

> *"The greatest mistake made by the contemporary generation — any contemporary generation — is that it does not read the minutes of the last meeting. It starts its course with the handicap of having to learn all over again in practice, what it could have learned readily from the records of its ancestors."*

Influenced by these thoughts, the Blueberry Producers Association of Nova Scotia asked the author to prepare The History of the Lowbush Blueberry Industry in Nova Scotia 1950–1990. The author has been associated with this industry since 1948. Beginning as Nova Scotia's first blueberry extension specialist, and through the years working closely with the industry as Director of Horticulture and Biology Services (1962–1978). The author later became the Director of Marketing and

Economics (1978–1986) for the Nova Scotia Department of Agriculture and Marketing, Truro, N.S. Since my retirement in 1986 I have been associated with the industry in minor roles.

I thought I knew the industry well and I set myself eight months to prepare this history; however, in looking back over 40 years, I found many things I had forgotten, many things I did not know, and other events twisted in my memory. I was able to review many of the Annual Reports of the Horticulture and Biology Services of the Nova Scotia Department of Agriculture and Marketing. I also had to turn to many blueberry growers, former federal and provincial blueberry specialists, as well as many of the present blueberry specialists to update my knowledge and refresh my memory.

I would like to thank the following persons for their help: Roger Bacon; Doug Bragg; John Bragg; Bob Burgess; Gary Brown; Stanley Cameron; Keith Crowe; Lorne Crozier; Rick Delbridge; Leonard Eaton; Del Emmerson; Ivan Hall; Charles Harrison; Christie Henwood; Ove Hjilbren; Roy Hoeg; Lloyd Jackson; John Kelligrew; Andrew King; Art Lightfoot; Gordon MacMillan; Albert MacPhee; Mitchell McLean; Ernie Mingo; Don Palfrey; Haldane Reynolds; Dave Robinson; Dick Rogers; Art Sargent; Jack Sibley; Marg Swan; Casey Van Dyk; Maurice Walsh; Bud Weatherhead; George Wood; Doug Wylie; and Lester Wylie.

Many hours were spent in studying published papers, reading personal and committee reports, interviews with blueberry producers, and letters written for specific information. To be certain that every item of information is correct is beyond my capability. Ernest Eaton, a lowbush blueberry research worker for many decades, used to say, "Anyone who cannot read and enjoy 'hearsay' makes a poor student of the Bible".

Gordon B. Kinsman
Truro, Nova Scotia
March 31, 1993

Chapter 1

INTRODUCTION

"While we read history we make history."
George William Curtis

The world's production of lowbush blueberries occurs in the five eastern Canadian provinces and the state of Maine (Fig. 1.1). Blueberry plants are part of the native vegetation and they are well adapted to the temperate climate. The large-scale commercial development of today's lowbush blueberry industry had its beginning in the late nineteen forties and early fifties.

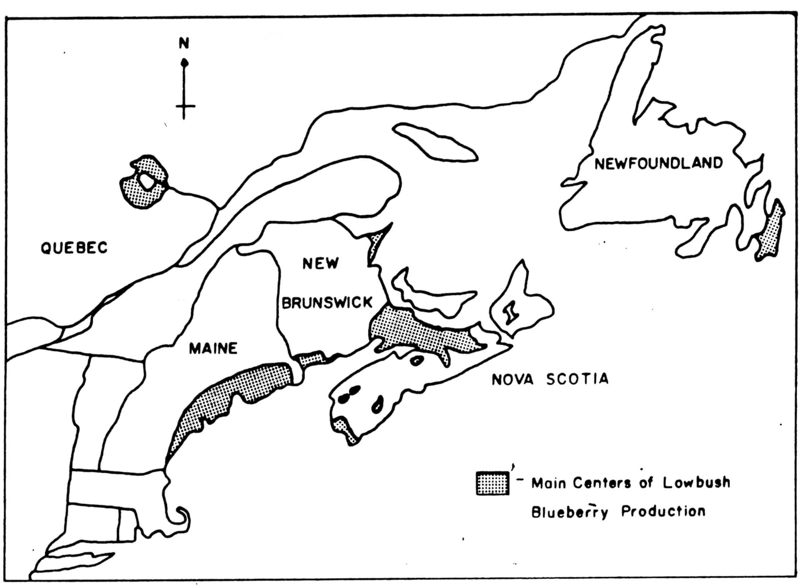


Figure 1.1: Lowbush Blueberries Growing Areas of Northern New England and Eastern Canada

Lowbush blueberries are a booming business in Nova Scotia. In fact, Nova Scotia is the leader in Canadian production. It is also the second largest producer of lowbush blueberries in the world.

Lowbush blueberries are not only part of our provincial heritage and natural vegetation, but they have also become nationally and internationally an important horticultural crop. Frozen blueberries are now Canada's major processed export crop. Today, lowbush blueberries, growing on land unsuitable for most other types of agricultural production, have become the number one fruit crop in the province in terms of total acreage and export sales. Blueberries are a perennial crop and their life span is indeterminate because they can regenerate.

In Nova Scotia, lowbush blueberries are almost entirely grown on land owned by producers and/or processors. Most of the area of blueberry land has been developed from abandoned or run-out farm land in Nova Scotia. Producer size of operation varies from as low as one acre to over 1000 acres. In 1990 the industry had over 1000 producers and the developed lowbush blueberry acreage was approximately 28,000 acres.

In 1951, the provincial production was 1,050,000 pounds with an approximate farm value of \$115,000. Lowbush blueberries are harvested from semi-wild shoots, but in the last 40 years, since the introduction of herbicides, increased pollination, and improved insect and disease control, production has increased dramatically. In particular, from 1980 to 1990, the increased use of the herbicide Velpar, combined with use of fertilizers, has increased production dramatically.

The five-year average production from 1986 to 1990 was 19,313,661 pounds with a farm value of \$10,043,103 and a total value to the province's economy of over \$30,000,000. In 1990, Nova Scotia blueberry production was 27,974,286 pounds with a farm value of \$13,997,000, and with a total value to the province's economy in excess of \$40,000,000.

Projections show this production will continue to increase due to an expanded land base, improved management and cultural techniques, new technology and better marketing. Indeed, the farming of this crop has become an exacting science, and the lowbush harvest is larger than that of any other commercially grown blueberry species.

The development of the lowbush blueberry industry is a dramatic achievement of extension and research blueberry specialists working in co-operation with blueberry growers and their organization.

The overall steady increase in production over the past forty years has been due to a strong production base of privately-owned land; continuous research and promotion of improved cultural practices by governments; aggressive and innovative industry entrepreneurs; ample modern processing facilities; a strong and active producers' association and steadily expanding markets.

Years of unusually high production have been mainly due to a particularly favorable growing season with an abundance of native pollinators and a good supply of moisture. The one year of exceptionally low production (1968) was due to a very late spring frost combined with a prolonged summer drought.

Prices to the producer have fluctuated greatly from a low in 1967 of 7 cents to a high of 61 cents in 1977.

The average price per pound received by the producers in the 1950's was 11.5 cents, and in the 1960's was 14.3 cents per pound. In the 1970's, the grower price averaged 33.6 cents per pound, and from 1980 to 1990 the average price was 47.8 cents per pound. The average price for the 5 year period, 1986 to 1990, was 55 cents per pound.

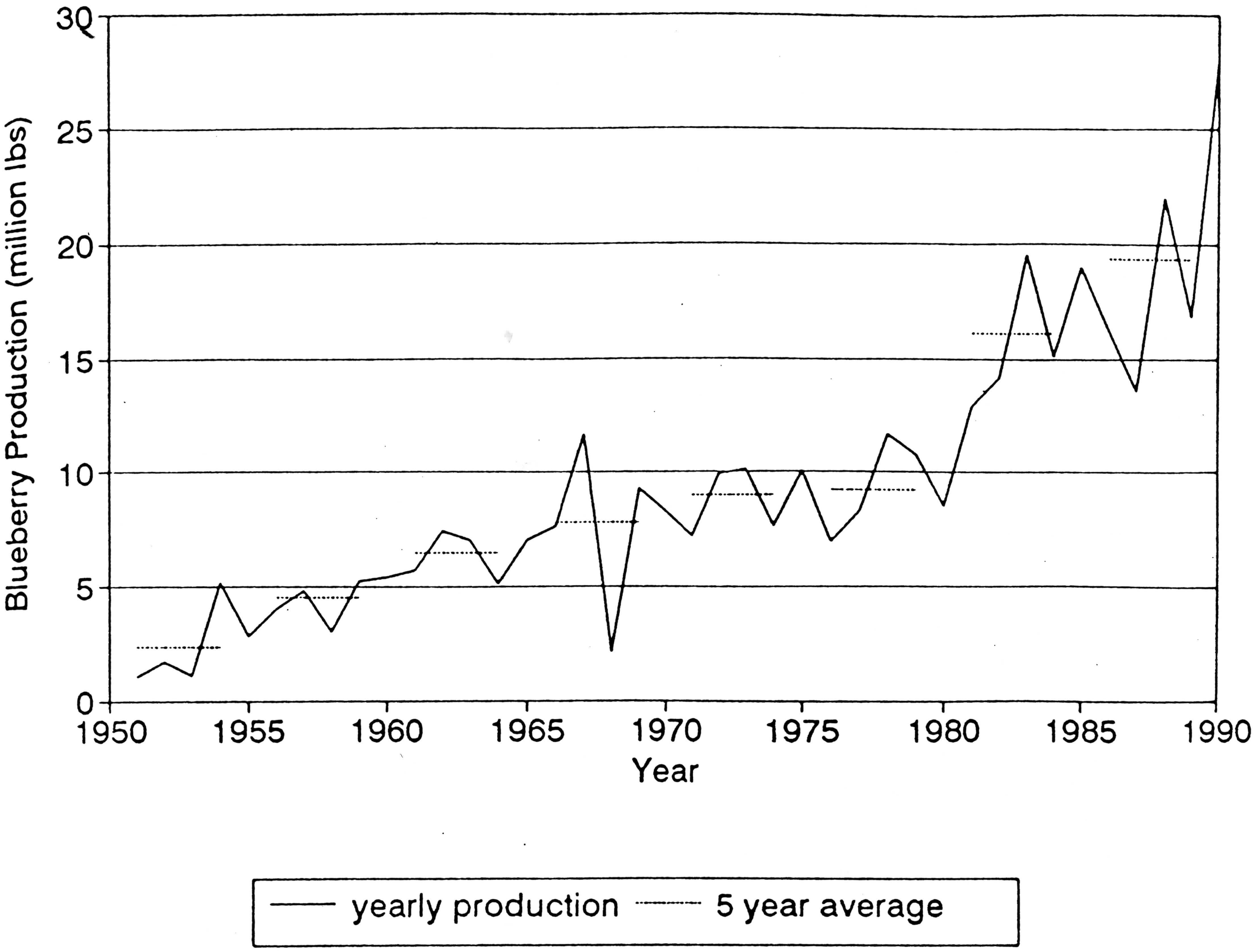


Figure 1.2: Nova Scotia Lowbush Blueberry Production, 1951 – 1990

Table 1.1: Farm Price and Value Nova Scotia Lowbush Blueberry Production, 1951 – 1990

Year	Production '000 lbs.	Average Farm Price $/lb.	Total Farm Value $000
1990	27,994	0.50	13,997
1989	16,832	0.60	10,099
1988	22,005	0.60	13,203
1987	13,525	0.60	8,115
1986	16,212	0.45	7,295
1985	18,951	0.25	4,738
1984	15,107	0.30	4,532
1983	19,502	0.40	7,801
1982	14,114	0.60	8,468
1981	12,866	0.48	6,176
1980	8,461	0.44	3,735
1979	10,762	0.39	4,173
1978	11,659	0.51	5,945
1977	8,275	0.61	5,069
1976	6,914	0.30	2,061
1975	10,001	0.26	2,567
1974	7,603	0.17	1,322
1973	10,101	0.28	2,805
1972	9,930	0.24	2,342
1971	7,151	0.16	1,116
1970	8,240	0.21	1,710
1969	9,232	0.15	1,413
1968	2,089	0.17	352
1967	11,665	0.07	861
1966	7,569	0.15	1,160
1965	7,000	0.23	1,610
1964	5,100	0.15	765
1963	7,000	0.12	840
1962	7,400	0.085	629
1961	5,700	0.09	513
1960	5,400	0.10	540
1959	5,200	0.105	546
1958	3,000	0.125	375
1957	4,800	0.12	576
1956	4,020	0.105	422
1955	2,800	0.08	224
1954	5,126	0.12	615
1953	1,125	0.14	152
1952	1,672	0.15	251
1951	1,050	0.10	105

Source: Nova Scotia Department of Agriculture and Marketing

Table 1.2: Five-Year Average Production Figures, Nova Scotia, 1951 – 1990

5-Year Period	Average Annual Production (lbs.)
1986–1990	19,313,661
1981–1985	16,108,080
1976–1980	9,146,868
1971–1975	8,911,526
1966–1970	7,656,400
1961–1965	6,444,000
1956–1960	4,484,000
1951–1955	2,442,000

Table 1.3: Five-Year Average Farm Price, Nova Scotia, 1951 – 1990

5-Year Period	Average Farm Price $/lb.
1986–1990	55.0
1981–1985	40.6
1976–1980	45.0
1971–1975	22.2
1966–1970	15.0
1961–1965	13.5
1956–1960	11.1
1951–1955	11.8

Chapter 2

PRODUCTION AREAS

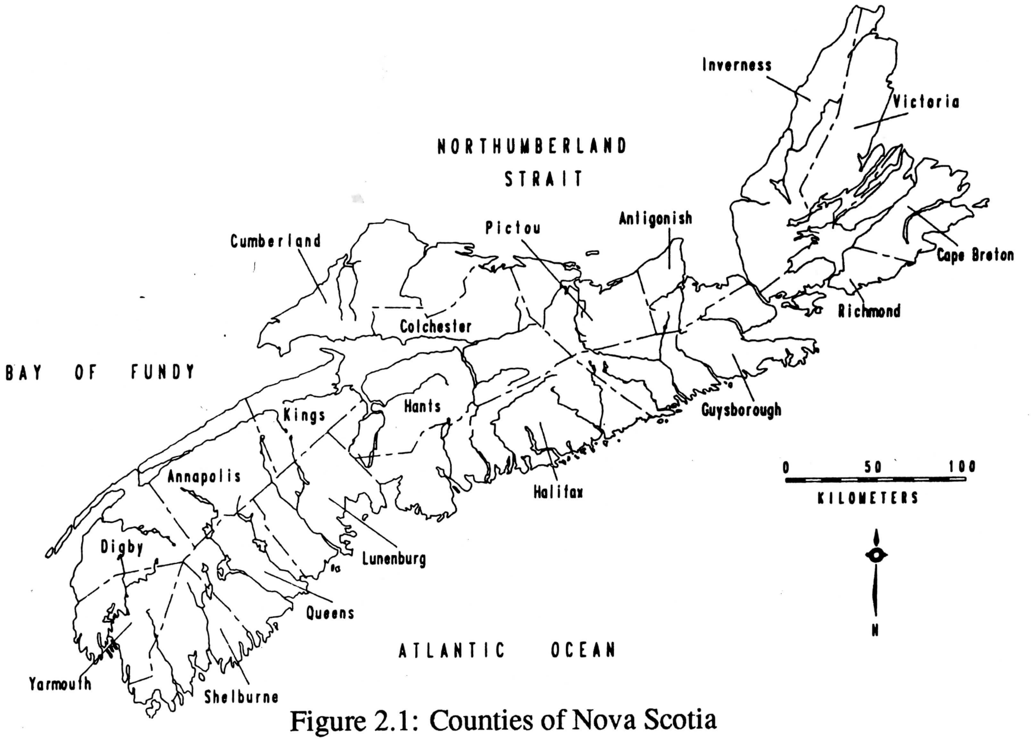


Figure 2.1: Counties of Nova Scotia

Nova Scotia's lowbush blueberry production is based in five areas:

1. Cumberland County;
2. Central area, includes Halifax, Colchester and Hants counties;
3. Eastern Nova Scotia, includes Guysborough, Antigonish and Pictou counties;
4. Cape Breton Island; and
5. Western Nova Scotia, includes Kings, Annapolis, Digby, Yarmouth, Shelburne, Queens and Lunenburg counties.

There have been growers and organizations throughout the five production areas that have been associated with this industry since the early 1950's or even earlier.

2.1 Cumberland County

About 75 per cent of Nova Scotia's present (1990) lowbush blueberry production comes from Cumberland County. There is still undeveloped acreage which could be brought into production in this county; however, improved production will result mainly from improved cultural practices.

Yields are generally higher here than in other areas of the province. Development of large acreages took place first in this county, and many fields have been continually improved by a good cultural program over a long period of time. Many of the present blueberry fields were former farm fields that had been plowed, land levelled, and many of the surface rocks removed. The central part of this county has near ideal soil and climatic conditions for good blueberry production.

Roger Bacon of Upper Nappan, Cumberland County, began his association with the blueberry industry began in 1945. In those early years, hand-picked berries were packed in 32 quart crates and shipped to Eastern Fruit Co., Montreal. After three or four years, some rakes were purchased and the raked berries were cleaned by pouring them on a tarpaulin in the breeze.

The advent of rakes increased production from 3 or 4 crates to 8 or 10 crates per day. Gradually, more of the old pasture areas on the farm were brought into blueberries and this, along with regular burning of the fields, increased production to 20 or 30 crates per day. In ten years time, production increased to 50 to 75 crates daily.

At the same time, Mr. Bacon was buying from approximately 30 growers in the Upper Nappan, Chignecto and Fenwick areas, as well as handling his own fruit. He began to hire about 300 pickers each season and picked fields for Dr. Barnhill in the Sackville, N.B., area and for several other growers.

The blueberry season ran from August 12 to mid September. During these early years of the blueberry industry, fields received very little management. There was some dusting for maggot but very little spraying for weeds. Mowing was done by hand brush cutters and mowing machines.

With community and political life taking more and more of his time, from that time on he sold all his crop to processors such as Gaklis, Halfway River, McLeans, Springhill, and Canada Foods, Kentville, in Nova Scotia, and Wymans in Maine. In 1967, he sold his blueberry business to Roy Hoeg of Athol.

Elmer Bragg, Collingwood, owned a large number of farms and woodlands, in his area, in the early 1950's. He had two sons, Doug and John, who have played a very significant part in the development of the wild blueberry industry not only in Nova Scotia but also in Maine. Doug operates a large production program plus his company manufactures mechanical blueberry harvesters, flail mowers and other blueberry equipment.

John started in 1956 as a school boy to grow blueberries. His first crop was 4000 pounds. Today, he is President and owner of Oxford Frozen Foods, Oxford, which is the world's largest processor of wild blueberries. His company processes 33 per cent of North America's wild blueberry crop and handles 52 per cent of Nova Scotia's crop. He owns two frozen food plants in Nova Scotia and one in Maine, as well as large blueberry holdings in Maine and Nova Scotia.

Cross Roads Co-operative Society, Parrsboro, Nova Scotia, operate a store in Parrsboro. Their manager, Ken Canning, had his first association with blueberries in 1950 when he sold blueberries for a friend to Eastern Fruit Co., Montreal. Later, in the winter of 1952, his members became concerned about the marketing of their blueberries.

In 1953, the co-operative started to handle blueberries for its members and they leased a building from Wilburn Allen, Parrsboro. The following year they built a receiving station at the cross roads north of Parrsboro. A new company, Cross Roads Blueberry Co-operative, was incorporated on June 16, 1954, with a membership of nine. Ken Canning was responsible for the sales and bookkeeping while Clayton Graham was the foreman. The original purpose of this co-operative was to assist the growers in stabilizing prices and to increase their markets.

In 1954 and 1955 they sold their berries to Medomak Canning Company, Rockland, Maine. The U.S. company would supply insecticides and fungicides. The co-operative purchased a power duster in 1953. The first year the demand was for packing in 20 pound tins or one-half bushel boxes. A study was also done to market fresh blueberries in quart, 6 quart and 11 quart containers on the local market. Agriculture Canada fruit and vegetable inspectors were inspecting and grading their fruit.

In 1960 the co-op built another extension on their receiving building, and in 1983 another addition was added. Membership had gone from the original nine to over eighty-five.

In 1956 the co-operative started to sell their total harvest to the Charlottetown Central Co-operative, Charlottetown, P.E.I. Mr. Cam McLean was the manager. In 1956, they handled frozen blueberries from the Tor Bay Canning Company, Larry's River, Guysborough County, and for the Bridgeport Co-operative, Bridgeport, N.S. In 1960 they seriously considered building their own freezing plant but Cam McLean built a freezing plant in Springhill in 1962.

The Cross Roads Blueberry Co-operative has increased their production from 40,000 pounds per year to over 2,000,000 pounds annually (1990).

Dickinson Bros. (Karl and Seymour) are synonymous with blueberries in the West Brook area. In 1926 their sister picked by hand enough berries to buy a violin. Karl and Seymour became involved in 1927 when they sold $1,000 of blueberries that had been hand-picked, put into 32 quart crates, and shipped to New York. In the mid 1930's they shipped 32 quart crates to England. World War II stopped these shipments and they turned to Aylmer's processing plant in Middleton, N.S., to handle their crop. The Dickinsons were one of the province's most progressive blueberry producers.

They were the first growers to try land levelling to improve their fields. In the mid 1950's they, with Gordon Kinsman, Berry Crops Specialist, and C. McNevin, Engineer, Nova Scotia Department of Agriculture and Marketing, visited Maine to see weed rollers in use. On their return home, they built one to use on their fields. The first straw spreader used in Nova Scotia was built for them in 1954 and it is still in use. The first blueberry field research was carried out on their farm when plots were established to test herbicides for weed control. They were the first in their area to use honeybees as pollinators and the first rotary weed sprayer was also used here.

Through the years they began to buy blueberries from the smaller growers in their area. They did the field burning, herbicide, insecticide and fungicide dusting and spraying, and spreading of straw for these growers when necessary. They built their own receiving shed to handle the berries.

This operation is being carried on by Seymour's son, David, and David's sons.

George Georgaklis, Soft Fruit and Produce Company, Boston, was a buyer in the Parrsboro area in the 1920's. It was his pioneering in the field that brought his son Chris to Parrsboro in 1949. Chris Georgaklis was always known in the industry as Chris Gaklis.

From 1950 to 1952, he operated out of Harold Quinn's barn, Halfway River, and he shipped fresh blueberries in 32 quart crates to Boston. In 1953, he built a receiving shed in Halfway River. The first year he installed cleaning-washing-pick-over tables and the berries were put in 20 pound tins. He later shipped fresh blueberries to the United States in 20 pound wooden boxes. In 1967 he built a freezing plant which was attached to his receiving building.

In 1958 he registered his company as Nova Scotia Blueberry Exporters. His father and another brother, Arthur, were partners in the firm. The company name was changed to Christy Crops Ltd. in 1979. The company was later known as International Blueberries Ltd. In 1982 this company went out of business.

In 1980 Christy Crops had 1600 acres of land under cultivation, 800 of which were in production each year. [94] This acreage is now owned by several growers.

Roy Hoeg, Athol, Cumberland County, N.S., started his blueberry operation in 1944 with 10 acres. Today he operates 385 acres in Cumberland County. He built his first receiving shed in 1967 and enlarged it in 1990. He buys blueberries from 80 other producers in three counties. Forty per cent of his sales are sold in Canada and 60 per cent are sold in U.S. markets. He and his company handle approximately 4.5 million pounds annually.

Keith Crowe, East Mapleton, Cumberland County, has been associated with the blueberry industry since the 1940's; however, it was in 1966 that he became involved full-time with the industry. He is associated with Roy Hoeg as half owner of Brookland Products which he and Hoeg purchased in 1969. Brookland Products operates in the Musquodoboit Valley, Halifax County, and they handle approximately 1,500,000 pounds of blueberries annually.

In 1990, approximately 20 per cent of their crop was harvested mechanically.

In 1950, Arthur Doyle, Mt. Stewart, P.E.I., commenced buying small lots of wild blueberries in P.E.I. on behalf of Cam McLean, then General Manager of Central Farmers Co-op in Prince Edward Island. All fresh blueberries were frozen in freezing plants on P.E.I. During the winter months the blueberries were cleaned and re-cleaned for sale to Ontario food processors.

This buying operation expanded to the Parrsboro area during the 1952 crop year. The operation in the two provinces continued, with expansion in 1960, to freezing the blueberries in facilities in Ontario, and they were re-cleaned there, by P.E.I. crews, during the winter months.

During this period (1952–1962) sales to large pie manufacturers and U.S. food processors in the northeast United States expanded.

Arthur Doyle worked with the McLean family in the blueberry business continuously from 1950 to 1980.

Terrence A. Meister of Westchester, Cumberland County, became interested in blueberries in his early youth on his father's farm in New Ross, Lunenburg County, where, in the process of clearing a farm out of woods, the native blueberry, encouraged by the burning, began to flourish. In 1930, when he came to Westchester, he was one of the first in the area to clear land for blueberries. His blueberry land clearing caused a dispute with the Baptist Church where he preached in 1977 which finally caused him to sever his connection with the church. He remained in Westchester as a preacher for the Independent Baptist Church.

The need for additional employment to supplement his income convinced him to buy a property and clear it for blueberries. This he did, one-half acre at a time, until he had cleaned and brought into production about 50 acres. He bought a couple of fields at Lower Greenville and cleared them, ready for production. In 1982, when the fields became too much for him to work himself, he sold them to Bragg Lumber Company of Collingwood. In 1982 Rev. Meister returned to live with his younger brother and his wife on the family farm in New Ross. By his diligent efforts and ambition in clearing and developing land, Rev. Meister showed the potential for commercial development of the blueberry crop in this area.

William C. Cushing, Crawford, Maine, and Albert V. Orff, Cushing, Maine, came to Parrsboro in 1949. Operating under the name of Orff and Cushing, they bought blueberries from local producers.

The first year they operated out of the Parrsboro Curling Club. In 1950, they built a receiving shed in Parrsboro. They were incorporated as Orff and Cushing Ltd., Parrsboro, on August 29, 1957.

They brought the first oil-fired burner (Woolery) to Nova Scotia in the spring of 1950, they were the first company that brought in a lot of metal rakes, and they were the first to use 50-10-40 dust for maggot control. This dust was applied by a hand or powered duster. The company brought in a number of half-bushel baskets, as used in Maine, for the rakers to rake into but the baskets were not accepted by the Nova Scotia rakers.

In 1965, they sold out to William A. Chase, Kennebunk, Maine, who operated this business for a number of years.

In 1968, Canada Foods Fruit and Pickle Division, a subsidiary of M.W. Graves and Company Ltd., Berwick, N.S., purchased the blueberry lands of William Chase. These lands were located within a 30 to 40 mile radius of Parrsboro and consisted of 10 separate lots ranging from 10 to 100 acres each. In 1968 and 1969 additional lands were purchased from William Wheaton and Mr. Murchinson with a few smaller lots from some other growers. This gave Canada Foods approximately 900 acres, approximately 90 per cent of which were producing or had the potential for productive acres.

M. W. Graves and Company Ltd., who was the parent company of Canada Foods Fruit and Pickle Division, was later sold to Stokely Van Camp of the U.S.A.

Stokely Van Camp decided in 1978 to sell its blueberry lands in Parrsboro to Arthur Sargent with the exception of approximately 175 acres of land and buildings at Parrsboro which are still owned by the company.

In April 1984, Stokely Van Camp Ltd.'s farm and processing operations were sold to Cobi Foods, Port Williams, N.S. This company continues to buy blueberries for their Hillaton, Kings County, freezing plant.

From the purchase of the Chase lands in 1968 until 1986, Cobi had their own farm fleet to do field work for growers. In March of 1986, they sold their equipment to Lewis Yorke, Parrsboro, who continues to service many of Cobi's customers today.

Carvell Stonehouse of Millvale, Cumberland County, began his association with the blueberry industry in 1933 on his farm at Millvale, Cumberland County. He picked berries on his lands and bought berries at that time for 2 cents per pound. His first berries were shipped, in quart boxes made of half wood and half cardboard, to the Montreal market where they were sold on commission. At one time, he also shipped to Boston. All berries were harvested by hand until 1940, when Carvell brought in six blueberry rakes from the United States.

In the early 1950's, Carvell arranged for bulk shipment of blueberries in 30 pound wooden boxes to Montreal. When he was not able to sell all these as fresh fruit, he rented frozen storage space at Amherst and Saint John, and sold frozen berries on through the fall and winter. About this time, Chris Gaklis and Orff and Cushing Co. came from the United States and established buying sheds in the Parrsboro area. These developments marked the beginning of the trend toward bulk shipment of berries.

Carvell's interest in business led him into various enterprises over the years. As well as his grocery store and the blueberry business, he operated a sawmill, exported Christmas trees and bought raw furs. At one time, he employed eight fur buyers and bought furs throughout the Maritime region. Beginning in the 1970's, he gradually phased out most of these other business operations and devoted most of his time to the blueberry business.

Over the years, he increased his blueberry acreage by buying abandoned farms in various areas from Collingwood, Cumberland County, through to Mt. Thom, Colchester County. While developing his own fields, he continued to buy blueberries and assist other growers in developing blueberry land. Eventually he was buying berries from over 100 growers, most of whom he had started in the blueberry business. From his first makeshift packing shed in Millvale, he moved to a converted barn in Debert. In 1967 he built a well-equipped receiving shed in Debert. Here he bought and shipped close to 1,000,000 pounds annually.

Carvell passed away in August 1984 and his son Peter, who lives in Debert, is carrying on the blueberry business.

Chesley Walsh, Collingwood, purchased his first blueberry field in June 1950 in Farmington, Cumberland County. The first harvest netted him $250 from berries raked and then winnowed by a home-made cleaner made from a car fan driven by a gas washing machine motor. The berries were packed in one quart boxes, covered with cellophane, placed in 32-box crates and shipped to the Eastern Fruit Company in Montreal. The following spring Chesley "free burned" the field and the second harvest saw the field yield 16 tons worth $4,800.

Upon leasing land at Farmington and Pigeon Hill from Elmer Bragg, Collingwood, on a 10-year lease, he purchased the first burner in Collingwood in 1952. He hauled this burner with a canvas-topped jeep for the first two years.

He saw a good future in the blueberry industry and purchased lands in Musquodoboit, Camden, Debert, Westchester, Millvale, Farmington, Windham, Black River, Wyvern, Street's Ridge and Mt. Pleasant. He kept exact records of every field, the costs, tons of berries produced, prices, etc., and as well had maps and aerial photographs of each field.

Over the years he attended almost every blueberry meeting and field day, and he was an active member of the Blueberry Producers Association of Nova Scotia.

He recognized early the value and use of herbicides, and was often the first to try and test them in his search to improve his fields. Clean, weed-free fields with good healthy plants became his aim and his realization. He was the first in his area to use honey bees in his fields for pollination.

In 1957 he began buying blueberries from other growers and he built the first receiving shed in Collingwood. He used the best equipment and cleaners available on the market. In his first year at the receiving shed he washed and packed some of the berries in 20-pound tins for export to the United States market. Since then, most of the berries have been shipped to freezing and canning plants in both the United States and Canada.

Chesley passed away in 1986. His son Maurice and his grandson Chesley now operate his fields.

William "Billy" Wells, Amherst, began in the blueberry business in 1922 when he hand picked enough berries to fill one thousand 32-quart crates. From this time on, William continued his interest and involvement in blueberries by buying lands in Cumberland and Hants counties and extensively in Prince Edward Island. He sold his berries as a fruit, packed in 32-quart crates and shipped to the Eastern Fruit Co. in Montreal, as well as the markets in Boston, New York, Toronto and Ottawa.

Following the war years Billy sold to buyers for the export market. During these years he became a buyer and purchased berries from the smaller growers. He continued this until 1976.

From his own fields over the years Billy harvested an average annual crop of one million pounds. His main interest during these years was always the blueberry.

In the mid 1970's, he sold his land in Gore, Hants County, as well as some of his lands in Cumberland County, but retained all the land he purchased in Prince Edward Island.

Up until the time of his death in 1984, he maintained an alert and active interest in the blueberry industry. His son Walter operates his blueberry business.

2.2 Central Nova Scotia

Central Nova Scotia has developed steadily during the past several years. This area has good climatic conditions and a good natural acreage base. Production from this region should continue to increase as more fields are developed and existing acreage is gradually improved.

In 1945, Roger Bacon, Upper Nappan, Cumberland County, leased a field in Gore, Hants County, owned by Austin Grant, with $500 borrowed to purchase some equipment, hired pickers from the Shubenacadie Indian Reservation, and began a new venture in blueberries. With the help of his brother Leonard, he shipped over one hundred 32-quart crates per day to Montreal. After a day's picking, the blueberries were trucked from the Gore area to Shubenacadie where they were loaded on the train.

After a few years, burning increased the yields on his farm in Gore and the extra flats of berries were hauled to Halfway River, Cumberland County, and sold to Chris Gaklis who had established a processing facility there.

He sold his lease at Gore in the early 1950's.

There have been a number of blueberry growers in this area who have been involved before and since 1950 in the lowbush blueberry industry. Some of these growers are: Austin Grant, Larry and Albert MacPhee, Arthur Bond, Alfred and Clyde Blois — later Barron Blois, Sid McGinnie, Ralph Grant, Fred and Mowat Kellough, Doug Hill, Gordon Hatfield, William Grant, Moroden Anthony Jr., Ira Dalrymple, Leslie Powell, William Wells, Earl MacPhee, Owen MacPhee, Albert Young and Dennis Casey. These men have a total of over 500 acres in blueberry production, where there is a potential to develop another 20 per cent more acreage plus 20 per cent "fill-in" of fields presently in production. Approximately 25 per cent of these berries are sold as fresh while the remainder is sold to processors.

Rainbow Farms, Upper Rawdon, Hants County, N.S., operated by Bud Weatherhead, has undergone steady growth since he bought his first field in 1972. Two years later he bought another 45 acre field and since then he has increased his acreage. He is presently managing approximately 570 acres of blueberry land in Hants and Pictou counties. He has always been interested in the local fresh market. His fresh sales climbed to nearly 100 tons in 1987. He sells to a local pie manufacturer, to other processors and on the European markets.

Dean Produce Co-operative Ltd., Dean, Halifax County, was organized on August 14, 1967 and it is still in operation. That year they shipped by air 1168 flats (12 pints per flat) or a total of 14,016 pints equivalent to seven tons to Boston. In addition, they sold one and one-half tons of berries on the Halifax market in 12-pint flats and fresh berries were also sold to the Sydney market. In the following years they put up a 10 pound pack of fresh blueberries to sell on Nova Scotia markets; as well, a volume of berries has been sold to processors. They are still operating.

Glenmore Industries, Glenmore, Halifax County, is operated by Bob Burgess and his son Jim, and it has been active since 1952. From 1952 to 1966, a total of 215 tons of blueberries were harvested. Since 1967, greater attention has been given to producing more berries by way of the use of fungicides, herbicides and fertilizers, etc. Land has been levelled, open ditches and tile drainage have been installed, and a storage pond for fire fighting and irrigation use was built. A mechanical harvester is being used. Production has increased from 113,000 pounds in 1967 to approximately

2,100,000 pounds in 1990. Acreage has increased very little; increased production has been due to better cultural and management practices.

Haldane Reynolds, Truro, started his blueberry work in 1958. His blueberry acreage has expanded from 20 acres until he has 140 acres in production in Colchester and Pictou counties. He has been using the latest scientific and extension cultural methods to improve his fields and increase his yields. He has adopted mechanical harvesting although he has some fields that have to be hand raked.

2.3 Eastern Nova Scotia

A continued increase in the development and improvement of acreage in eastern Nova Scotia is also expected during the next several years. Most fields in Pictou and Antigonish counties and the northern part of Guysborough County have very few weed problems and climatic factors appear favorable for development. Production potential on the large tracts of barren land in the southern and coastal areas of Guysborough County is not great because of climatic factors (i.e. short growing season, severe winter kill) and extremely rough terrain. Only a few of these fields are burned on a regular basis, and usually this is the only cultural practice followed. These fields are rough and rocky and, in most cases, they are owned by the province (Crown lands). With no private ownership and severe production constraints, there is lack of individual initiative to develop fields for higher production.

Ray Cameron, Antigonish, N.S., attended a 1955 blueberry meeting in Antigonish. He became interested in seeing if some of the Veteran's Land Act settlers would develop their potential blueberry land. Failing to stir their interest, he began to purchase land, acquiring a property at Fraser's Grant in 1956 and later at New France and Pleasant Valley (all properties were located in Antigonish County.)

He set to work on the lands, doing the cutting, cleaning, burning and spraying on week-ends and holidays while employed in Antigonish. He studied blueberry culture at various short courses.

As his labours began to show fruit, others gradually became interested in blueberry development. He was always ready and willing to share his knowledge and enthusiasm with interested neighbours. In recent years, his son, Bill, and daughter, Colleen, have assumed most of the management of the family blueberry fields, but Ray still maintains a keen interest in all blueberry activities. He is the pioneer and promoter of the blueberry industry in Antigonish County.

In 1933, the Tor Bay Canning Company Ltd. was built at Larry's River, Guysborough County. On March 27, 1934 this company was incorporated under the Fishermen's Co-operative Societies Act and later that year began to can blueberries and salt fish. Blueberry canning was a strong secondary concern to lobsters. In 1939, 5000 cases (24–20 oz. cans per case) of blueberries were canned. This is equivalent to 74 tons of blueberries — all hand picked.

These blueberries were picked primarily from Crown lands. Proper blueberry cultural management procedures were not known and often serious woodlot and barren fires would occur in the middle of the summer which caused severe damage to blueberry plants.

In 1954 a freezer unit was added to the Whitehead fish plant, a subsidiary of the Tor Bay canning plant, and in 1956 blueberries were frozen for the first time. In 1953, sales reached an all-time high; however, from that time on sales decreased, and in 1956 a net operating loss occurred. Co-operative leadership in Larry's River was also curtailed in 1953 when Father C. J. Forest, P.P., the force behind co-operative development in Larry's River and surrounding areas since 1918, was assigned to a new parish in Cape Breton. [82] The Tor Bay Canning Co-operative Ltd. was closed in 1962 as an operating co-operative.

Christy Crops, Halfway River, Cumberland County, purchased and leased several hundred acres of blueberry land in eastern Pictou County during the early 1960's to the late 1970's. These lands were sold in the 1980's to blueberry growers or processors.

Murray Feltmate, Goshen, Guysborough County, became interested in the late 1950's and early 1960's in developing blueberry land in Goshen, Garden of Eden, and near the community of Country Harbour. He and his father had several hundred acres of land on which they grew Christmas trees. Much of their land also had good blueberry plant coverage. Murray is still very active in growing blueberries.

Roger MacAloney and Kenneth Skidmore, Parrsboro, bought and leased considerable blueberry acreage in the Bridgeville, Sunnybrae and Blue Mountain areas of Pictou County. They developed many of these fields which they later sold to local producer or to Cumberland County processors.

Stanley Cameron, East River St. Mary's, started to cultivate blueberries in 1951 on approximately 20 acres. By 1990 he owned 200 acres plus leased another 148 acres. He bought berries from local producers and in 1968 erected a receiving station. He first sold to Orff and Cushing, Parrsboro, and Christy Crops, Halfway River, and for many years has sold berries to M. W. Graves. Some of the biggest changes he has seen occurring in blueberry culture have been the introduction of weed control due to new chemicals, and better marketing coupled with improved harvesting methods.

Ernest Mingo, New Glasgow, saw the potential of blueberry development in nearby communities. He started to buy some smaller blueberry fields until he had 160 acres in production. He has always sold through one buyer. He now mows instead of burning, uses better control for insects and diseases, and uses mechanical harvesters.

A survey of potential lowbush blueberry land was carried out in 1980 and 1981 in the counties of Pictou, Antigonish and Guysborough. Areas surveyed included those where there was some blueberry production or where it was suspected production potential existed. Density of clones, weed and tree cover, terrain and length of time to develop the areas were assessed by visual inspection of potential fields. Approximately 4400 acres in the three counties were identified as having potential for lowbush blueberry development — approximately 2000 acres in Pictou County, 1800 acres in Antigonish County, and 600 acres in Guysborough County. [44]

2.4 Cape Breton Island

Cape Breton Island has historically never produced satisfactory commercial yields. For years, this was attributed mainly to lack of sufficient heat units during the growing season in coastal areas where commercial development has been attempted. Several inland locations on the island are currently being developed for commercial blueberry production. It now appears that some of these areas have good potential, and that lack of a proper long-term cultural and management program may have been the limiting factor in past commercial development attempts.

Dr. Barnhill, Sackville, N.B., owned large areas of blueberry acres in the 1950's and 1960's near the shore at Judique, as well as lands on Creignish Mountain, Inverness County. Plant stand was excellent but yields were low. [54]

Bridgeport Co-operative Ltd., Bridgeport, Cape Breton County, was organized in 1965. Its objectives were to meet the needs of displaced miners who were interested in growing vegetables, strawberries and blueberries for their own use and as well to sell them on local markets.

A converted building was used for office space and as well to handle, grade, package and store produce. A small freezer plus storage room was also built with a total capacity of 20 tons. Approximately 100 acres of blueberry land was developed.

This co-operative went out of business in December 1965.

Christy Crops Ltd., Halfway River, Cumberland County, owned and leased blueberry lands in the Egypt and Mabou areas of Inverness County, but their yields were low, and after a period of five to ten years they stopped developing their land in the 1970's.

Clarence Calder, Sydney, N.S., acquired approximately 125 acres of blueberry land in the Lake Ainslie-Whycocomagh area. He has developed these lands in the past 15 years and yields have been improving under his cultural management program. These lands are located in the interior of Cape Breton Island and they don't suffer the winter injury as experienced in the coastal blueberry areas.

Mira Pasture Co-operative Ltd. was incorporated in March of 1977. They became interested in developing their blueberry land starting in 1981. They had land to clear, weeds to remove, equipment to buy, etc., however, they have been harvesting blueberries since 1983 with an average crop worth approximately $3700.00 annually.

2.5 Western Nova Scotia

In the western part of the province, blueberry acreage has been developed mainly in Annapolis, Digby, Queens, Lunenburg and Yarmouth counties. There are over 1,000 acres presently in production and many more potential acres could be developed. This area has the natural advantage of a longer growing season. However, fields have historically been plagued with rocky rough terrain and more weed problems than in other areas of the province. With the introduction of new and improved methods of weed control and land improvement, there is a growing interest in developing new acreage in these counties.

Fred Armstrong of Yarmouth began his association with blueberries many years ago. Fred's first active work in blueberries began at eleven years of age when he hand-picked berries for his father at Argyle. His interest never lessened, and by 1934 he was shipping blueberries by boat to Boston and New York markets. The use of any mechanical device to harvest blueberries was outlawed in 1917 by the provincial government to increase employment. This law was changed in 1950 to allow the use of metal rakes. Prior to that year all the berries were hand-picked. In one year he shipped 6500 32-quart crates to the Boston and New York markets of a total of 33,000 crates shipped by boat from Yarmouth. Over the years Fred bought and developed blueberry land, and actively managed his fields. He recalls a blueberry association organized in Pubnico in the 1930's, perhaps the first in Nova Scotia. It lasted for about ten years. A bad infestation of maggots plus the advent of refrigeration in Maine ended Fred's markets in Boston and New York. The blueberry barrens grew up in weeds and were not picked. Yet Fred remained active with his fields. He continued to do so until around 1967 when the advent of freezers and frozen berries diminished the fresh market.

Bonda Foods, Yarmouth, bought blueberries from Yarmouth County from approximately 1950 to 1968. The berries were frozen in 12 and 20 pound cartons and in the early years the fresh berries were sold in 20 pound cans. The berries would be sold in the Boston and New York area. The average volume handled ranged between 200,000 and 400,000 pounds annually.

M. W. Graves, Berwick, N.S., bought Bonda Foods in 1968. They established buyers in the area and Fred Armstrong was one of them. The berries, shipped to M. W. Graves, would be raked, cleaned and shipped by truck in half-bushel boxes.

Ernest Shaffner, Annapolis Royal, had been acquiring and developing blueberry land in the 1960's. He had a large field in Concession, Digby County, seven fields in Victoria, Digby County, and four fields in Queens County. In addition, Shaffner had several leases on blueberry fields.

In 1972 he sold these fields to Casey van Dyk, Caledonia, Queens County. Van Dyk had established a small dairy operation but he soon found there wasn't enough cleared land to provide sufficient pasturage. Several of the fields he looked at had good coverage of blueberry plants. In the early 1960's, he decided to close out his dairy operation and to set up a hog and blueberry enterprise.

Within a few years he had acquired four blueberry fields in Queens County containing over 200 acres. In 1972 he was able to secure all the blueberry lands plus leases, except one, formerly held by Shaffner. In 1975 he also acquired a 100 acre blueberry field in Milford, Annapolis County, from Shaffner. He was able to buy another 35 acres in Concession, Digby County, located next to his blueberry field. In 1979 van Dyk bought 250 acres in Shelburne County and approximately 100 acres were growing blueberries. By 1990, van Dyk had acquired 900 acres; of this total, 600–700 acres are producing blueberries.

Western Nova Scotia Blueberry Co-operative was established on March 20, 1981, at Yarmouth. Malcolm Fuller, Agricultural Representative, Nova Scotia Department of Agriculture and Marketing, Yarmouth, felt the county had the potential to increase its blueberry production from 100,000 pounds a year to one million pounds annually, if it made use of all its blueberry fields and developed them to their full potential. [22]

In 1981 a custom burning operation was established in the Yarmouth area and seven blueberry growers used this service.

At the present time approximately 400 acres of the approximately 1000 acres of Yarmouth County lands identified as having potential for blueberry production are being developed. In 1983, proper burning and weed control methods hadn't been employed to the same extent as in Cumberland County.

By 1990 an organized core of blueberry growers from the original co-operative have acquired their own land and have adopted the latest cultural management programs.

Chapter 3

CLASSIFICATION OF BLUEBERRY PLANTS

Four kinds of lowbush blueberries grow wild in Canada. The fruits of all, with the possible exception of ground hurts, are harvested and sold commercially.

Velvet-leaf blueberry *(Vaccinium myrtilloides Michx)* can be distinguished by its hairy leaves and stems and non-toothed margins of the leaves. It is the blueberry most often found in woodlands and is the most abundant species in blueberry fields recently developed from woods. It tends to be eliminated by repeated burning. Blossoms are bell-shaped and greenish-white, sometimes tinged with red. Fruit is bright blue, covered with a grey casting, more tart than low sweet. The plants grow from six to twenty-four inches tall.

Ground hurts *(Vaccinium boreale* (Hall and Aalders)) is found in small numbers in exposed northern regions of Cape Breton Island [51] and it is most abundant on the exposed highlands of Newfoundland. It is not economically important. The stems of this species are much branched, and the plant grows along the ground.

Common lowbush blueberry *(Vaccinium angustifolium Ait.)* plants have a shiny smooth leaf with toothed margins, the points of which bear minute glands. It is the most abundant type of blueberry in stands developed on abandoned hayfields and in other fields that have been burned for many years. It grows four to fifteen inches tall. Blossoms are bell-shaped and usually white or pinkish white. Fruit is usually bright blue-coloured with grey casting bloom and is borne in clusters.

Black lowbush blueberry *(Vaccinium angustifolium f. nigrum* (Wood))Boivin) plants have blue-green leaves and black, shiny berries. In range and habitat it tends to increase more rapidly with repeated burnings. It has the same characteristics as common lowbush, except fruit is black with no grey casting (bloom).

Plants of the two common species, velvet leaf and common lowbush, are found intermingled in lowbush blueberry fields. [50] Plants within a given species differ greatly in vigour and productivity; colour, shape and size of leaves; resistance to foliage disorders; and earliness, flavour, size, colour, firmness and shape of fruit.

The velvet-leaf and ground hurts are both diploid (24 chromosomes), whereas the other two lowbush types are tetraploid (48 chromosomes). This is important in pollination. Plants of species with the same chromosome numbers will effectively pollinate each other, whereas crosses between species with different chromosome numbers rarely, if ever, set fruit.

They differ in form, however, the fruits are quite similar in size, flavour and extent of waxy bloom.

Lowbush blueberry populations are characterized by extreme plant to plant variability. This is manifested in both the diploid and the tetraploid species and is so extreme that it is practically impossible to find two morphological identical clones in the same field. In *V. angustifolium*, clonal distinctiveness has been demonstrated in stem colour [104], pollen production [3], fruit colour [4, 6], response to photoperiod [55], vigour [34], disease susceptibility, date of fruit ripening, fruit set and yield.

This variability, when combined with the irregularity of plant density and the intermingling of two species, makes it extremely difficult to establish valid field experiments. Studies at Tower Hill, New Brunswick, over a five-year period demonstrated yield variations in rod square plots from 0.8 to 222.0 bushels per acre. Indeed it has been necessary to use long narrow plots that incorporate many clones, to replicate them extensively and to consider several criteria (stem length, number of fruit buds per shoot, number of branches per stem, etc.) in addition to yield, before much validity can be attached to experimental findings. [33]

Chapter 4

DEVELOPMENT OF THE PLANT

4.1 Basic Botany

The basic botany and genetic work of H. P. Bell and his co-workers, N.S. Research Council, Halifax, N.S., and I. V. Hall and L. E. Aalders, Agriculture Canada, Kentville, N.S., in the 1950's and early 1960's, on the taxonomy, structure, growth and variability of the lowbush blueberry plant led to the many technical and cultural management practices now used by the producers.

The blueberry plants are low growing, four to twenty-four inches tall, with the new shoots of maturing plants developing from dormant buds on underground stems called rhizomes, which originate from seedlings. The roots are generally shallow and fibrous, although a thickened, deeply-penetrated tap root can be found under the plant crown when single plants are excavated. [48] Similar tap roots are found on transplants in the field. (Figure 4.1)

Lowbush blueberry plants spread by rhizomes. The rhizomes give rise to additional roots and new crowns, which may develop to a size and shape similar to the parent crown. A piece of rhizome, with well developed roots, if separated from the parent plant, can grow to be a separate plant. In moderately heavy sod, rhizomes grow an average of two to three inches per year. In areas with few competing plants and high organic matter, rhizomes have been found to grow as much as 15 inches per year.

Lowbush blueberry plants eventually spread through a field or forest, forming a dense mat. Each original plant, with its wide-spreading rhizome system, is called a "clone". Assessing the density of the plant stand is one way to predict potential production in a given field.

Bell and his co-workers described the life cycle of the blueberry plants. [8, 9] The tips of growing blueberry shoots die in the early part or middle of the summer [7] and the buds develop into either vegetative or flowering types. Whether a particular bud will be vegetative or flowering is determined the year the shoot arises.

By late September in the year of the burn, most, although not all, flower buds can be distinguished from vegetative buds as they are usually about three times as large. The ratio of flower to vegetative buds is greater on new sprouts than on older twigs. The flower buds formed on new sprouts are also hardier and contain more flowers per bud. The ratio of flower buds to vegetative buds differs from clone to clone but relates to vigour and undoubtedly to other factors including

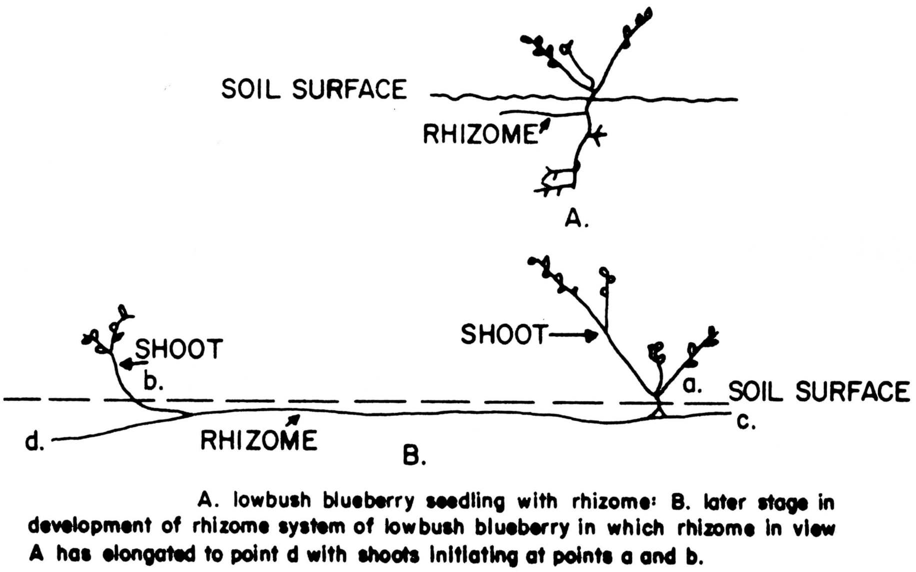


Figure 4.1: Lowbush Blueberry Seedling

nutrition and climate.

In the season following the burn, flower shoots develop from the flower bud. The blossom opens and, when pollinated by bees, fruits are set. The rate of maturing and the size of the berry both depend upon the number of ovules developing. [3] The anatomy and development of the flowering structures have been detailed. [10, 11, 12]

Seventy per cent of the blueberry plant is underground.

4.2 Soil Requirement

Lowbush blueberries are found on nearly every soil type but they thrive best on well-drained areas free from competing plants. The pH of these soils is generally in the range of 4.0 to 5.5.

The soil capability classification for agricultural purposes is an interpretive grouping of soils made from soil survey data. It is a nation-wide system developed for the Canada Land Inventory [61]. The mineral soils are grouped into seven classes according to their potentialities and limitations for agricultural use. The first three classes are considered capable of sustained production of common cultivated crops, and the fourth is marginal for sustained arable culture. The fifth is capable of use only for permanent pasture and hay, the sixth is capable of use only for wild pasture, and the seventh class is for soils and land types considered incapable of use for arable culture or permanent pasture. For the purpose of this classification, blueberries that require little or no cultivation are not considered as cultivated or common field crops.

Chapter 5

DEVELOPING BLUEBERRY FIELDS

Lowbush blueberry plants are native to Nova Scotia and grow naturally in most areas of the province. Abandoned farmland has the greatest potential for blueberry production because the land has been previously levelled and cleared of rocks. It is thus easier to burn, control weeds, and harvest. Through cultivation, the woody shrubs have largely been removed and the weed problem consists more of keeping out weeds than of controlling existing plants. [50]

Woodland on which wild blueberry plants are growing may be cleared of trees and brush and then managed to increase the blueberry stand. First, cut and remove any trees on the area. Haul the brush and unusable wood to a barren area, such as a rock pile, for burning. It is best not to burn brush in the field if possible because the intense heat from such a fire may destroy underlying blueberry plants. Burn brush only when the fire hazard is low. Stands of evergreens can be destroyed by a single cutting. With deciduous species, the stumps of hardwood trees and saplings should be treated with a herbicide-oil mixture to prevent growth of suckers. Mow hardwood saplings with a rotary mower before burning. After the land has been cleared, lowbush blueberry plants shoot up from rhizomes that were previously shaded out by the trees.

Very few fields cleared from woods are completely covered with blueberries, and any great increase in stand results not from the growth of new seedlings but from the initiation of stems from rhizomes present in the field before clearing.[47] The length of time required to obtain a solid stand depends on the condition of the soil, the number of plants present, and the degree of competition from weeds. Repeated burning appears to encourage the growth and spread of lowbush blueberries and to retard weed development. If pruning or weed control is stopped, the area grows up to brush and woodland again.

The healthy state of the blueberry industry in 1973 prompted increased interest in "cleaning up" fields and developing new areas. In response to a request from the Blueberry Producers Association of Nova Scotia for some government assistance in clearing blueberry land, a Lowbush Blueberry Land Clearing Policy was announced on September 28, 1973 by the Honourable Jack Hawkins, Minister, Nova Scotia Department of Agriculture and Marketing.

This policy was designed to promote clearing of unused blueberry land, to increase producing acreage, improvement of established fields, land levelling, and initial construction of fire breaks.

This policy provided a stimulus for the continued development of blueberry acreage. It had been especially effective by 1975 in getting a good nucleus of acreage in production in Pictou, Antigonish and Guysborough counties.

The application by blueberry growers often exceeded the allotted policy funds and in some years over one-third of the applications could not be accommodated.

Surface ditching or underground drainage may be put in place when developing the field. The water table should be kept at least 14 inches below the soil surface. Ponds, to be used for fire protection or irrigation, were established by many producers.

In the fall of 1954, H. P. Bell, Nova Scotia Research Foundation, G. Kinsman, Nova Scotia Department of Agriculture and Marketing, and Dickinson Bros., West Brook, N.S., undertook a land levelling project. A CAT D-6 tractor pulled a six-ton Rome Disc to level a blueberry field that had 80 per cent of the soil surface with two to three foot deep cradle-hills. Several passes were made over the land which was levelled. A large "cat spruce" was dragged by a farm tractor over the soil surface. Within five years blueberry plants had completely covered the soil surface.

Glenmore Industries, Glenmore, N.S., had many rocks protruding above the soil surface. These rocks interfered with burning, insect and disease control, as well as harvesting. Pneumatic drills were used to bore holes in the rocks and then dynamite sticks were inserted, ignited, and the rocks were removed.

The forestry industry had mechanized with Tree Farmer Porters, truck-mounted knuckle boom loaders, and pre-haulers, and this equipment was available and used by many blueberry producers to remove rocks, tree stumps, brush, pulpwood and other debris from their fields.

In the 1980's, there developed a renewed interest in land levelling and smoothing of blueberry lands to facilitate the use of flail mowers and harvesters. Some growers levelled their acreage by using heavy discs and rollers, others used rollers. The use of excavators is being used to remove rocks, to level land and to leave the blueberry plants basically undisturbed.

Chapter 6

PRUNING

Pruning of lowbush blueberry plants is necessary to encourage new upright shoot growth from the underground stems (rhizomes). Methods of pruning which have been tried include burning, mowing, chemical sprays and electricity. Pruning by burning does the most thorough job with no injury to the plants and eliminates most of the stubs and other growth which interfere with raking the berries. Close mowing with flail mowers has also proven effective and is less costly than burning. Pruning with chemicals or electricity has not proven effective or practical to date.

Pruning any plant encourages new vigorous growth the following season. To help produce new vigorous shoots, the lowbush blueberry must be pruned every two or three years by a method that will remove or kill back old stem shoots to their growing point (stem sites) on the underground rhizome. Pruning alone is not all that is necessary to produce vigorous new blueberry shoots with high yields. Plant type, moisture and fertility are other important factors.

6.1 Methods of Pruning

Of the methods mentioned, only burning and flail mowing have been used commercially. These two methods have produced the most vigorous new shoot growth and the highest yields of blueberries. Burning kills back the shoots to their growing point or stem site on the underground rhizome. Thus, new shoot growth begins on the buds underground. Growth is tall and vigorous if other factors such as nutrient supply and moisture are available. A fire guard must be established around any area to be burnt. Three or four furrows should be ploughed around the edge of the area before burning takes place. Bulldozers are frequently used to cut an eight to ten foot wide strip around the edge of the area intended for burning. Liquid propane gas burners have also been used when the bushes are wet. Several other workers should be present to take care of any fire emergency during the pruning process.

6.2 Methods of Burning

Fields are burned by using one of four methods:

1. by using a free burn,

2. by burning with straw,

3. by burning with fuel oil, and

4. by burning with liquified petroleum (L.P.) gas.

6.2.1 Free Burn (Wild Fires)

If blueberry land contains an abundance of grass growth, it is possible to burn it by simply lighting the field. After dozing, plowing furrows, or burning a fire line, the field is ignited by a hand torch and allowed to burn at will. A slight breeze is needed to carry the fire. Many times "skips" are found and need touching up. This type of burning is possible on only a few fields in early stages of development. This is obviously the cheapest method of burning as only a few hours of labour and a match are required.

6.2.2 Burning with Straw

In the early 1950's, straw burning was the only method of pruning lowbush blueberries. Free oat straw was available from many farms on the north shore of Nova Scotia and on Prince Edward Island. The straw was baled and then taken to the blueberry fields.

Hand spreading is very labour intensive. It takes one man a day to spread straw properly on about one acre of land. The straw is usually spread in the fall, after the blueberry leaves have turned red or fallen, so it will settle around the base of the shoots during the winter. The straw is burned the following spring when the temperature is in the 60^0F range, the ground is frozen and fairly damp, and a moderate wind is blowing.

Albert and Larry MacPhee, Gore, Hants county have been using straw for burning for over 40 years. To light the straw in the spring, they use a hollow 1.5 inch diameter metal pipe, four feet in length, with the lower end bent like the blade on a hockey stick. A cloth rag, to server as a wick, is stuffed in the trailing blade end of the pipe. The pipe is filled with kerosene and the hand-held upper end of the pipe is plugged with a cork or screw cap to slow the flow of oil to the flame. The cloth rag is lit and the pipe blade is dragged behind the person lighting the straw.

Growers, with a large acreage to hand spread straw, wished there was a faster mechanical method. In the early 1950's, David Friday, Michigan, U.S.A., had introduced a mechanical straw spreader to mulch strawberry rows. This spreader spread straw 30 to 40 inches wide and 3 to 4 inches thick. The machine was a trailer-mounted, gas engine-driven, and used rectangular straw bales. It was designed to be used by a tractor, trailer and two operators.

In the early 1950's, Gordon Kinsman personally bought the Friday strawberry mulcher. He, C. McNevin, Engineer, Nova Scotia Department of Agriculture and Marketing, Ed Adams, Southampton, N.S., and Karl and Seymour Dickinson, West Brook, N.S., worked for several months to modify this spreader.

Below the cutting rotor a method had to be designed to mechanically spread the straw over a 10 to 12 foot width and thin enough to carry a pruning fire. A three-foot circular saw blade, with its teeth removed, was horizontally mounted below the cutting rotor and a horizontal rotating impeller was mounted over the saw blade. As the impeller spins, straw falling from the cutting rotor is centrifugally thrown outward 10 to 12 feet and spread thinly over the blueberry shoots. This machine would cover an acre in 18 to 25 minutes. A clutch was added to the original machine to provide overload damage protection. Dickinson Brothers bought this spreader and the machine is still in operation in 1990.

The oil crisis of 1974 focused attention to again look at mechanical straw spreaders. During the late 1970's and early 1980's commercial and some home-made mechanical straw spreaders became available.

In 1987, tests were conducted on eight different straw spreading machines for use on blueberry fields. Laboratory tests were conducted on each machine to calibrate the distribution patterns, uniformity of ground cover, throughput capacity and power consumption with the sensitivity of these factors to straw conditions, wind and rough terrain. The machines were also assessed to determine their serviceability, noise level, and other factors which would affect their suitability for straw application to blueberry fields.[93]

Cost (1990) of burning with straw was $100 to $130 per acre.

6.2.3 Burning with Oil

The first oil burner, a Woolery, was brought into Nova Scotia in 1950 by Orff and Cushing, Parrsboro, Nova Scotia. C. Walsh brought the first Woolery burner to Collingwood in 1952.

All burners had a rigid pole and, because of the rough terrain of the blueberry fields, the wheels of the tractor and the wheels of the trailing burner would often drop in opposite cradle-hills, throwing the tractor and burner into opposite directions, and often breaking the rigid pole. Walsh installed a rotating sleeve within the pole, thus no more broken poles. His modification was quickly adapted by the manufacturer.

A workshop on the operation and maintenance of blueberry burners was held at the Nappan Experimental Farm, Nappan, Nova Scotia, on March 17, 1975. Sessions were held on remodeling the propane gas burners and oil burners, efficient burning of gas and oil, and safety and maintenance tips. Approximately 30 blueberry growers attended. Technical information was provided by Bill Bridges, St. Stephen, N.B.; Evatt Lewis, Irving Oil Ltd., Bridgewater, N.S.; and Gordon MacMillan, M. W. Graves, Berwick, N.S.

The oil crisis of 1974, resulting in a shortage of burning fuels and higher costs, caused many blueberry growers to question how they might increase the efficiency of their burners. Approximately 10,000 acres of blueberry land annually use burning as a pruning method. Most of this burning was done by oil-fired burners which consume 40 to 50 gallons of furnace oil per acre, depending on field conditions for an approximate annual total of 300,000 to 400,000 gallons of fuel oil used.

Research and inquiry was carried on to determine what is the minimum burn necessary for pruning, how these machines work, and burner head efficiency, in order to improve oil burning efficiency.

On April 11, 1978, five burner treatments were used with the Bossé burned head with 6, 8 and 9.5 U.S. gallon/hour burner nozzles, the new Woolery "economy" burner using 10 gallon/hour washer nozzles, and the old conventional Woolery burner with 40 gallon/hour washer nozzles. The Bossé burner used a complex automatic starting system and there were gaps between the flames which resulted in an uneven and insufficient burn. To correct this, flappable metal sheets were attached to the bottom of the burner head to make a solid curtain of flame.

The Woolery "economy" burner and the Bossé prototype were more efficient than the conventional burner. Re-growth of new shoots was satisfactory. Design modifications had to be made as the Bossé heads needed to be lighter in weight. The 9.5 U.S. gallon/hour nozzles resulted in the best flame pattern. The Woolery "economy" burner resulted in a streaky burn due to gaps between the flames. Ground speed had to be reduced to burn back the length of the blueberry shoots.[83]

In December of 1981, Don Carr, former Director of Research and Development, Enheat Ltd., Amherst, N.S., was hired to work with oil burner operators and manufacturers to develop a more efficient burning unit for use in pruning blueberry land.

A BB850 prototype blueberry burner was tested in 1985 by Bert van Leewen, P.Eng. The tractor was equipped with 11VO PTO-driven alternator, burner heads equipped with four modified AERO flame retention heads, domestic-type oil burners with high speed motors, and additional afterburners designed to deflect flame into a desired pattern. The port burner was 10.5 U.S. gallon/hour while the other three were 12 U.S. gallon/hour, semi-solid pattern. Ignition was electrical from the tractor cab.

The new prototype burner used one-third less fuel per unit of area compared to the conventional Woolery and similar designs. Operator safety was better, there was electrical ignition, off-the-shelf burner parts, and a world-wide potential for a Canadian-designed flame burner. [101]

Presently (1990) the fuel oil burner is the fastest method of burning blueberry land. The fuel oil flame is very hot, even though much of the flame's efficiency is lost to the atmosphere. The Woolery-type oil burner is the most common machine used for burning with oil. There are three and four stack models. Currently (1990) it costs about $100 to $130 per acre to burn with oil.

6.2.4 Burning with L.P. Gas

L.P. (Liquid Propane) burners were introduced in the early 1960's. Their introduction caught many L.P. suppliers by surprise and it was several years before sufficient numbers of 100-pound (23.2 gallon) cylinders equipped with liquid eduction tubes became available and a good service system was developed.

A small portable L.P. burner was developed in 1967 by Hubert Toole, Toole's Machine Shop, Truro, N.S., specifically for areas of rough terrain in Guysborough County which are unsuitable for mechanical burning. Cost of these burners was approximately $125 and very safe to use. Several other growers in other countries bought this burner for touch-up jobs.

The number of L.P. gas burners had increased to the stage where a workshop was held at the Nova Scotia Agricultural College on February 6, 1967. The course dealt with the use and maintenance of these machines. Approximately 40 people attended. As a follow-up to the gas burner workshop, an information sheet was prepared.

Gordon MacMillan, Field Manager, Canada Foods Ltd., Kentville, N.S., working with a local L.P. gas dealer in 1969, made a modification using a new type of orifice which had several small holes instead of the original, straight slit opening. The machine operated at half the previously required pressure and fuel consumption was cut by 30 to 40 per cent.

This type of L.P. burner offers the small grower an excellent burn at a reasonable price. It is slower than oil burning, but on smaller acreage, where the grower is not on a strict time schedule, it is an excellent burner. The L.P. unit is usually made in models containing three, four or six burners. The four burner machine is the most popular.

The cost (1990) for L.P. gas burning is about the same as oil burning — $100 to $130 per acre. It usually takes about 200 to 250 pounds of propane to burn an acre.

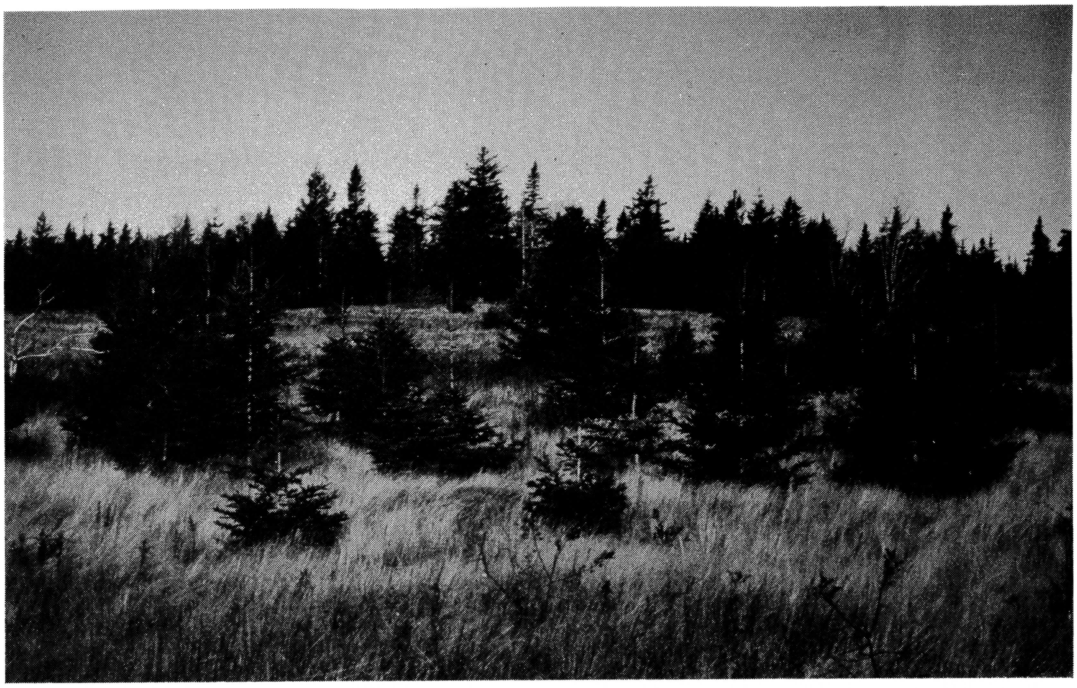
Blower-type oil burners and liquid propane gas burners may be used in the fall after harvest and often in the spring under conditions unfavourable for straw burning. A late fall burn can be accomplished in areas that are often inaccessible in the spring.

6.3 Flail Mowing

Flail mowing was first used in the late 1970's and it proved cheaper than burning. Its use in the 1980's rapidly increased in popularity as a pruning method on level ground. Cost of flail mowing is approximately $35 per acre.

6.4 Frequency of Pruning

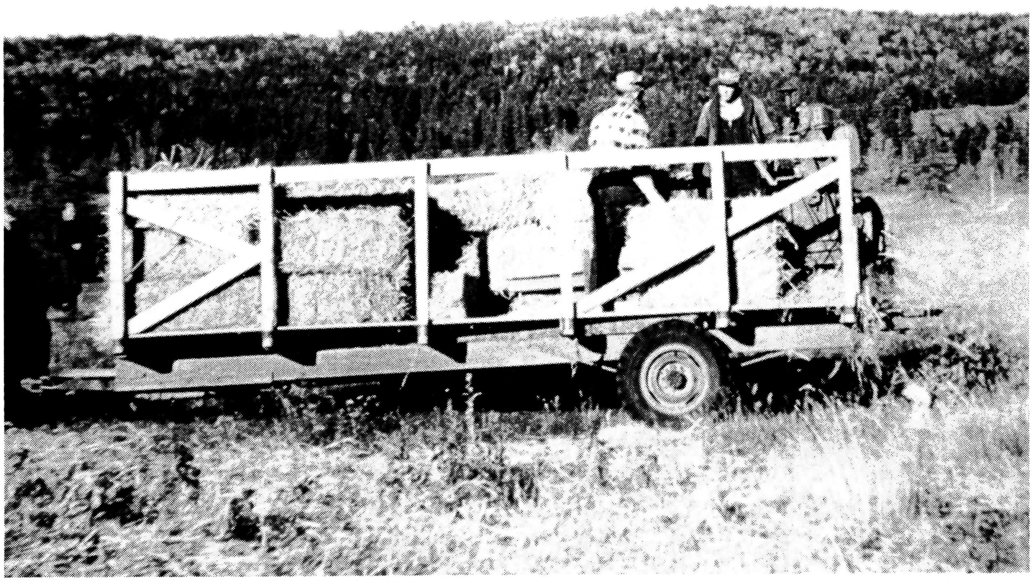
Most commonly occurs on a two-year cycle which includes burning in the fall or spring, allowing new shoots to grow for one year (new burn), harvesting a crop the following year, then burning or flail mowing that fall or the following spring.



An old "run out " field or pasture starting to grow small spruce. A typical blueberry field.

Leveling and rock removal with an excavator to allow for mechanical pruning and harvesting.

Early leveling experiments using a "rome" disc and vibrating roller.



"Friday" straw spreading machine."

Woolery Burner used for many years to prune lowbush blueberry fields.

Home-build liquid propane gas burner, used as an inexpensive alternative to the Woolery Oil Burner for pruning small acreages.

Flail Mowers began to be used as an alternative to burning when oil prices increased rapidly in the late 1970's.

Endel Karmo, Provincial Apiarist. (1950–1977)

Hives of honey bees on a trailer could be easily moved from field to field for increased efficiency.

Single hives of honey bees set out in a blueberry field to provide a supplementary pollinating force.

Chapter 7

POLLINATION

In order to produce blueberries, the flowers need to be pollinated by insects, of which bumblebees, solitary bees, and introduced honeybees are the usual ones. Bumblebees and solitary bees work in colder weather than honeybees. In places where wild bees are scarce, the introduction of colonies of honeybees usually ensures a higher fruit set.

Kinsman [70] considered inadequate pollination as probably the most common cause of poor yields of lowbush blueberry in Nova Scotia. He pointed out that the wild bee population fluctuates from year to year and that in order to insure good production of lowbush blueberries in Nova Scotia, honeybees should be used to supplement the wild bee. As a rule of thumb, he suggested a minimum bee population of one per square yard under sunny, calm conditions with the temperature over 60^0F. He suggested the use of at least one strong colony of bees (30,000 workers) for each two acres in Nova Scotia. To circumvent the diversion of honey bees from blueberries to other blossoms for pollen, he advised the rotation of hives and making pollen or pollen substitutes available to the bees. The rotation of hives entails moving colonies at least two miles to new sites, and allowing the bees to remain at one site as long as they work the desired area. The success of this procedure is based on the fact that the field bees of a newly moved hive will remain in a relatively close proximity to the hive during the first few days.

Due to the wide variation in factors such as clonal compatibility, pollinating weather, general growing conditions, the native pollinating force, and honey bee concentration, meaningful data on fruit set can only be tabulated after a period of several years.

Lowbush fields contain large numbers of clones which contain varying degrees of self-sterility. Aalders and Hall [3] examined 21 clones of *V. angustifolium* in Nova Scotia and found that 12 were completely self-sterile while nine were partially self-fertile; the self-fertile clone set from zero to 52 per cent of the blossoms when they were selfed, while the range was from 81 to 90 per cent when they were cross-pollinated.

Their study of the pollination of the lowbush blueberry is complicated by the fact that the stand often shows a high percentage of the diploid species *V. myrtilloides*, which has pollen incompatible with the tetraploid species *V. angustifolium.*

Aalders and Hall found that cross-pollination of these two species resulted in reduced set of the important lowbush species *V. angustifolium.* Neither honeybees nor wild pollinators discriminated between species in their foraging habits. This resulted in dilution of the pollen of *V. angustifolium*, which adversely affected fruit set.

E. Karmo, Apiarist, Nova Scotia Department of Agriculture and Marketing, began to research the beneficial effects of using honeybees in the 1950's to supplement native pollinators in lowbush blueberry fields. In his blueberry work, he closely worked with Gordon Kinsman, and later with Jack Sibley, blueberry extension workers with the Nova Scotia Department of Agriculture and Marketing. He collected data which showed the wild bee population should be supplemented with honeybees. He determined, after several years of study, the dispersal rate of honeybees under various weather conditions.

To ensure maximum use from the hives of honeybees, he researched the rotation of hives so that the concentration of pollinators would remain high throughout the season.

His work and recommendations in this field are now widely recognized and practiced on many of the large acreages of the Maine blueberry barrens by using mobile tractor trailer loads of hives and moving them from field to field. Karmo authored numerous articles and publications over the years as new techniques in pollination were developed from his research. He also developed extension techniques to show the beekeepers and blueberry growers correct procedures in preparing hives, how long to leave them in a location, etc. In the Maritimes, the use of honeybees to supplement native pollinators has become a standard management practice with many growers as the result of his research and extension efforts.

Karmo proposed that if honeybees were to be used for blueberry pollination there should be a standard for colony strength and condition. The colony should have a population of 20,000 to 30,000 workers, 4 to 8 combs of brood in all stages, and housed in a hive of ample dimensions — two story Langstroth. The hive must have ample food stores — 10 pounds of honey plus good pollen reserves. All hives should be securely fastened for transportation.

Between 1965 and 1969 a five-year pollination study was conducted on blueberry fields throughout Nova Scotia. [68] The study found that honeybee hives should be placed in the blueberry fields the middle third of the blooming period. A high percentage of blossoms remain receptive well past the peak of bloom but the percentage of fruit set was reduced.

High pollinator density over the full bloom period can cause 72.7 per cent fruit set. A fruit set of 52.3 per cent was obtained when the blossoms were exposed to honeybees for only one working day at full bloom. Ten honeybee hives were placed at one end of a mile long blueberry field which was in full bloom. The honeybees spread 450 yards the first day, 1235 yards the second day, and 1700 yards to the end of the field on the third day. The wild native pollinating force varies greatly from year to year. The use of supplementary pollination improved fruit set in 1965, 1966, 1968 and 1969. In other years, it would appear that an adequate native population force was present, providing there were quite a number of good quality working days in which insects could effect pollination. Where honeybees were used to aid pollination, a comparison was made between the percentage of honeybees and the percentage of native bees, which make up the total pollinating force from year to year. Table 7.1.

A two-year study [65] of the effect of pollination on the number and quality of blueberry seeds showed there is a high correlation between a high set of fruit with that of a high seed count. There appeared to be no significant difference in the quality of the seeds between poor and good sets of fruit.

With high production costs and generally low fruit sets, the surest and shortest way to increase yield and thus lower the unit cost is by improving the fruit set. Present fruit set is 30 per cent, but with improved pollination, 60 to 75 per cent fruit set is attainable. The total crop can be doubled without increasing the acreage. There is a need to provide one honeybee hive per fruiting acre. [66]

Studies [67] showed good pollination helps keep ripe berries of early clones on the shoots longer.

Table 7.1: Three-Year Study of Honeybees, Solitary Bees and Bumblebees Percentages

Years	Honeybees %	Solitary and Bumblebees %
1967	30	70
1966	82	18
1965	65	35

Also, a high concentration of pollinators did not cause earlier ripening of blueberries on late blooming clones.

The use of honeybees as pollinators increased dramatically since 1953. (Table 7.2) By 1970, 2150 hives were in use. The number of hives used for blueberry pollination had increased to 5000 in 1988.

Table 7.2: Incomplete Record of Honeybee Hives Used for Pollination, 1953 – 1990

Year	Hives
1953	0
1960	500
1963	453
1964	800
1965	1400
1967	1600
1968	2130
1970	2150
1971	—
1988	5000
1990	—

Traditionally only a few blueberry producers own bees, the vast majority rent them. Available bee pasture in Cumberland County, the major user for the first 20 years, was limited; consequently, bees were obtained from the Annapolis Valley, Nova Scotia, New Brunswick and Prince Edward Island.

The Nova Scotia Department of Agriculture and Marketing introduced a Honey Bee Transportation Policy which helped to defray the cost of moving honeybee hives from the Annapolis Valley to the blueberry fields over a hundred miles from the bee yard. From 1968 to 1982, where statistics are available, there was an average of 765.4 hives moved annually. Rental fees for the first number of years were $8 to $10 per hive. In 1970 it was $10, the 1980 fee ranged between $25 and $30, and by 1988 the rental fee was $55 to $60 per hive. In 1980, most beekeepers moved their rental hives on a pallet to facilitate handling and to provide some protection from bears.

In 1985, however, the honeybee tracheal mite was found in Florida and, as a result, a ban on the importation of Florida honeybees was put in place. Nova Scotia's main source for package bees had always been Florida. Package bees (800) were then obtained from Georgia and another 540 were purchased from New Zealand.

In 1987 there was a complete ban on the importation of American honeybees because of Varroa mite finds in the U.S.A. This latest closure is still in effect (1990).

Honeybees have been imported from New Zealand and Australia since 1986. Shipments have been hampered by delays, unpredictable condition upon arrival (i.e. many dead or dying bees), and are increasingly expensive every year. Also, there have been complaints about premature queen failure or death, and heavy over-wintering losses.

Alternative suppliers of bees had to be found and thus the move to greater Nova Scotia self-sufficiency became more desirable. Nova Scotia Department of Agriculture and Marketing Annual Reports indicate the number of colonies and beekeepers bottomed out in 1987 and is now on the increase. Nova Scotia's beekeeping industry is the only one in North America that is experiencing positive growth and is in a healthy state. This is the case only because of its relative mite-free status which has been maintained and prolonged because of border closures, improved legislation and inspection.

Since the closure of Nova Scotia's borders to bee imports, the demand for rental hives has increased 300 to 400 per cent. There have been sincere attempts to satisfy the demand; however, even with the record number of hives available for blueberry pollination, the demand still exceeds the supply. It is predicted the demand for rental bees will be for 15,000 hives within two years (1992) and 23,000 hives within five years.

Although no formal pollinator count was done in blueberries in 1989, one day was devoted to collecting bumblebees. It was discovered that the majority of bumblebees present at the time were parasitic cuckoo bumblebees, *Psithyrus sp.* As a point of interest, these parasitic bumblebees do not have a worker caste, and they lack pollen baskets on the hind legs. Based on typical host/parasitic cycling, the prevalence of parasitic bumblebees suggests that populations of non-parasitic bumblebees may fluctuate dramatically in some years. Therefore, it may not be possible to rely on bumblebees to pollinate a large crop of blueberries every year. [27]

Chapter 8

FERTILIZER

The lowbush blueberry is a stress-tolerating calcifuge (calcium requiring) plant that thrives on acid, infertile soils [38]. These soils are usually gravelly to sandy loams that are well drained and have distinctly developed organic and mineral horizons [99]. Since the beginning of commercial production, blueberry producers have continuously attempted to increase production through more efficient management practices, including pruning, weed and pest management, introduction of honeybees, and fertilizer applications.

Fertilizers have been applied as nitrogen, phosphorus, potassium, boron, magnesium and lime, singly and in various combinations. Evidence from experiments suggests that the blueberry plant responds to fertilizer applications with increased vegetative growth [95] and greater yield potentials [38]. Effects on fresh fruit yields, on the other hand, have been somewhat inconsistent, with reports ranging from yield increases to no effect or yield decreases [38]. Several Nova Scotia researchers have contributed to the body of knowledge related to blueberry nutrition through laboratory, greenhouse and field studies.

In 1964, Hall, Aalders and Townsend reported on the effects of soil pH on mineral composition and growth in a greenhouse study. Optimum growth occurred at the lowest pH levels (4.2, 4.9, 5.0) for three of the media, and for seed compost at intermediate levels (4.9 and 5.5). Nutrient uptake, foliar nutrient levels and pH were closely associated with growth. Although some clones grew more than others, the patterns of responses to applications of limestone were similar for all clones [53].

Ches Lockhart outlined the symptoms of nutrient deficiencies in lowbush blueberries in 1959 [74]. Lockhart and Win Langille reported on the mineral composition of blueberry plants in several commercial fields in 1962 [81].

Jack Sibley, Lowbush Blueberry Specialist, Nova Scotia Department of Agriculture and Marketing, initiated a study to determine the feasibility of using nitrogen fertilizers in Nova Scotia blueberry fields, beginning in 1965. Ammonium nitrate was applied at several rates to burn-pruned fields, in plots and to large acreages. The results show that ammonium nitrate increased shoot length of the blueberry and the average number of fruit buds per stem. At the same time, however, the fertilizer stimulated weed growth, particularly that of grasses, which lessened the beneficial effects for blueberries [90].

In 1968, a study was completed on the chemical composition of rhizomes and associated leaves of the lowbush blueberry. Chemical analyses revealed that levels of inorganic nutrients, with the exception of Al, were higher in leaves than in rhizomes. Sucrose and reducing sugars were considerably lower in rhizomes than in leaves, whereas starch was markedly higher. Levels of starch in the rhizome decreased substantially during the period of active growth but increased toward the end of the growing season. There was a substantial decrease in rhizome sucrose during the initial spring growth period, with a concurrent increase in reducing sugars. In general, concentrations of most inorganic nutrients and organic fractions in the rhizome decreased during the growing season until late summer, when increases were observed. These results suggest that nutrients move from the rhizome into above-ground plant parts during growth, and then back into the rhizomes prior to leaf senescence and drop in the fall [98].

Townsend and Hall [97] reported in 1970 on trends in nutrient levels of lowbush blueberry leaves during four consecutive years of sampling. Levels of N, P, K, Ca, Mg, Mn and Fe in blueberry leaves were monitored over four seasons, two sprout years and two crop years. In crop years, levels of N in leaves decreased from July 22 to September 22, suggesting that N was translocated from leaves to developing fruit. By contrast, trends of N in the sprout year suggest an increase from July 22 to September 22. For all other nutrients, trends were similar in both sprout and crop years.

On the basis of this study and earlier investigations in Maine [100], the suggested optimal ranges for major nutrients in blueberry leaves at the time of flower bud initiation should be:

Nutrients	Range of Concentration (%)
N	1.50 – 2.00
P	0.08 – 0.12
K	0.40 – 0.55
Ca	0.40 – 0.65
Mg	0.15 – 0.20

Sibley continued his series of fertilizer experiments with ammonium nitrate into the 1970's, in co-operation with Bragg Lumber Company, Collingwood, N.S. Growth of plants in fields fertilized with ammonium nitrate at 35 lbs. N per acre was exceptionally good in 1970, with high fruit bud counts. Crop yields in 1970 were also high. Yields in subsequent years, however, were not consistently high in fertilized fields compared to unfertilized fields [91].

In conjunction with the fertilizer trials, Sibley took soil samples from 34 commercial fields and later obtained leaf samples. The objective was to determine relationships between soil and tissue levels of nutrients and requirements of the blueberry. Tissue levels in leaf samples taken from fields rated by producers as "excellent", "good" and "poor" were all within the satisfactory range for blueberry leaf tissue established by Moody Trevett in Maine [99]. Fertilizer applications resulted in plants with greener leaves, more vigorous appearance and more branching.

The most effective time of fertilizer application was judged to be pre-emergence in the spring.

Don Palfrey, Provincial Weed Control Specialist, became involved in fertilizer research during the early 1970's in conjunction with weed control problems. Palfrey established plots at Pigeon Hill, Cumberland County, in 1973, to evaluate the effects of heavy applications of fertilizers in conjunction with the herbicide Terbacil. Terbacil controlled grasses, but not some of the other weeds, particularly goldenrod. High rates of fertilizers stimulated vegetative growth of the lowbush blueberries, but prevented fruit bud development in the fall. At the highest rates of fertilizer, there were no berries produced at all. These experiments showed that only low amounts of fertilizer could be safely applied to blueberries.

In 1974, Leonard Eaton, Professor of Biology at the Nova Scotia Agricultural College, became involved in lowbush blueberry research. The first study, which was a co-operative effort with Don Palfrey and Jack Sibley, involved the interaction of fertilizers and growth regulators. The design for the study was provided by Palfrey, with Eaton and Sibley providing help to set up and monitor the experiment. In the preliminary experiment, the growth regulators CF Maintain, Alar and Ethrel, in conjunction with Terbacil and a complete NPK fertilizer, showed some promise as a means of increasing yield potential. Numbers of fruit buds per 1000 cm^2 were increased by 1.8 to 2.5 times over those observed in control plots. In subsequent years Eaton completed two further trials with growth regulators.

The results of these trials suggest that only Alar and Ethrel are effective in increasing yield potential (fruit buds) of the lowbush blueberry. Yield responses, however, were not consistent, and any yield increases observed did not justify the extra cost of application [35].

Beginning in 1975, Eaton, co-operating with Sibley, Gary Brown, Small Fruit Technician, Nova Scotia Department of Agriculture and Marketing, and a number of blueberry producers, began a series of studies to evaluate the effects of herbicides and fertilizers on growth and yields of lowbush blueberries. Results of early experiments suggested that fertilizers will stimulate vegetative growth of blueberries, but do not result in consistent yield increases [43].

Effects of herbicide and herbicide plus fertilizers on vegetative and reproductive growth of the lowbush blueberry were assessed by Eaton over a period of 12 years (six production cycles). There were four treatments: untreated controls (burn only), herbicide plus ammonium nitrate, and herbicide plus a complete NPK fertilizer. All plots were burn pruned. Herbicides were those recommended for the industry and included Terbacil, Atrazine and Velpar. Fertilizers were applied at rates of 56 kg N per hectare.

All treatments stimulated stem densities, stem lengths, fruit buds and fresh fruit yields compared to untreated controls, but only after three to six years. After year three (the second cycle), stem lengths and fruit bud numbers were greater in plants treated with herbicide plus NPK fertilizer than in all other plots. Fresh fruit yields were similar in all herbicide and herbicide plus fertilizer plots except in 1984. Nitrogen levels were greater in leaves and rhizomes of plants in all herbicide and herbicide plus fertilizer plots in 1989, whereas phosphorus was higher only in plants fertilized with NPK; phosphorus and potassium levels were 5.4 and 2.6 times higher, respectively, in NPK plots than in all others in 1989. These results suggest that the lowbush blueberry responds slowly to herbicide and fertilizer applications with increased vegetative and reproductive development. Much of the yield increases observed in recent years may result from the effects of herbicides. Fertilizers applied in conjunction with herbicides stimulate vegetative growth and fruit buds (if an NPK fertilizer), but appear to have no consistent effect on fresh fruit yields [39].

Nitrogen is a very important nutrient for blueberries as well as other plants. Leonard Eaton conducted a number of studies on nutritional aspects of nitrogen in lowbush blueberries, as part of his Ph.D. program, which was completed in 1988. This study assessed nitrogen cycling in commercial lowbush blueberry stands, the effects of management and losses and additions to the system. The overall results of the study are given in Eaton's Ph.D. thesis [38].

The lowbush blueberry plant takes up nitrogen from fertilizer quite quickly, with approximately 50% of nitrogen from labeled fertilizers within leaves, roots and stems by August of the year of application. The plant retains one-quarter to one third of that nitrogen over winter through translocation to stems, rhizomes and roots prior to leaf drop in autumn. This ability to retain nitrogen within the plant is typical of a stress-tolerating life style, and allows the blueberry to prospering areas where nitrogen is limiting [37].

Nitrogen is lost from blueberry fields mostly by burn pruning, which removes nitrogen from above-ground plant parts and litter by high heats. The amount of nitrogen lost is determined by the severity of the burn, with low losses from "light" burns and greater losses from "medium" and "heavy" burns. The losses observed through burn pruning are approximately the same as the amount of nitrogen (35–50 kg N per hectare) currently recommended for the industry [36].

Other nitrogen losses from lowbush blueberry fields include denitrification, leaching and export through harvest. Because of the low soil pH levels characteristic of blueberry fields, nitrification is slow; therefore nitrate levels are characteristically low and losses through leaching are minimal. There are, however, increased losses after repeated applications of fertilizers, which appear to stimulate nitrification processes [41]. Denitrification losses are also low and do not present problems to producers even after fertilizer applications [42]. Losses of nitrogen through export (harvest of fruit) are also quite small, approximately 10 kg N per hectare ever second year.

In 1989, Eaton, Sibley, Andrew King, Field Manager of the Nova Scotia Blueberry Institute, and Dale McIsaac, Plant Industry Branch, began a four-year study entitled "Database survey for lowbush blueberries". The objectives of this study were to obtain management and yield data from as many blueberry producers as possible in order to compare production among different areas throughout the province. Maps of fields in Cumberland and Colchester counties were developed in co-operation with the Nova Scotia Department of Natural Resources. Part of the project involves obtaining soil and tissue samples from approximately 70 commercial fields, in order to determine correlations among soil and tissue levels of major nutrients and fruit yields. By the second year of sampling (1990), it was evident that levels of major nutrients in soils showed poor correlations with nutrient levels in leaves[40].

In 1989, Eaton began a long-term study of a three-year management (double cropping) system established by David Dickinson, a Westbrook, Cumberland County, producer. The objective of this study is to determine why second cropping is successful for David Dickinson when earlier attempts in Maine (during the 1950's) failed due to low second crop yields. Nutrition and management are most likely important aspects of this production system.

A second study designed to compare combinations of burning, two and three year cropping systems and fertilizer applications was initiated in 1989. This study, a co-operative effort between Eaton, the Nova Scotia Blueberry Institute, Bragg Lumber Company, and the Blueberry Producers Association of Nova Scotia, will run for a period of 12 years. Two experiments were established — one at the Nova Scotia Blueberry Institute Field Station, Debert, and the other in Mount Thom, Pictou County.

Chapter 9

ENVIRONMENTAL RELATIONSHIP

Although the lowbush blueberry is found in many areas, Figure 9.1, the commercial production is dependent on specific climatic conditions.

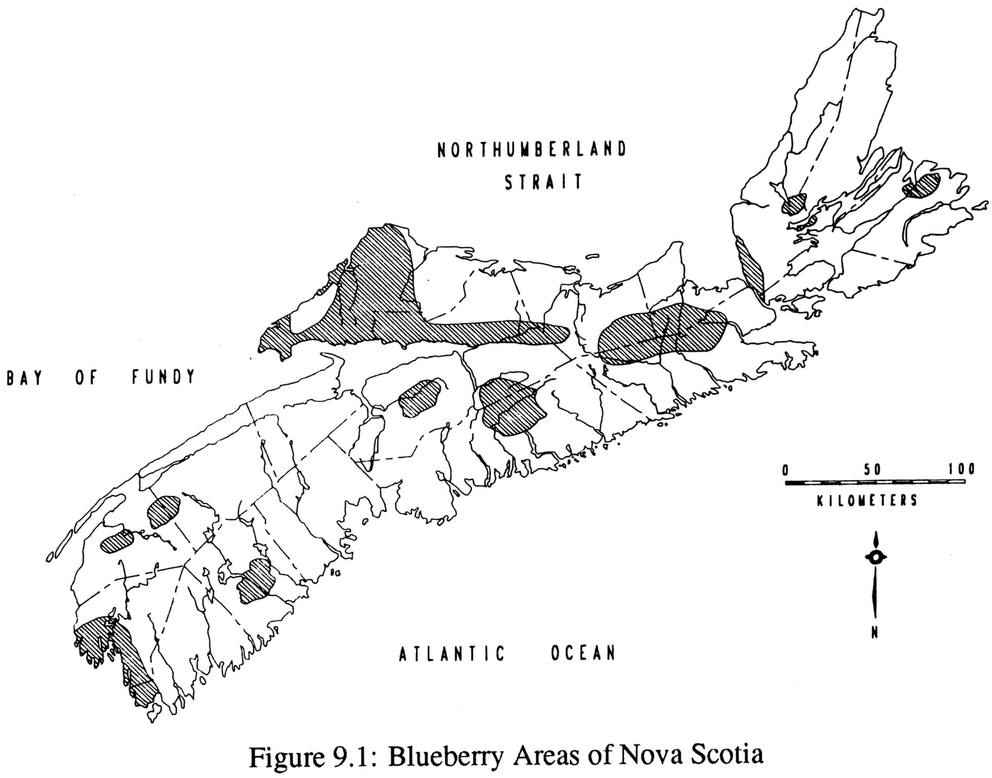


Figure 9.1: Blueberry Areas of Nova Scotia

9.1 Climate of Nova Scotia

Nova Scotia, lying in the middle latitudes, is subject to constant conflicts between cold, dry air masses from the sub-polar regions to the northwest and the warmer, moisture-bearing marine air from the south.

The influence of the westerlies causes many of the low pressure areas moving across North America to pass over the Atlantic provinces. As a result, this area has storms more frequently throughout the year than any other part of the country. The frequent passing of low pressure areas, with their associated bad weather, and the maritime location provide Nova Scotia with ample precipitation.

Despite the maritime location of Nova Scotia, the climate is a modified continental type. A continental climate is characterized by a wide range of temperature. The ocean reduces the temperature range of coastal areas by supplying heat when it is cold and providing cooling when it is warm. Areas near the coast have milder winters and cooler summers, with a longer frost-free period. However, the advantage of a prolonged season is offset by the cooler temperatures and fewer heat units available for plant growth.

9.2 Climatic Regions of Nova Scotia

Nova Scotia has a modified continental climate with distance from the coast, and elevation determining the local variations in climate. The ocean waters exert the major modifying influence in Nova Scotia, since the relief of the province is not extreme as only the Cobequid Mountains and the Cape Breton Highlands have elevations over 1600 feet.

In Figure 9.2, Nova Scotia is divided into eight broad climatic regions which provide an overview of the climate of the province.

A — Northumberland Shore has a delayed spring, a warm summer and fall, but a cold winter, and the lowest precipitation in the province, being sheltered from storm winds from the south or east. The Northumberland Strait is a shallow, sheltered body of water that warms quickly in summer and freezes in winter, and provides less of a moderating effect than other coastal waters.

B — Northern Nova Scotia The highlands receive high snowfall and have the coldest winter temperatures, but quite warm summer temperatures.

C — Cape Breton Highlands Receive the highest total precipitation in the province and have cool temperatures summer and winter.

D — Eastern Nova Scotia A diverse geographic area with high rainfall, and generally cool temperatures due to the influence of the cool Labrador current.

E — Western Nova Scotia A peneplain sloping upwards from the Atlantic coast, has high rainfall and warmer temperatures than eastern Nova Scotia.

F — Annapolis Valley A sheltered lowland with the warmest temperatures and the second lowest precipitation total in the province.

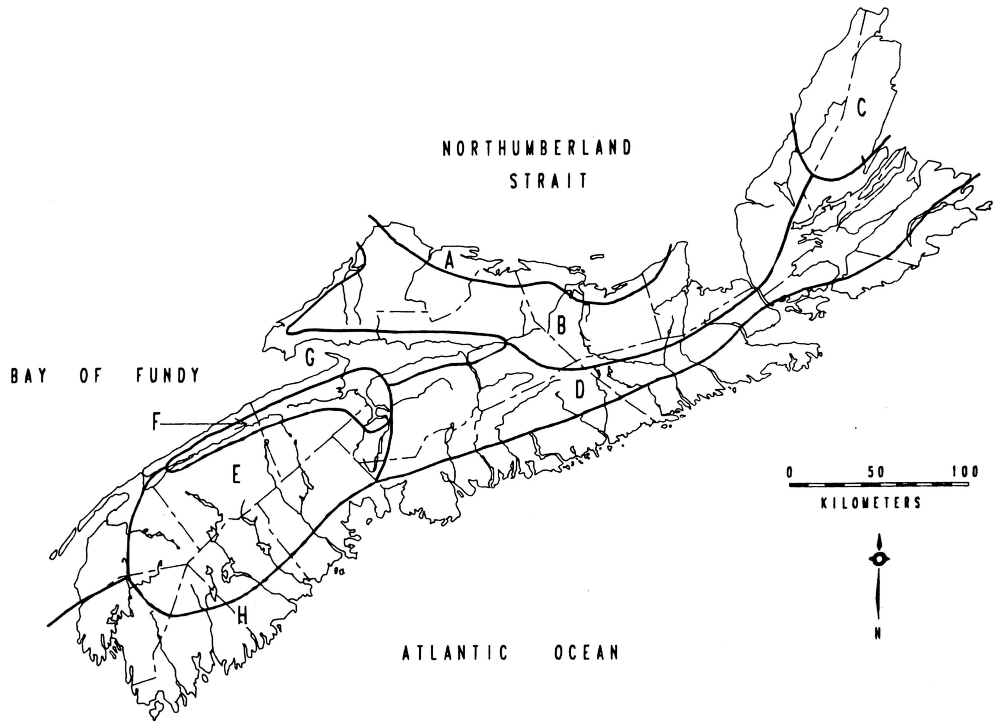


Figure 9.2: Climate Zones of Nova Scotia

G — Bay of Fundy Region	A narrow strip along the coast from New Brunswick to Yarmouth. A strong coastal influence produces a long cool summer and a mild winter. There is frequent fog and moderate precipitation.
H — Atlantic Coastal Region	A strong coastal influence produces the coolest summer and warmest winter temperatures in the province. However, this effect extends only several kilometers inland. The moderating influence is strongest in the extreme south west where the coast waters are well mixed and unstratified. Rainfall amounts are high with the relative humidity also high, and there is frequent heavy sea fog along this coast and from Parrsboro to Advocate in Cumberland County during bloom and harvest. [31]

The lowbush blueberry is found farther north than the highbush species, not because it is hardier, but because it is covered by snow in the winter and is thus protected from cold injury. [32]

The snow may not stay on the ground long enough to prevent the loss of some lowbush blueberry shoots as the result of desiccation by the winter winds. In other cases, light snowfall may result in the exposure of blueberry shoots above the snow line. Injury may be observed on the upper portions of shoots where buds and stem tissues appear shriveled. Shoot tissues appear gray to dark brown.

Buds on injured portions of the shoot fail to develop when growth begins in spring. Some winter injury usually occurs annually.

Vegetative buds in early stages of development may be damaged by spring frosts (temperatures below 28.5^{0}F). The injury results in death of tissues inside the bud. Subsequent growth of the bud results in a rosette of leaves consisting of the blackened centre of the bud surrounded by a few expanded leaves, which previously were the outermost leaves of the bud. Extensive frost injury may adversely affect yields as less vegetative growth occurs to support fruit production. Flower buds do not appear to be susceptible to frost during early stages of development but become sensitive during bloom.

The selection of favorable sites is one of the best frost-protective measures. It has been found that the site chosen for developing must have good air circulation. Such a condition is found in level, open country not surrounded by a dense growth of trees and shrubs, or on a gentle slope. Low pockets, with their regular nightly gravitational influx of cold air (air drainage), should be avoided. Blueberries do better at higher levels above the lowlands. Areas completely surrounded by trees and brush, which tend to inhibit air circulation, are also more subject to frost than open sites.

Temperature affects the characteristics of the blueberry fruit as well as the plant. Blueberries are more highly flavored toward the northern limit of their growing range, where the days are long and the nights are cool at the time of fruit opening.

Photoperiod studies indicate that the vegetative growth of blueberry plants is increased by long days and that short days are required for flower bud initiation [55]. Bell[7], however, have shown that flower primordia were present on lowbush plants before the onset of short days. Subsequent studies[52] suggested that temperature may be an important factor in initiating flower buds under long days in the field.

Flower bud initiation has been induced in the lowbush blueberry in a greenhouse environment in the absence of a dormant period suggesting that cold treatment is not essential for growth and flowering. [52] Under a 16-hour day the plants experienced only vegetative growth, but when they were given short day treatments, flower primordia were initiated. When the plants on short days were returned to long days, flowers were produced, indicating that the rest period is not an essential part of the flowering process.

In lowbush blueberry fields, Hall [49] observed that low light intensity results in shorter, thinner shoots, fewer sprouts with flower buds, and a lower total of flower buds. Therefore shade produced by weedy shrubs may be an important factor in decreasing lowbush blueberry production.

Irrigation has been found necessary during unusual droughts or where the plants have been growing on shallow soils. Uniform and adequate soil moisture is important for successful production.

Additional climatic maps are found in the Appendix A.1 to A.9.

The 1968 crop was the smallest since 1953 due to a late spring frost combined with a summer drought which reduced the potential crop of 10,000,000 pounds to 2,100,000 pounds.

A hail storm in the Parrsboro Shore area around Fox River and Diligent River on June 15, 1973 caused considerable damage to a number of blueberry fields. Others were only slightly damaged and some escaped altogether. In badly damaged fields the blossoms and leaves were stripped from almost all the shoots. About three inches of large hail stones covered the ground. The storm followed a path about six miles along the Parrsboro Shore area around Diligent River. Besides the crop damage there was considerable damage to some homes and buildings in the area.

Severe winter injury occurred in many areas of the province in 1976, which resulted in the smallest crop since the disaster year of 1968. The injury was most severe in coastal areas of Cumberland County with less injury further inland. A poor growing season occurred in 1975 for the production of new shoots which also reduced the crop.

A combination of salt injury and cold temperatures during the February 2, 1976 storm are attributed to have caused the injury. Percentage of dead buds at various fields in Cumberland were as follows: Diligent River 71.8; Diligent River 86.0; Glasgow Mountain 61.1; Windham Hill 29.8; Southampton 37.9; Diligent River 85.1; Kirk Hill 39.0; and Kirk Hill 54.2 . Counts were made May 19, 1976. Fields along the coast, such as the Diligent River fields, were almost entirely wiped out and, as a result, many fields were not harvested.

Snow fences were established in the Parrsboro area in 1979 to determine if they could reduce winter damage from wind and salt air coming from the Bay of Fundy. Bud counts and yields from Fox Point indicate that the fences are definitely an advantage, but only for a distance of 30 feet to either side of the fence.

The effects of snow fences on fields at Fox River and Parrsboro, Cumberland County, were monitored for three years. Although it appears the snow fences reduce the high winter kill in that area, it also appears that fertility and sinbar treatments help. No statistical differences were found in yield as the result of erecting snow fences, but the yields reported by Curtis Erb, Parrsboro, show encouraging results (10 tons in 1976, 25 tons in 1978 and 86 tons in 1980). The increase in production at Fox River probably came from the combined use of fences, fertility and sinbar.

A long-term study on lowbush blueberry growth and development, in relationship to weather, was initiated in 1982 by Peter Dzikowski, Climatologist, and L. Crozier, Apiarist, Nova Scotia Department of Agriculture and Marketing. The purpose of this project was to acquire quantitative data on lowbush blueberry growth and development in relation to measured weather conditions and management practices. Nine commercial fields across the province were visited regularly. Five 3.5 square inch quadrants were placed in each field. Measurements of shoot length, fruit bud number, blossom number, berry number and berry weight were obtained.

Environmental parameters were measured by electronic dataloggers in three fields and by hygrothermograph in two fields.

Prolonged rains during the normal picking season will lower the quality and quantity of the production.

Chapter 10

CROP PROTECTION FROM ANIMALS AND BIRDS

Kinsman [70]reported crop damage to blueberry fields by animals.

In the early 1960's, severe damage to blueberry fields was caused by small birds, mainly robins, in the Glenmore area, Halifax County. Fiberglass models of cooper's hawk, the natural enemy of many small birds, were mounted in trees and on fence posts around the ripening fields. In addition, a six-foot model of a flying hawk was suspended from a helium-filled balloon approximately 50 feet above the fields. Wind gusts would hit the balloon and the model created an image of a hawk in flight. Results using these methods were variable.

Carbide guns ("acetylene cannons") were used by many blueberry growers to scare small birds out of their ripening berry fields. These guns made a blast like a gunshot. The blasts could be timed for various intervals around the clock. Results were only fair.

Several blueberry growers mounted battery-operated radios in their fields that were tuned to music programs. Fluctuation in the music programs did help but the results didn't warrant the continual replacing of radio batteries.

The Nova Scotia Research Foundation workers, in 1965, developed a method of keeping seagulls out of blueberry fields. They hung aluminum pie plates, on a leash, from a 10 foot pole (see Figure 10.1). The sun's reflection off the twisting aluminum plates was sufficient to keep seagulls from the ripening berries. One aluminum pie plate was hung per acre. Prior to using these plates, in 1966, Ron Durning, Highland Village, Colchester County, had suffered losses of $2000 from feeding seagulls.

A patch of inner tube rubber (2"x2") is glued (use Pliobond) off centre to the outside bottom of the pie plate. One end of a rubber strip from an inner tube (36"x 3/16") is glued to the patch. The other end of the strip is tied to a fishing line swivel. The other end of the swivel is tied with rabbit wire to the pole. The pole (an alder or maple sapling 10 feet long) is driven into the ground at a 45-degree angle, pointing east so the prevailing wind will not wrap the rubber strip about the pole. The only material that will not break is old inner tube. The pie plates must be free to blow about in the wind.

During 1968, bird damage to ripening berries was very severe in all production areas. The density of using aluminum pie plates was increased to four to five per acre but did not prove effective in protecting the crop from robins and other small birds. They did, however, keep seagulls and crows from feeding on the ripening berries.

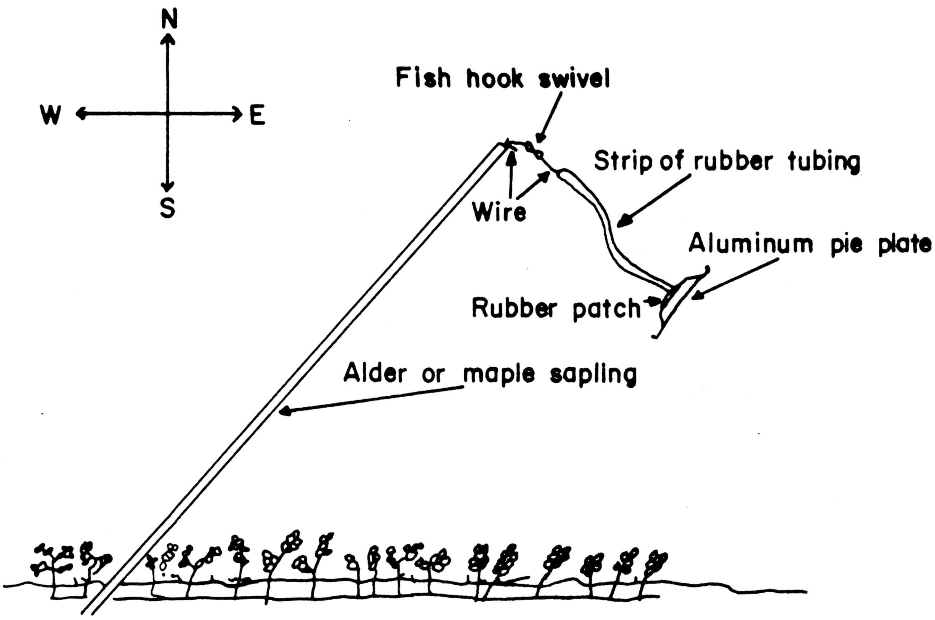


Figure 10.1: A Method of Keeping Seagulls Out of a Blueberry Field

In most areas, serious damage to the fruit crop results from predation by land animals (deer, raccoons, bears and porcupines). Considerable destruction is caused by deer which not only enjoy the ripe fruit but also browse heavily on over wintering shoots in the early spring.

Several growers have erected wire fences around their fields for deer control. Chemical deer repellents were tested by wildlife specialists of the Nova Scotia Department of Lands and Forests. They worked quite well although they had to be put on repeatedly in rainy weather.

Several blueberry growers reported in the 1980's that the red-tailed hawk numbers had been increasing in the province and that many had been nesting around their fields, thus reducing crop losses by small birds.

In 1974 The Nova Scotia Department of Agriculture and Marketing obtained a radio-controlled plane, with a six-foot wing span, which resembled a peregrine falcon. The builder had used similar planes to chase birds away from the international airport in Vancouver, B.C. Keith Silver, a technician with the Nova Scotia Department of Agriculture and Marketing, was the operator of the plane. This plane was used on several occasions in lowbush blueberry fields to scare small birds from feeding on the ripening berries. Difficulties in operating the plane and problems associated with maintenance proved the device could not be readily adopted by growers.

Although very few effective controls were found, it is felt that such losses must be written off as part of management costs. A watchman employed to stay in the fields during the two weeks preceding the harvest will not only reduce bird and animal losses but will also discourage theft.

A meeting was held regarding crop depredation by vertebrate pests at the Agriculture Canada Research Station, Fredericton, on January 27, 1975. This was the first in a series of cross Canada meetings being held by a committee which was commissioned to prepare a national report on this topic. Small animals and birds bring about the greatest losses.

As growers began using honey bee hives in lowbush blueberry fields for pollination purposes, wild bears became a nuisance. Beekeepers were paid compensation by the Nova Scotia Department of Agriculture and Marketing for hives destroyed or damaged by bears. In 1977, 50 hives were destroyed which resulted in $10,000 damage to the beekeeper. Approximately 60 hives per year were destroyed in the next four years and many others were damaged. Electric bear fences were introduced in 1980 and they have proven satisfactory but not to the extent they should have. To fence a site costs $300 to $500 and it takes one to three hours to set up. In 1990, a survey showed that bears are still a problem and literally thousands of dollars in equipment, bees and honey production were lost.

Chapter 11

WEEDS

Weeds (any plant growing where not wanted) represent one of the major limiting factors in commercial production of lowbush blueberries. They are strong competitors for the resources necessary for adequate plant growth, harbour diseases and insects, interfere with the proper application of fertilizers, and make harvesting more difficult. Crop quality and value may also be reduced if weeds and their fruit are harvested with, and contaminate the blueberry pack.

Lowbush blueberries, a crop that is not cultivated, is biennial. The major weeds differ from those found in cultivated crops, and are species found in blueberry fields associated with nature's plant cycle designed to produce forests from run-out fields. As blueberries begin to establish themselves, weeds such as lambkill, hardhack, hay-scented fern, pearly everlasting, wild rose, birch, poplar and chokeberry also appear; they all compete with the blueberry for space, light, moisture and soil nutrients.

The acreage of lowbush blueberries, compared with many agricultural crops in North America, is relatively small, therefore research associated with the discovery and development of pesticides specifically for lowbush blueberries understandably is insignificant to those in the pesticide development industry. This results in a few weed scientists having to carry out a great deal of herbicide screening, residue methods, and timing of application trials to obtain registered products and application methods.

The types of weeds found in lowbush blueberries are, for the most part, native plants as compared to introduced (mainly from Europe and Asia) in cultivated fields. This means the transfer of research from other countries is not as significant as in other cultivated crops.

The variation in lowbush blueberry fields between species, clones, varieties and forms can result in significant variation in crop effects and injury caused by growth regulators and residual herbicides such as hexazinone (Velpar).

The fact that field burning and harvest only occur once in two years provides considerable flexibility in utilization of herbicides, growth regulators and fertility practices.

11.1 General Weed Situation

As nature is allowed to take us from the mainly cultivated hayfield and pastures to the final or climax growth in Nova Scotia, the fields proceed from the cultivated grasses and legumes to a mixture of primarily sugar maple and beech in well-drained, upland areas. Other areas may support a climax stage of red spruce or white pine. As they proceed from the initial stage to the climax stage, nature ensures we see hundreds of varying plant species of which we wish to retain only the blueberry. The major weeds and growth stages relating to lowbush blueberries are as follows.

The initial fields were made up of cultivated grasses and legumes, then the run-out grasses such as red and brown top, as well as poverty grasses on more open soils. Perennial broadleaf weeds such as hawkweed, yarrow, sheep sorrel, pearly everlasting, goldenrod, asters, bracken fern, hay-scented fern, bunchberry, blackberries, sweet fern, spirea, wild rose and bayberry then start to show. Heath plants would also start to grow — lambkill, Labrador tea, rhodora, teaberry and blueberry. Bushes and trees such as alders, birches, cherries, poplars, red maple and willows would then follow. Spruce, fir and pine trees would appear and then the climax stage would occur when sugar maple and beeches started to grow.

The problem, of course, is that there is a need to eliminate the plants already growing in the blueberry fields and also to prevent tree growth from taking over. All of the major weeds are perennial in habit and many can regenerate, much like the blueberry, from underground rootstocks or rhizomes after the pruning burn.

When weeds are controlled, blueberry yields often increase dramatically, and these increases have been attributed to greater plant stand, fruit bud development and berry size. All fields will benefit from weed control.

11.2 Early Weed Research

As Plant Pathologist with the Nova Scotia Department of Agriculture and Marketing, Truro, N.S., between 1949 and 1986, Don Palfrey had the major responsibility in weed control. In the early 1950's, he carried out research on brush control in pastures, roadsides and power lines; most of this information was transferable to lowbush blueberries.

At this time he, in co-operation with Dave Milligan, Engineer; G. Townsend, Engineer; C. Purdy, Technician, Agricultural Engineering Department, Nova Scotia Department of Agricultural and Marketing, Truro, N.S., were constructing tractor-mounted sprayers as well as spray booms for attachment to hand and knapsack sprayers. Herbicides such as 2,4-D; 2,4,5-T, Brushkill (2,4-D + 2,4,5-T); and amino triazole were used in the control of brush, spirea, lambkill, rhodora, hay-scented fern, sweet fern and grasses. Bracken fern was controlled by mowing. Amino triazole was the first herbicide to show considerable selectivity to blueberry plants. The other herbicides, 2,4-D and 2,4,5-T were non-selective to lowbush blueberry plants and application techniques and equipment were developed so that these herbicides could be utilized.

Amino triazole was found to control bunchberry, pearly everlasting and teaberry. Blueberry growers, by the late 1950's, were very quick to utilize new herbicide techniques and treatments. In 1957, plans were drafted and in 1958 a tractor-mounted roller-wiper type of sprayer was built by the Nova Scotia Department of Agriculture and Marketing engineers for Seymour Dickinson, West Brook. This machine was developed for applying non-selective herbicides such as 2,4-D and 2,4,5-T to trees and shrubs that stood above the blueberry plants.

Chemical treatment is the most effective and acceptable method for the control of weeds in large fields. When applied to the growing leaves the chemicals are taken into the plant and move in the plant sap to all parts, including the roots. When conditions are right, not only the tops but all living parts of any susceptible weed can be killed. Herbicides are usually obtained in the form of concentrated liquids and must be diluted with water or oil according to directions given on the containers.

11.3 Application Methods

The best method of applying herbicides depends upon the size of the operation. The simplest one is the glove method. The leaves and stems of the weeds can be wiped with a woolen mitten soaked in weed killer. The herbicide is carried in a pail and the applicator must wear a rubber glove beneath the mitten to prevent his skin from absorbing the chemical. This method is somewhat risky, time consuming, and suitable only for those wishing to treat a small area or for spot treatment of the few plants not killed by a more intensive but less costly method of control. Growers with moderate-sized holdings have found it more economical to use a knapsack sprayer supplied with pressure from a hand pump. The least expensive method of applying herbicide to fields is with a power sprayer, and growers with 20 acres or more find this method economical even though the initial cost is high. Two machines, the roller-wiper and the revolving brush applicator, were developed.

Herbicides should be applied to most weed species when the growth is active and leaves are green.

In the 1950's the only weed work being carried out in connection with lowbush blueberries was in Nova Scotia and Maine. The first recommendation to weed scientists appeared during the mid 1950's and consisted of transfer of brush control treatment to lowbush blueberry as well as the use of 2,4-D on sweet fern and mowing for bracken fern.

Palfrey, in the late 1950's, showed that 2,4-D could be applied to blueberry plants for lambkill control, when the blueberry plant drops its leaves in the fall and before spring burning. Webster, Agricultural Centre, Kentville, conducted research with 2,4-D; 2,4,5-T; CMPP; MCPB; and Polychlorbenzonic acid on lowbush blueberries.

In the early 1960's Palfrey reported his research plots had shown that the herbicide amino triazole gave control of bunchberry, pearly everlasting, teaberry, sweet fern and blackberry regrowth.

In 1961, a revised pamphlet was produced by Palfrey on "Weed Control in Wild Blueberries" stressing methods and timing techniques as well as equipment used in applying 2,4-D, Brushkill and amino triazole.

Weeds in blueberry fields in Annapolis and Queens counties were generally similar to Cumberland County fields, although teaberry was more prevalent in Annapolis County, and wild roses and blackberry prevalent in Queens County. Inkberry (Ilex globra), a member of the holly family, was reported as a problem in Shelburne County. It was found that regular burning would control it.

In co-operation with a number of growers in Cumberland County, a rotary-wiper machine applicator from Maine was tested in various blueberry fields. It was found this machine was less effective than the roller-wiper machines used by a number of growers.

In 1965 Palfrey entered into a co-operative agreement with V. Green, Federal Food and Drug Directorate, Halifax, Nova Scotia, for further testing of herbicides on blueberries. Palfrey had shown that eight pounds active ingredient of amino triazole per acre on blueberries could cause a residue in the berries. In the early 1970's, amino triazole was not allowed to be used on blueberries. The loss of this herbicide was very meaningful as this herbicide was the only major selective weed killer for lowbush blueberries.

The Nova Scotia Weed Control Act was in force by early 1967 and Palfrey had to devote more time to administer this Act. Keith Silver was appointed as Palfrey's technician in 1972. In 1968, the Maritime Advisory Committee on Weed Control was established.

11.3.1 Weed Rollers

In the late '60's, T. A. Meister, Westchester, Nova Scotia, built a number of weed rollers for applying herbicides. The first one, patterned off one built at the Nova Scotia Agricultural College, ran on skids or runners behind the tractor. This proved very effective and was eventually sold to Ivan Purdy of Williamsdale, Cumberland County, Nova Scotia. A second weed roller was built. The roller was raised and lowered by hydraulics. This machine was sold to Ross Rushton of Oxford, Nova Scotia. His third machine incorporated a new concept in weed roller design. It had two rollers mitered on an angle, for more complete coverage. This machine also proved successful and he later sold it to Bonnyman and Byers of Tatamagouche.

Roller-wiper applicators, which use a rotating carpeted roller to wipe herbicides on the weeds, eliminate most crop injury problems since the herbicide is wiped rather than sprayed on the weeds.

Regular testing of herbicides was carried out by Webster, Leefe and Jackson, Agriculture Canada, and Palfrey, Nova Scotia Department of Agriculture and Marketing, in the late 1960's. Jackson, in 1968, reported that very low rates of picloran injured lowbush blueberry plants and that parquat gave better control than diquat but it caused slower regrowth of the blueberry plant.

L. Dodsworth, B. Creelman and E. Karmo in 1970 developed and manufactured a hand blueberry weed roller which could be operated by one person. It worked so well that plans of this machine were circulated to blueberry growers and many were built and still used in 1990.

In the late 1960's, parquat and diquat were used to establish fire breaks around the blueberry fields.

In 1970, 2,4,5-T was no longer recommended on blueberries because of its high dioxin levels. This herbicide was replaced with 2,4-D.

A new group of plots was established in the fall of 1972 to evaluate various materials, rates, and management techniques for lambkill control. This was a continuing project which ran for several seasons to update the information and recommendations on lambkill control.

In 1972, Banvel was registered for use on blueberry plants. Palfrey registered his concern to the Pesticide Technical Office, Agriculture Canada, Ottawa, regarding herbicides that can be used on lowbush blueberry plants (2,4-D, Brushkill and dicamba) but that they were not registered. The Pesticide Technical office began to register herbicides for commercial use and for minor crops such as blueberries.

In 1974, D. Clark, and J. MacAulay, engineers, along with D. Palfrey and J. Sibley, drafted a proposal to develop a prototype applicator for herbicides based on assessments of existing applications. Their report:"An Investigation to Determine Design Parameters for Weed Rollers, which are used to Apply Herbicides to Plants Growing Above the Blueberry Plants", was initiated. A number of home-built machines were inspected and it appeared that the applicator success was largely due to the skill of the operator.

The chief problem was regulating the amount of herbicide on the roller. This is usually controlled by the operator with an on-off switch, leading to dripping when weeds are scarce and under application in very weedy sections. Since the weeds are seldom of uniform density across the roller a surface material which holds considerable moisture before dripping was required.

On November 25, 1972 a change occurred in the enforcement of regulations under the Pest Control Products Act. From that date onward, growers and extension workers were advised that anyone recommending or using a non-registered pesticide would be subject to severe penalties including jail sentences.

This development posed a new situation for lowbush blueberry growers and extension workers in the province. Growers had been freely using 2,4-D; 2,4,5-T; and amino triazole for weed and brush control in lowbush blueberry fields. Extension workers had been recommending use of 2,4-D and 2,4,5-T for many years. None of these chemicals were registered for use on blueberries.

A meeting of blueberry buyers and processors in the province, together with the executive of the Blueberry Producers Association of Nova Scotia, was held December 14, 1972 at Leamington, Cumberland County. The purpose of the meeting was to discuss the status of herbicides presently being used on lowbush blueberries in light of recent changes regarding herbicide registration.

Subsequent to this meeting, letters requesting registration for 2,4-D and 2,4,5-T were sent to the chemical companies concerned. It was decided at the meeting that more research should be carried out on amino triazole before applying for a registration for blueberries. Another factor in this latter decision was the fact that amino triazole was banned on all food crops in the United States where 80 per cent of Nova Scotia's berries were sold.

A woolen mitten, soaked in a herbicide and worn over a rubber glove, was recommended since the late 1950's in Nova Scotia. In 1974, Croptex Ltd. of Illinois, USA, manufactured and sold an improved herbicide glove for wiping herbicide/water solution on weed foliage.

Jensen, Agriculture Canada, Kentville, took an active role in having terbacil and pronamile registered for lowbush blueberries.

Sibley conducted a survey on bunchberry infestation levels in Cumberland, Colchester and Pictou counties. Palfrey reported bearberry was a problem in several fields in Queens County. Since this weed is an evergreen, as is lambkill, it can be controlled in the same manner as lambkill.

11.4 New Material Registrations

Management trials conducted in the 1970's by Lloyd Jackson, Agriculture Canada, Nappan, in co-operation with blueberry scientists at Kentville resulted in showing that Velpar applied to blueberry stands decreased the weed competition and increased yields dramatically. This has become a procedure accepted by the industry and one of the main reasons that the total crop production has increased in the region in recent years. [62]

Herbicide screening and testing was a continuing program. Some interesting results of 1974 and 1975 trials were:

1. the combination treatment of 2,4-D + Banvel appears to give better and faster control of lambkill than 2,4-D alone;
2. asulam (2 lbs./acre) gave complete control of bracken fern with no injury to blueberries.

From 1974 to 1979 L. Eaton, Nova Scotia Agricultural College, carried out considerable research work on herbicides such as terbacil and diuron in combination with the use of fertilizer treatments and various growth regulators.

In the late 1970's, Jackson, Agriculture Canada, Nappan, Nova Scotia, reported good control of lambkill with Velpar. By this time it was very evident that the use of application techniques developed in the '50's (roller-wise, glove-wiping, spot treatments, etc.) that permitted application of herbicides to weeds while keeping the sprays off the blueberry crop was permitting responsible use of certain non-registered products by the growers. This was fortunate as requirements for registering herbicides for grower use were being greatly expanded by the federal regulatory officials.

From 1977 to 1979 the following herbicides were added: diuron, lenuron, chlorboromuron, as well as 10 additional herbicides, a number of which were code numbered products. This was the first time that lowbush blueberry select clones were listed with herbicides recommended for trial by weed scientists.

In 1979 herbicides registered for farmer use in lowbush blueberries were Banvel, Asulam (Asulox F) and Terbacil (Sinbar). Methods of application used were overall spray, hand and machine wiping, stump and basal bark and spot treatments.

Projects to study the combined effects of Sinbar (Terbacil) and Karmex (Diuron) on grass and other weeds were completed in 1979. Sinbar alone gave good results on brome grass for up to three years. A secondary effect of Sinbar (Terbacil) is that it increases fruit bud set and helps to reduce winter damage. There were also indications that Sinbar contributes to increases in yields.

Karmex (Diuron) did not provide good control of goldenrods, particularly rough, Canada and narrow-leaf goldenrods.

The combination of Terbacil and Diuron did influence yield when used in conjunction with fertilizer, especially when compared to plots where fertilizer alone was used.

A recirculating sprayer was purchased and tested under the Innovative Demonstration program in 1981. This machine showed promise for a cheap and selective application of herbicides in blueberry fields. Follow-up tests and demonstrations were carried out that year and the machine proved to be a good unit for use in commercial fields.

By 1984, the new herbicides Atrazine and Velpar had revolutionized weed control in wild blueberry fields. Most growers apply a pre-emergence treatment of one of these herbicides in the spring of the sprout year. This results in very good weed control throughout the cropping cycle. Some touch-up work to control escape weeds is sometimes necessary during the sprout year or following harvest in the crop year.

The effects of paclobutrazol (PP333) on the growth and physiology of lowbush blueberries were carried out by Hal Ju, Nova Scotia Agricultural College, Truro, Nova Scotia.

The goal of this project was to screen various plant growth regulators and to identify those conferring useful growth modifications in lowbush blueberries. After a series of such experiments in both sprouting and first fruit year lowbush blueberry plots in 1986, it became evident that the plant growth retardant PP333 did confer some desirable growth modifications to the test plants.

In 1987, a series of experiments were initiated to test the effect of PP333 on frost damage to the flower primordia of the flower buds and a possible significant reduction in winter die-back. Also, an exhaustive series of carbohydrate analysis of test plants was initiated to determine if there were, in fact, excess levels of carbohydrate present in PP333-treated lowbush blueberry plants.

Pesticide availability is probably our major problem today. In the early '50's, due to lack of knowledge, toxicological concerns were minimal.

Today there is no allowance for toxicological gaps in attaining registration of a new pesticide. Toxicological studies are not only required for the herbicide itself but for its contaminates and metabolites as well. This has resulted in a marked increase in development costs and a drastic decline in the number of new products reaching the market place. In 1956 the average cost to acquire the necessary data for registration of a pesticide was 1.2 million dollars with one chance in

Table 11.1: Major Pesticides Introduced at World Level 1931 – 1990

Decade	Number of Pesticides
1931–1940	1
1941–1950	9
1951–1960	18
1961–1970	19
1971–1980	4
1981–1990	1 to 2*

* unknown but probably in range

1800 of any given test chemical becoming commercial. By the mid 1980's the cost was estimated at 40 million dollars, requiring eight to eleven years (half the patent life) to obtain the data necessary for registration with one change in 17,000 of the product reaching the market. The number of major pesticides introduced at world level over the past six decades are found in Table 11.1.

In 1970 the cost of producing a pesticide was broken down into 53 per cent for discovery and research versus 47 per cent development and regulatory compliance. By 1976 the breakdown was 34 per cent and 66 per cent respectively.

Excessive regulations and escalating costs could well result in more effective and safer pesticides already discovered, but not yet commercialized, never benefiting mankind. This in turn assures virtually no pesticides for minor and new crops thus eliminating the advantages of chemical diversification. Problems associated with resistant strains of pests, toxicology, residues, etc., would certainly follow.

Hexazinone (Velpar) has proven to be an effective herbicide widely used in the cultivation of lowbush blueberries, especially in Nova Scotia where most of the acreage had received at least one application since its registration in 1982. Hexazinone is especially useful where the major weed problem is woody weeds, and for bringing new fields into production and for renovating old fields infested with brambles, hardhack or other woody weeds. Alder, bayberry, black chokeberry and some other woods are not killed by hexazinone. Hexazinone is applied in the spring after the pruning burn but before emergence of the blueberries. [63]

Atrazine has been used to control the more common perennial weeds in blueberries. The blueberry plant is highly tolerant to atrazine. This herbicide was registered for use on lowbush blueberries in the early 1980's. Because of its activity against a number of broad-leaved weeds, Atrazine generally gives better weed control than terbacil (Sinbar). However, unlike hexazinone (Velpar), it is not known to control any of the common woody weeds often associated with blueberries, such as lambkill, hardhack, trailing blackberry, etc. Because of its herbicidal activity, atrazine should be used on crops that are relatively free of woody species, but may be infested with a mixture of grasses and broad-leaved weeds. Where woody weeds have to be controlled, hexazinone (Velpar) is recommended.

Blueberries respond to reduced weed competition with significant yield increases — generally 50–100 per cent. These increases were attributed to significant increases in the number of fruiting shoots and fruit buds per shoot. Atrazine is applied before shoot emergence in the burn year. [64]

There was limited information available on the number and abundance of individual weed species present in blueberry fields. To meet this need, a new publication "Weeds of Eastern Canadian Blueberry Fields" was published in 1990. [89] This publication will be used by extension workers, researchers and lowbush blueberry producers.

Chapter 12

INSECTS AND THEIR CONTROL

Studies on the insect fauna in the blueberry fields of Cumberland County were initiated in 1952 and involved studies on:

1. species that are annually of economic importance;
2. species that periodically are of economic importance; and
3. species that feed on blueberry, but do not rank as a pest.

Annual surveys are still made to determine the distribution and abundance of blueberry insects in Nova Scotia. The life histories, habits and controls of several species were studied in the field. When sudden outbreaks of new insect species occurred, such as tussock moth and case beetles, George Wood, Entomologist, Tower Hill Blueberry Station, would be contacted and he, in conjunction with the Nova Scotia Department of Agriculture and Marketing entomologist, would study the species, and make control recommendations.

The blueberry, like most other crop plants, is subject to a variety of insect pests. Fortunately, most of these can be controlled by the proper application of insecticides. The amount of chemicals used does not cause problems with residues on the fruit, and the cost is not prohibitive.

Insects may cause economical losses in blueberry production but they have not caused major losses in recent years. There is a wide range of pesticides available and, if properly used, will give growers protection against major pests affecting the lowbush blueberry crop. Burning, for pruning blueberries, is considered to be an effective control method for many pests and probably is the reason why insect problems are not extensive. Burning the fields after harvesting apparently destroys most of the wintering-over insects. Higher insect numbers are generally found in fields where flail mowing, rather than burning, is used as a pruning method.

Dusting for blueberry maggot was used by some growers in 1950. Small portable hand-crank dusters were being used. Kinsman states that well distributed and even applications of insecticide dusts were necessary for insect control. Traverses across the blueberry fields should be made every 20 feet when using hand-crank dusters every 100 feet when using small power dusters and every 200 feet when using large powder dusters.[70]

Aerial spraying of lowbush blueberries became increasingly common in the mid 1960's as a means to control insects. The Nova Scotia Department of Agriculture and Marketing spent money in 1973 to lengthen the runways in Parrsboro and Collingwood to make it easier for spray planes to land, service their planes and for sufficient length for the heavily loaded planes. A fixed wing aircraft was used to spray 1000 acres for casebeetles in central Cumberland County. In addition, Canada Foods Ltd., Kentville, and Bragg Lumber Company, Collingwood, both used aerial spraying for maggot control in Cumberland County.

Aerial spraying of lowbush blueberries took place from the mid 1960's until 1988 from the Parrsboro airport. During the peak years in the late 1970's, approximately 3000 acres in total were sprayed by air. During the early years all the spraying was done for blueberry fruit fly control but by the late '70's, as growers became more and more aware of *Monilinia* and *Botrytis* blights, the majority of the aerial spraying was done for blight control. Weather conditions make it very difficult to spray by air. Wind, rain and fog often delayed flights thus throwing off timing. Rough, rugged terrain (especially hills), tree lines and other obstructions make it difficult to spray and obtain adequate spray coverage. Public pressure against aerial spraying was also building in the area.

In the 1980's, tractor-mounted mist blowers became the most widely used method for spray application. These sprayers effectively cover a 50 foot swath, and therefore are preferable to boom-type sprayers, in that the number of trips across the field is reduced. This permits large acreages to be sprayed in a short time frame. Mist blowers are also not affected by uneven terrain as much as a boom sprayer. The amount of water used per acre is greatly reduced (1–2 gallons per acre).

The usage and timing of insecticide applications must take into consideration the presence of pollinating insects, especially near or during bloom.

The array of insects capable of causing economic losses points out the need for constant vigilance for possible outbreaks. The areas of commercial production are so extensive that it is necessary for each grower to be alert to the problem and to make constant checks of his fields for unusual insect abundance. The Nova Scotia Department of Agriculture and Marketing plus Agriculture Canada entomologists conduct excellent research and extension services for the blueberry grower and they may be called on for assistance in any insect problem that may occur. These entomologists survey blueberry acreage for harmful as well as beneficial insects, including pollinators. Their studies, evaluations of present pesticides and new ones under test are used for the regular Blueberry Newsletter issued during the growing season and the Blueberry Protection Guide.

An insect pest monitoring system (IPM) was started in 1979 and is carried out in all blueberry areas except western Nova Scotia. Growers must register each year to start this program. Approximately 30 to 40 growers register with approximately 300 fields per year being tested. The growers take 25 sweeps with an insect net and the collected insects are placed in a one liter ice cream container. Three samples are taken per field. The producer samples are picked up weekly, and the grower is notified by mail of the insect counts within a few days. If an insect problem occurs the producer is notified by phone. This IPM service operates from the second week in May until the middle of July. This survey has been very effective in pinpointing and controlling potential outbreaks before they become serious. Blueberry maggot, *Rhagoletis mendex* Curran is the most important pest of the lowbush blueberry. It is common in most blueberry areas in Nova Scotia. The larva develops in the berry and causes premature ripening and breakdown. Maggoty berries are soft, mushy and they leak over other berries causing a sticky, wet and unattractive fresh pack. It is not possible to wash out, winnow or eliminate by hand all the infected berries.

Fruit containing maggots is liable to seizure and condemnation by the U.S. Pure Food and Drug Administration. Careful inspection by laboratory tests is carried out by processors and buyers to determine whether the berries are contaminated.

In the 1950's, a 50-10-40 maggot dust (50 parts of calcium arsenate, 10 parts of monohydrated copper sulphate, 40 parts of monohydrated lime) was commonly used. The first dust was applied on bearing fields at the rate of six to ten pounds per acre when the producer could harvest one quart of ripe blueberries per acre. There have been many insecticides used for the control of this insect since 1950.

G. W. Wood, Entomologist, Agriculture Canada, Fredericton, N.B., showed that sticky yellow traps can be used effectively in monitoring activity of the adult blueberry maggot. He recommended that the first insecticide for maggot control should not be applied until seven to ten days after the berries have started to ripen. He recommended the destruction by burning of refuse piles which accumulate at sites of field winnowing or cleaning.[105]

A study was done on the ecology and control of blueberry maggot.[60] Fruit was harvested from numerous fields in Cumberland County in 1983, 1984 and 1985. In these years, 21 per cent, 33 per cent and 71 per cent respectively of the fields had infestations of maggot exceeding the maximum tolerable limit of four maggots per liter of fruit. Suggestions were made as to how growers could reduce levels of infestation in their fields.

W. Neilson, Entomologist, Agriculture Canada, Kentville, reported in 1987 that, based on two years of experience, it appeared that one or two sprays of insecticide to moderately infected sprout fields can prevent or reduce maggot infestation in adjacent fruiting fields. By reducing the primary source of maggot flies, insecticidal applications to fruiting fields may be eliminated.

Blueberries from the Kentville area were irradiated at low doses of gamma rays to investigate whether this technique might eradicate the blueberry fruit fly, *Rhagolatis mendax*, without affecting fruit quality.

A dose of 3.0 kGy was required to kill the maggots and pupae. Such a dose caused some loss of quality, particularly with respect to texture and skin integrity. Pupation occurred at a dose of 0.78 kGy but not at 1.5 kGy. [103]

12.1 Major Blueberry Insects

Blueberry leaftier *Croesia curvalana* (Kearfott) — The blueberry leaftier became a pest on improved blueberry fields in 1977. In 1982, this insect caused serious damage in the Fox River area of Cumberland County, N.S.

Blueberry spanworm *Itame argillacearia* (Packard) — The blueberry spanworm became an important pest of lowbush blueberry in Nova Scotia in the late 1980's. Occasionally it will cause extensive damage to leaf and flower buds, blossoms and vegetative shoots. In severe outbreaks, current crop yields are reduced and extensively damaged areas have the appearance of burned areas with only twigs and stems remaining. Spanworm has become more prevalent with the introduction of mowing as a pruning method. In 1983 and 1984 spanworm outbreaks occurred in Cumberland and Colchester counties. A Blueberry Spanworm fact sheet was prepared. [59]

Blueberry thrips

Frankliniella vaccinii Morgan and *Catinathrips kainos* O'Neill — Two species of thrips have been identified from lowbush blueberry. They are similar in appearance and are more common in sprout fields. Injury is easily recognized by tightly curled, red leaves. In sprout fields the leaves are generally wrapped around the stem of the plant, whereas in crop fields lateral or terminal leaf rolls are formed. Infestations are usually spotty, but in some sprout fields, they become major pests and may reduce yields by more than 50% in the following crop year. Infected sprouts bear little, if any, fruit during the following crop year, and control treatments should be applied during the sprout year to prevent crop losses.

Blueberry flea beetle

Altica sylvia Malloch — The blueberry flea beetle is common in many lowbush blueberry fields in the Maritimes and occasionally causes severe foliar damage resulting in crop losses. It is more prevalent in crop than in sprout fields, but can cause extensive damage in sprout fields that are close to infested crop fields. It is seldom a problem in fields that are burned every two years. The damage is usually localized although occasionally the damage is widespread. Small outbreaks occurred in 1970, 1971, 1972, 1978 and 1983. Damage occurred in fields 10 to 200 acres in size.

Blueberry leaf beetle

Pyrrhalta vaccinii (Fall) — The blueberry leaf beetle occasionally causes damage to blueberry plants, especially in newly developed or poorly managed fields. The adults and larvae feed on the lower leaf surfaces between the veins, which results in skeletonization. The upper surfaces eventually turn brown. Severe infestations in successive years can kill the plants.

Blueberry case beetle

Neochlamisus cribripennis (Leconte) — The blueberry case beetle is present in most blueberry areas and occasionally causes serious damage to the stems of blueberry plants. Although it feeds on both leaves and stems, extensive girdling of the stems kills these shoots and results in a crop loss. Although new growth arises from underground rhizomes after the field is burned, repeated feeding and girdling causes permanent damage. When prevalent, insecticides are necessary to prevent crop losses. The blueberry case beetle was first found in one field in Mapleton, Cumberland County, in 1960. By 1965 it had expanded to over 500 acres and in 1969 close to 1000 acres were aerial sprayed in Cumberland County. Two new areas in Pictou County were found with severe blueberry case beetle. This insect was carefully monitored each year and by 1981 it was causing severe damage in localized areas. This insect hasn't been a widespread problem in the late 1980's.

Black army cutworm

Actebia fennica (Tauscher) — Several species of climbing cutworms feed on blueberry foliage, but only the black army cutworm has caused extensive crop losses. In most years, the black army cutworm and other species are present in low numbers, but periodically widespread outbreaks occur to defoliate hundreds of acres with substantial crop losses.

Chainspotted geometer *Cingilia catenaria* (Drury) — The chainspotted geometer is an occasional pest of blueberries but is seldom destructive, except during outbreaks when it may completely destroy the foliage and fruit as it did in 1982.

Near Kirkhill, Cumberland County, in 1969, about one and one-half acres were infested with the chainspotted geometer. Defoliation ranged from 10 to 80 per cent.

Whitemarked tussock moth *Orgyia leucostigma* (J. E. Smith) — In 1956 a widespread and destructive outbreak of this caterpillar occurred in blueberry fields. This was the first known economic damage to blueberries caused by this insect. Defoliation of bushes resulted in failure of the blueberries to ripen. [70]

In 1970, several blueberry fields in the Sunnybrae-Blue Mountain area of Pictou County were ruined by this insect and practically all fields in this area received some damage. The following year, tussock moth was prevalent in blueberry fields in Antigonish, Pictou and the eastern part of Colchester County.

It was five years later (1976) before another severe infestation, complete loss to moderate loss, occurred in the Londonderry-Economy area of Colchester County and parts of Cumberland County. Over 1500 acres of blueberry land were affected. Approximately 1100 acres were aerial sprayed and another 400 acres were dusted using ground dusting equipment. The following year an infestation occurred in the Musquodoboit and Stewiacke areas.

Redstriped fireworm *Aroga trialbamaculella* (Chambers) — The redstriped fireworm is a minor pest of lowbush blueberry but occasionally causes severe damage in some fields. This insect, until 1969, had only been considered a very incidental pest. Damage was usually confined to sprout fields in the fall and buds were not affected. Damage in 1970 and 1971 was noted on crop fields and infestations were severe. Damage occurred in Colchester, Cumberland and Halifax counties. It is generally more plentiful in sprout fields, but it also attacks crop fields and can reduce yields by webbing of the fruit. Webbing presents difficulties in raking the crop and may also affect the size of berries.

Other Insects The Small leaf chafer *Serica tristis* (Le Conte) sometimes occurs in large numbers in blueberry fields during bloom and occasionally damages blossoms. An outbreak occurred in blueberry fields in Mt. Thom, Pictou County in the 1970's. This was the first time this insect was reported as an economic pest in Nova Scotia. The next occurrence was in 1981 in a field near Earltown, Colchester County, and control measures were necessary.

Sawfly larva were found in large numbers in several blueberry fields in 1982. Spot insecticide treatment brought this pest under control. Sawflies are usually found in blueberry fields and, since flail mowing, sawflies are more abundant than in burned fields.

In 1977, an outbreak of fruit tree leaf roller heavily damaged a 40 acre field in Parrsboro; a smaller acreage was also damaged in Musquodoboit, Halifax County, N.S.

Chapter 13

DISEASES AND THEIR CONTROL

The first disease report on lowbush blueberry in Nova Scotia occurred in the early 1900's when leaf rust was reported. [23] Since then, much time and effort has been devoted to disease research and extension in Nova Scotia. The early history of lowbush blueberry diseases was found in Conners' [23] and Gourley's publications. [46] In the late 1940's and 1950's, survey work in blueberry fields in the Maritimes was conducted by Dr. J. Frederick, D. Hockey and Donald W. Creelman, Plant Pathologists, Agriculture Canada, Kentville, N.S. Hockey first reported *Botrytis* blight in 1941 from the Tusket district of Nova Scotia. Creelman conducted a special survey of the Maritimes in mid August of 1948. Red leaf was the most widespread and serious disease. Witches' broom, mummy berry, and *Botrytis* blight were also observed.

Ches L. Lockhart joined the staff at the Kentville Research Station and began blueberry work in 1950. At that time, little was known about the life cycles of the blueberry pathogens. Lockhart conducted a detailed study of *Monilinia* and also worked with red leaf [73] and *Botrytis* blight.

In 1983 Dr. Paul D. Hildebrand joined Agriculture Canada at Kentville and began working on *Monilinia* blight. His work has led to a very comprehensive strategy for controlling the disease.

Dr. Nancy L. Nickerson, Agriculture Canada, Kentville, began working with lowbush blueberries in 1979. She studied the spread of red leaf between 1979–1984 and in 1991 described a new *Exobasidium* leaf spot of lowbush blueberry. [84]

Three plant pathologists have worked with the blueberry industry in an extension capacity. Allan A. MacNab (1965–1967), Bart Bolwyn (1967–1968) and Rick W. Delbridge (1969–) have been employed by the Nova Scotia Department of Agriculture and Marketing as extension pathologists. They work closely with researchers and growers. Technical transfer has been accomplished through demonstrations, grower meetings, field days, short courses and newsletters.

During the 1950's, growers were largely unaware of disease problems and losses occurring in the blueberry crop. As disease research intensified and extension programs were developed, growers became more and more familiar with the pathogens attacking their crops and the need to apply controls.

Dusters were used to apply fungicides to control blight in the period from 1950–1970. The first dusters were hand-held with limited tank capacity. Obviously only a limited acreage could be covered. Power dusters which were tractor mounted were used in the late 1950's. These machines could cover much larger acreages but they were very messy and adequate coverage often was difficult to achieve. Boom sprayers really did not become popular for disease control because of the frequent tractor tracks that injured the blueberry crop. Aerial spraying was very popular in the 1970's and early 1980's. During the peak years in the late 1970's, approximately 3000 acres were sprayed by air. During the early years all the spraying was done for blueberry fruit fly control but the by late 1970's, as growers become more and more aware of *Monilinia* and *Botrytis* blights, the majority of the aerial spraying was done for blight control. Weather conditions made it very difficult to spray by air. Wind, rain and fog often delayed flights, throwing off timing. Rough, rugged terrain, tree lines and other obstructions made it difficult to spray and obtain adequate spray coverage. Public pressure against aerial spraying also intensified.

Mist blowers are now used almost exclusively for insecticide and fungicide spraying. These machines have proven to be dependable and effective performers. Wide swaths of up to 50 feet may be taken in the field and low water volumes (1–2 gallons per acre) utilized.

13.1 Major Blueberry Diseases

***Monilinia* blight**

Monilinia vaccinii-corymbosi (Reade) Honey — Lockhart [75] was the first to describe this disease and its life cycle on lowbush blueberry. He concluded that burning helps control *Monilinia* by destroying the mummy berries and that second crop fields were more prone to blight due to the build-up of mummy berries. Lockhart surveyed fields in 1956 — 13 fields in New Brunswick and 2 in Cumberland County were severely infected. A survey of fields in the Maritimes was conducted in 1980, 1981 and 1982. The disease was more serious in fields having wet soils throughout early May and in locations with extended wet periods. The disease was considered a threat in 40 per cent of the fields and a potential threat in an additional 43 per cent. [77]

Lockhart and Delbridge [79] confirmed that the fungicide triforine gave excellent control of the disease. Hildebrand and Braun's [57] work has led to a reduction in the amount of fungicide required to control the disease. The relationship between infection and frost injury to the host, bud developmental stages, wetness duration, and temperature of wet periods were studied. With this information, growers are now able to base disease management decisions upon weather factors. Delbridge and Hildebrand studied and reported on the timing of fungicide applications for *Monilinia* blight.[28]

***Botrytis* blight**

Botrytis cinerea Pers — Hockey found *Botrytis* on the occasional flower and fruit cluster in Yarmouth County in 1941. *Botrytis* is considered to be a major disease of lowbush blueberry throughout the province but particularly in coastal regions which are prone to fog and rainfall. *Botrytis* blight attacks the leaves, blossoms and fruit. The majority of the losses occur from midbloom until several weeks after fruit set. *Botrytis* blight is favored by wet weather during and after bloom. Little research has been directed to *Botrytis*. Fungicide evaluation work has been conducted by Hockey, Lockhart and Delbridge. Ferbam, captan and thiophanate-methyl (Easout) were shown to be effective fungicides. In the late 1970's and early 1980's, Easout was used frequently for *Botrytis* control. A survey of 54 fields was made by Hildebrand

and Delbridge in 1984 and 1985 to determine if resistance had developed to Easout. Twelve fields were designated as having partially or fully resistant populations of the pathogen. [58] Since that time, captan and ferbam have been relied upon for disease control.

Very little is known about the life cycle, or environmental requirements for the fungus on lowbush blueberry. Hildebrand began a project on the epidemiology of *Botrytis* on lowbush blueberry in the late 1980's.

Red Leaf

Exobasidium vaccinii Wor. — Red Leaf is a very common disease of lowbush blueberry. In June and July infected plants develop brilliant red foliage. The lower surface of the leaves becomes covered by a white spore-bearing mat of the fungus. Following this, plants defoliate, bear little fruit and usually die. This is a systemic disease which over-winters in stems and rhizomes of the plant.

Red leaf was first reported in Nova Scotia by Hockey in 1941 in Tusket, Yarmouth County. In a survey of fields in 1956 in Cumberland County, Lockhart reported an average of 6.3 per cent shoots infected. Some fields had as high as 30 per cent of the shoots infected in the Parrsboro area (10 fields). Research by Nickerson from 1979-1984 indicated that blueberry clone resistance and regular burn pruning limits the spread of red leaf disease. [86] The shift by the industry to mowing for pruning purposes may lead to increased incidence of the disease.

Witches' Broom

Pucciniastrum goeppertianum (Kuehn Kleb) — Witches' broom is caused by a rust fungus that attacks both balsam fir and blueberry. On blueberry the fungus stimulates the production of multiple shoots and a broom-like mass of swollen shoots is formed. In the spring, spores produced on blueberry are carried to balsam fir infecting needles of current year's growth. Another type of spore produced on fir infects the blueberry causing swollen shoots. William P. Fraser, mycologist from Pictou County, found the ascial stage of this fungus on balsam fir in July 1909. This was the first collection made in North America. The fungus is perennial in the blueberry plant and the symptoms persist until the plant dies.

Ken A. Harrison, Plant Pathologist, Agriculture Canada, Kentville, recorded the disease in Kings, Halifax and Annapolis counties in 1931. Since then it has been frequently reported but at low levels. A survey by G. A. VanSickle, Canadian Forestry Service, Fredericton, N.B., was conducted in 1971. Twelve fields in N.S. and eight fields in N.B. were examined. In N.S. 2.2 per cent of the plants were infected while in N.B. the figure was 0.7 per cent. Within individual fields the proportion of plants affected ranged from 0.0 to 5.5 per cent. [102]

Despite the low level of infections found in Nova Scotia, grubbing out of diseased plants is recommended. Removal of balsam fir from the vicinity of blueberry fields may also be helpful.

Dieback *Diaporthe vaccinii* (Shear) — Dieback is caused by one or more weak parasitic fungi that attack blueberry shoot tips after they have fruited or have been exposed to winter injury. The disease is seldom serious except in fields held over for a second crop.

Godronia canker *Godronia cassandrae* Pk — This disease was described for the first time on lowbush blueberries in Nova Scotia by Lockhart and Delbridge in 1972. [78] The fungus previously was found only on highbush blueberries, where severe losses may develop. This canker is controlled in commercial fields by burning.

Powdery mildew *Microsphaera penicillata* (Wallr. ex Fr.) Lév. var. *vaccinii* (Schw.) W.B. Cke — Powdery mildew is seldom serious enough to warrant control measures.

Leaf Rust *Pucciniastrum vaccinii* (Wint.) Jorstad — Leaf rust is a disease caused by a rust fungus that passes part of its life cycle on hemlock and part on lowbush blueberry. Leaf rust causes little damage.

Leaf Spots *Septoria* leaf spot (*Septoria* sp.) — *Septoria* leaf spot, caused by a fungus, is of minor importance on the blueberry.

Gloeosporium leaf spot (*Gloeosporium minus* Shear) — The disease is rarely found on the lowbush blueberry.

Exobasidium leaf spot (*Exobasidium* sp.) — A minor leaf spot found mainly in unmanaged blueberry stands.

Other leaf spots — Leaf spotting of unknown causes occurs on lowbush blueberries during midsummer and is more severe in crop years. The spotting occasionally appears in the sprout year. Leaf spotting is more severe during prolonged dry weather or where blueberries are grown in light sandy or gravelly soils. Unshaded leaves show more injury than those in the shade. Some leaf spotting is caused by plant viruses. Defoliation occurs if spotting is severe.

Virus Lockhart and Hall published on an indication of shoestring virus in the lowbush blueberry. This is a minor disease.[80]

Usually one man 'running' string for lanes can accommodate 50 rakers. The stringing of fields can begin the day before the actual harvest if desired. It is usually not wise to string fields several days in advance of harvest, as animals can "mess up" the lanes quite badly before the crew arrives.

The length of the lanes is not critical and will vary with field lay-out and type of terrain. The string is kept at the level of the blueberry plants. The ends can be tied to weeds or the blueberry plants. Stakes may also be used if desired. Many growers take up their string after harvest and store it for the next season. A stringing reel simplifies laying out and taking up of the string.

14.1.3 Using the Blueberry Rake

The raker usually works from either a standing or kneeling position while raking. However, more berries can be raked in the standing position. Alternating positions occasionally will help reduce fatigue.

The raker should begin either in the lower left or right-hand corner of the lane where possible. They should have their back to the sun as it is easier to see the berries. They should rake across the lane, always moving straight ahead. The rake should overlap its former position about one-half inch each time to collect any missed berries.

To maneuver the blueberry rake, the following procedure is generally followed: the rake is placed flat on the ground and then it is moved slowly into the shoots straight ahead to the base of the teeth, tilting the tip of the rake up a little. The rake is then rolled upward and backwards, pulling it through the blueberry shoots. This allows the berries to catch in the teeth, detach, and roll back to the heel of the rake. Three or four scoops are made into the shoots, always straight ahead, then the berries are emptied into the pail.

Rakers must rake carefully and slowly. Slower and more careful raking will generally result in higher berry quality and a cleaner raking job.

Rakes that are over-filled crush and mash the blueberries. The rake should be emptied often and it shouldn't be held too high over the pail when the raker empties it. After the rake has been emptied twice, the flat of the hand is used to remove the grass and weeds underneath the rake. This procedure is important to reduce berry damage. If weeds are exceptionally thick, the raker usually cleans his rake every time he empties the berries into the pail.

Daily production per raker will vary considerably depending on the worker's ambition and ability, the condition of the field and the yield of the crop being harvested. Most crews will average about 200 pounds per raker per day. However, hard-working and experienced rakers, under favorable conditions, may harvest 800 to 1,000 pounds per day.

During the 1950's and 1960's most of the blueberry rakes were brought into Nova Scotia from Maine. Claude Cossman, Albion Street, Amherst, Nova Scotia, built good quality rakes for many years. He stopped making rakes in 1973. John Kelligrew, Brookdale, Cumberland County, N.S., has built rakes since the early 1970's. He manufacturers approximately 650 rakes per year and they are sold throughout Atlantic Canada. He finds the 40 tooth rake the most popular.[69] Keith Crowe, Mapleton, N.S., also manufacturers blueberry rakes. He has built a total of 600 rakes. There are several others who make rakes as well. T. A. Meister, Westchester, Cumberland County, built a wooden rake which he used for many years before the Tabbut metal rake from Maine became available in the 1950's.

14.1.4 Winnowing (Cleaning)

In most harvesting operations, after the rakers fill their pails, the blueberries are carried to the winnowing machines for field cleaning.

In the early 1950's, electrification of many rural areas was underway. Many farm homes had washing machines that were powered by a four-cycle Iron Horse or similar make of gasoline engine, equipped with a kick starter. After electrification, many of these motors would be mounted on the top of a wooden sawhorse. A car fan was also mounted on the top of a sawhorse and a belt was connected to the motor and fan. A sheet of canvas or a heavy bed sheet would be spread on the ground in front of the sawhorse. Blueberries would be held above and in front of the fan and the berries would be poured slowly into a box on the ground. Spilled berries would be gathered in the canvas or bed sheet. The fan would create enough wind to blow out the leaves, soil and light debris.

Commercial blueberry field cleaners became available in Maine many years before 1950, and many of these were brought to Nova Scotia and are still being used. These machines were faster and they did a better job of winnowing and cleaning the berries. They would blow out leaves, soil and light debris, while the clusters, green berries and heavier trash is carried off the inclined belt. The larger, marketable fruit rolls down the inclined belt of the winnower and into the shipping boxes. These machines will handle 500 to 1000 pounds of berries per hour. The capacity depends upon the condition of the berries - the drier the berries the greater the capacity. An experienced person should operate the winnowers as they must be able to adjust the rate of flow, from pail to winnower, as well as the machine's belt speed to the condition of the berries.

The portable winnowing machine is placed near the raking area, if possible, in the shade and each machine is used for 20 to 30 rakers. Berries that are wet or damp tend to stick together on the belt. Berries that are raked under dry conditions can be winnowed rapidly at medium belt speed. The moving inclined belt must be kept as clean and dry as possible as many high quality berries may catch in any heavy debris that may accumulate on the belt and they will be discarded. Proper winnowing is an important factor in placing high quality fruit at the door of the processing plant. Approximately 2,000,000 half bushel wooden boxes were used annually in providing containers for the crop. This involves a lot of handling and truck movements.

14.1.5 Recording the Harvest

After the blueberries are raked, there are several methods growers use to record the harvest and pay their rakers. These include:

Payment by weight. This is done by weighing the berries in the field pail. Almost any type of scale is suitable for field weighing of the blueberries. Many growers prefer to use a set of dairy scales hung from a tripod or portable metal rod holder. The weight of berries harvested by each raker is recorded daily on a card or in a book. Paying by weight provides an incentive to rake cleaner berries. Rakers soon discover that they get more weight per pail when the berries are raked clean. The tare weight of the picking pail is subtracted from the total weight when this method is used.

Payment by the pail. This method requires less labour and equipment but does not provide the incentive for raking clean berries.

Payment by the hour. This method is used occasionally by smaller growers who stress very careful raking to help eliminate loss of berries.

The price paid per pound for raking varies with the crop and field conditions. The average price paid in the 1980's has been 10 to 15 cents per pound or between $1.00 and $1.50 per pail.

14.1.6 Harvesting Studies

During the 1964 and 1965 harvesting seasons, a study of harvesting operations was conducted by the Atlantic Region Work Study Centre, Halifax, N.S. Recommendations made as a result of this study led to several projects designed to improve harvesting methods and reduce harvesting losses.

Alternative Harvesting Containers

Several types and sizes of harvesting pails and shipping boxes were evaluated in co-operation with growers and shippers during the 1965 harvesting season. It was shown that losses could be greatly reduced and better harvesting efficiency gained by using a wide mouth pail with larger capacity than pails which were being used.

14.1.7 Harvest Losses

Harvesting losses varied from crew to crew, but the range had been estimated at between 15 to 40 per cent with an overall average of 20 per cent. In many cases, field supervisors had more rakers than they could properly supervise. It was recommended that each supervisor should look after no more than 20 rakers and also the supervisors should have more authority over their crew. Harvesting schools were conducted to train field supervisors and rakers how to do a better job.

A very successful course for lowbush blueberry field supervisors was held at the Leamington School, Leamington, Cumberland County, from March 30 to April 3, 1970. Thirty trainees attended the course. Instruction was given by Jim McLevey and Wally Burke from the Atlantic Region Work Study Centre, Halifax. The two main topics covered were: "Job Instruction Training" and "The Supervisor's Job". The former dealt with increasing the supervisor's appreciation of the teaching/learning process, while the latter was concerned with how to deal with human problems that arise in the work situation. Throughout the course, there was a continuing emphasis on running the blueberry harvesting operation by organizing and training crews as is done in any factory production line operation.

Two one-week courses for blueberry field supervisors were held the following year at the Parrsboro Legion Hall March 29 to April 2, 1971, and the Leamington Elementary School, April 12 to April 16, 1971. Twenty-five field supervisors, who had no previous formal supervisory training, attended each of these schools. These courses were followed up by field checks during the harvest season and a post-harvest evaluation was done by all the crew supervisors on the practical value which was gained from taking this training.

On August 15, 1972, a training session for field supervisors was held in the Collingwood Hall.

The blueberry crop was approximately 10 days later than normal in 1974 and, coupled with a very early school opening, created a serious harvest labour situation. Weather conditions fortunately remained favourable (no frosts) and the total crop was harvested. Harvesting in some areas of Cumberland County continued until September 21.

Availability of labour became critical in the 1970's due in great part to the increased industry being developed in Cumberland County. It takes approximately 27,000 man days to harvest the crop or a field force of 1,800 per day. Any change (industrialization, poor weather, etc.) can seriously affect harvest.

In 1975, harvesting started in most areas about August 15. Harvesting labour did not seem to be as big a problem that season due, in part, to activities of the Scotsburn Farm Labour Pool, an organization set up to help with labour problems in the farming industry. The pool opened a sub-office in Nappan, under the direction of Bob Nash and were able to provide many new pickers and make greater use of available labour. There were no early fall frosts and some large growers continued harvesting as late as October. However, the bulk of the harvest was completed by September 15.

A blueberry field supervisors course was held at Nappan from May 12 to May 16, 1975. Eighteen registered for the course and seventeen completed it. Instruction was provided by the Atlantic Region Management Training Centre, Halifax, N.S. This course was arranged by the Nova Scotia Department of Agriculture and Marketing Labour Committee in co-operation with the Farm Labour Pool.

Two evening short courses to recruit and train harvesting crew supervisors in the eastern Nova Scotia areas were held on May 24 and May 31, 1983 at Goshen, N.S. There were over 50 people in attendance. A field day session was held on August 9 to complete the course. A training session for field supervisors, in the New Glasgow area, was held August 8, 1983.

These courses brought out many points that are being followed by supervisors.

The crew boss or supervisor should be courteous and helpful in any way possible to regulate his crew's activity. He should, however, have a firm attitude in order to be respected by the crew. He should be able to work with all types of people in a friendly, responsible way. Many times, the resulting efforts of a raking crew are determined by the attitude of the crew supervisor. One crew supervisor should not handle over 40 rakers. A smaller number is better, if possible. The following should be some of the activities and responsibilities of the crew supervisor.

- Assign raking lanes so that all rakers get a chance at some nice raking.
- Inspect blueberry plants in areas where string separates the lanes. Rakers will often leave blueberries unraked in this area.
- Inspect areas where the crop is light. Rakers may only rake where berries are heavy.
- Always have rakers rake uphill, unless the grade is short.
- If the rakers are paid by the pound after winnowing, stress to them that careful, slow raking will result in a higher percentage of firm berries and a cleaner pail of berries. This means more money.

Proper raking and handling methods will help to eliminate: (1) clusters, (2) large stems, (3) leaves and other foreign material, and (4) immature and overmature berries.

The first step, after quality berries reach maturity, begins with the harvesting rake. It is well worth the effort to train and supervise the crew for proper raking and handling of the lowbush blueberry crop to ensure an attractive product. The accent must be on producing high quality fruit!

With the co-operation of the Farm and Fisheries Branch of the Canadian Broadcasting Corporation, Halifax, about 700 feet of film was shot in blueberry fields during the 1966 harvest season.

From this footage, an educational film "Who Dropped the Blueberry" was prepared. This film was used at extension meetings and supervisor and raker training sessions.

The Nova Scotia Department of Highways were repeatedly approached to improve the roads in the blueberry areas in 1974. A special report was prepared by the Nova Scotia Department of Development to the Nova Scotia Department of Highways pointing out the economic value of this industry to the economy of Cumberland County, and the need to upgrade many of their roads. Spring and fall months are particularly critical as they are the periods when the fields must be burned (pruned) in a relatively short period. Over 400,000 gallons of fuel oil and 100,000 gallons of propane are trucked to the burners during these periods. Millions of pounds of harvested berries must be taken from the fields to the receiving stations or processing plants. Roads in poor repair reduce the quality of the harvested berries.

Blueberry Rake Project

One of the recommendations made as a result of this harvesting study was that an investigation be carried out to determine whether the blueberry rake now being used could be re-designed and constructed effectively from some other material.

Field experiments in 1966 showed that harvesting losses average around 20 per cent and that much of this loss was due to the raking procedure. It was felt that an improved design could eliminate much of this loss.

Working in co-operation with Mr. Ernie Bacon, a Design Engineer with the Nova Scotia Research Foundation, Halifax, N.S., a project was started in 1966 to design a new rake. In deciding on the basic design change which should be made, consultation was held with the Atlantic Region Work Study officers who had conducted the study of harvesting methods, as well as with growers and research and extension workers in the industry.

Once a basic design had been decided upon, initial experimentation with various types of plastic materials was tried. These did not prove entirely satisfactory. They were light in weight, but there was some question on their strength and durability.

In July 1967 several prototype fiberglass rakes were built which had the desired toughness, combined with light weight. These rakes were delivered to various progressive growers in Cumberland County who were asked to assess them and pass on their comments and suggestions.

Prototype rakes were field tested during the 1968 and 1969 growing seasons. About 125 rakes were manufactured by LeGay Plastics, Waverley, N.S., and were sold to growers for use in harvesting the 1969 crop.

The teeth of these rakes did not stand up when used by regular picking crews during the harvest season.

14.1.8 Plastic Field Boxes

Many of the half-bushel wooden field boxes, which had been used over and over again for many years, were badly stained from blueberry juice, were in constant need of repair, and the federal health authorities were concerned with regard to health risks.

Can-Am Containers, a plastic manufacturer in Springhill, N.S., introduced their plastic field boxes in 1978. These boxes each hold approximately 22 pounds of lowbush blueberries. Their acceptance by the blueberry industry was immediate and this company was able to supply field boxes to other lowbush and highbush blueberry areas in North America.

These containers are much easier to handle and stack and have less breakage. They are easier to keep clean by washing with water or steam. Many large blueberry growers and processors have their plastic field boxes colour coded as well as having their name on them.

14.2 Mechanical Harvesters

Many efforts were exerted during the past thirty years to develop a suitable mechanical harvester for harvesting lowbush blueberries. The problems were numerous, and they revolved around these facts:

- the topography of the fields is usually very irregular,
- berries, when ready for harvest, are usually only one or two inches above the ground,
- weeds are abundant, and
- rocks and holes are common in the fields.

Mechanical harvesters research work was started by the University of Maine Agricultural Engineering Department in 1947. In 1967 five prototype commercial models were tested. Cost of these machines was approximately $1500 to $2000 each. These harvesters could be expected to do the work of seven to ten pickers. Their picking rate was approximately 2000 pounds per seven hours of operating time.

Four different harvesters were at various stages of development in 1977. The Darlington harvester is a modified cranberry harvester that was available commercially to lowbush blueberry growers. It is a walk-behind machine with a 24-inch wide picking head. Twenty-five of these harvesters were sold in Maine in 1976 and growers reported different results. The effectiveness and, in turn, growers satisfaction, are related to field conditions. Level fields, with little or no weed growth, were more suitable to this method of harvesting. A few mechanical problems were also reported, although such experience is normal and expected in the first trial year.

In co-operation with John MacAulay, Professor of Engineering at the Nova Scotia Agricultural College, Truro, N.S., trials and demonstrations of a mechanical blueberry harvester were carried out in 1974. This machine was based on a similar machine developed at the University of Maine and manufactured by the Chisholm Ryder Company of Niagara Falls, New York, U.S.A. It was based on a modified cranberry harvester. These machines picked blueberries but had a low productivity.

In general, the consensus of all who were involved with the trials of the MacAulay tractor-drawn machine with a 30-inch picking head was that the picking head was excellent and the rest of the machine needed modifications to make it stronger and more adaptable to Nova Scotia field conditions. Growers and Department workers were equally enthusiastic that the needed modifications could be made and that a mechanical harvester which would work on at least 50% of Nova Scotia fields can be a reality for another season if a concentrated effort is put into its development. Negotiations were made with Chisholm Ryder to build one or more picking heads to be used in modified versions of the original machine.

Both the availability and quality of rakers took a serious drop in 1984. The development of the mechanical harvester was therefore considered a top priority project by all connected with the blueberry industry.

MacAulay and several innovative blueberry growers worked on constructing and evaluation of several mechanical harvesters during 1975 and 1976. By 1977, a commercial small-type harvester was available and another larger prototype model was nearing completion. Clayton Graham, Parrsboro, N.S., a commercial blueberry grower, worked for several years on building a picking head which by 1977 picked effectively, and was easily constructed. Terry Meister, Westchester, N.S., began to build a mechanical harvester. He drew up the plans and solicited the help of agricultural engineers and commercial steel suppliers; however, the project was beyond his limited resources available at the time and the harvester was never built.

By 1981, three excellent prototype mechanical blueberry harvesters had been developed in Nova Scotia. However, the final stage of development leading to commercial adaptability and use throughout the industry did not materialize. Following the encouraging field trial of the third prototype in August 1980, the Blueberry Producers Association of Nova Scotia initiated a drive to have a commercial harvester produced.

Following a meeting of the Blueberry Producers Association of Nova Scotia Research Committee, representatives from Agriculture Canada and the provincial Department of Agriculture and Marketing met on February 27, 1981, at Truro, N.S., Bragg Lumber Company was authorized to proceed with the development of their prototype harvester which they had been working on since 1972.

Dr. Mac Weaver, Director of the Kentville Agricultural Centre, agreed to proceed with a contract research proposal to allow for the construction and necessary field testing to proceed. The 1981 field tests were quite successful and 96,000 pounds of blueberries were harvested. Final modifications and testing were carried out in 1982. It appeared the industry was very close to having a commercially feasible mechanical harvester. In 1983, 180,000 pounds of blueberries were harvested.

Bragg Lumber Company, Collingwood, N.S., in 1983 made a commitment to build 20 harvesters for the 1984 season. Doug Bragg was President of Bragg Lumber Company. The machines were built by Lloyd Weatherbee and staff. These were the first commercially successful lowbush blueberry harvesters in North America. The machine was designed to operate side-mounted on a tractor. This machine lessened harvesting costs, extended the harvesting season and helped to offset the shortage of harvesting labour in many production areas.

The 20 harvesters operating in 1984 averaged five tons of berries per day. Operating costs were about half of conventional hand harvesting, berry quality was improved, and the winnowing fan mounted on the picker eliminated field winnowing of harvested berries. Approximately 15 per cent of the 1985 Nova Scotia crop was mechanically harvested.

Several mechanical harvester studies were carried out in 1985. A contract was given to M.B.H. Harvesting Ltd. to develop and test a prototype mechanical lowbush blueberry harvester. Several modifications had to be made to the machine as it underwent three field tests. The final test showed the harvester had the potential to become an economical commercial unit. [76]

As is usual with farming equipment, other external factors enter into the cost equation. Such things as topography, crop density, soil type, climate, size of harvest operation, single or multi-use power units can all cause small or drastic changes in the feasibility of one configuration of harvester over another.

At the present stage of the analysis it appears that on a field with 2000 pounds of blueberries per acre, harvesting costs for the Bragg Harvester are less than 10 cents per pound.[87]

By 1990, approximately 40 per cent of Nova Scotia's blueberry crop was mechanically harvested. It is anticipated this percentage could be increased to 70 per cent in the near future as blueberry fields are being levelled and obstructions to harvesting removed.

14.3 From Field to Processing Plant

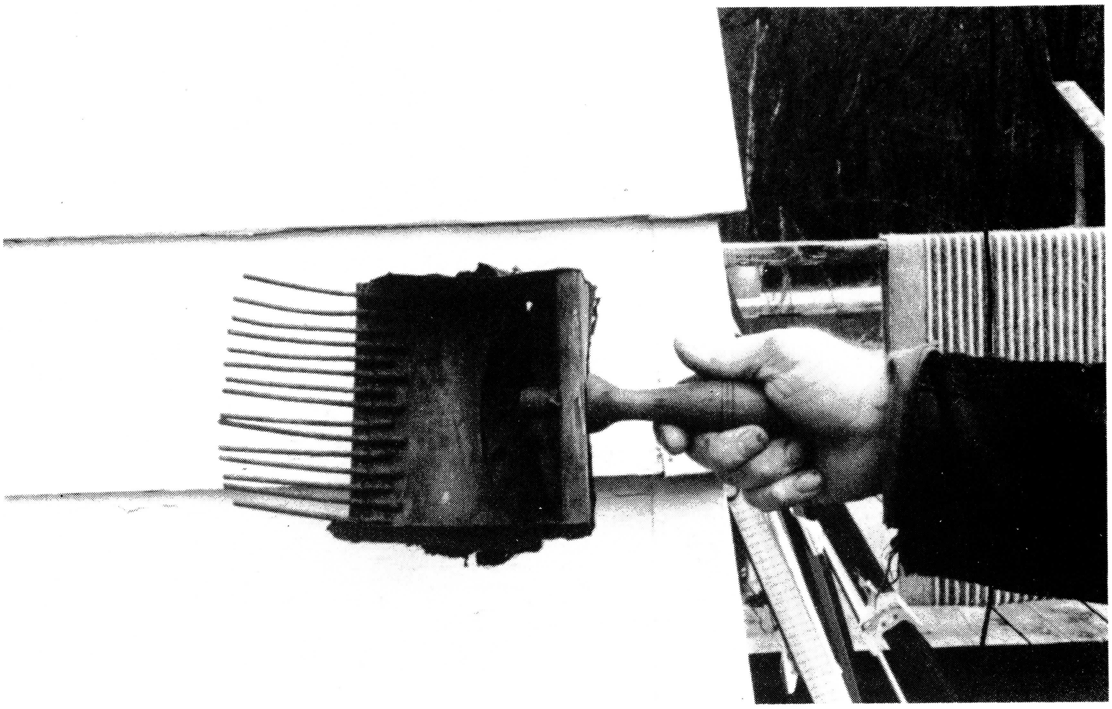
After harvesting, the blueberries are ready to be sent to a central receiving shed or to the processing plant. The time interval between raking and processing vastly influences blueberry quality. This is especially true in hot weather when berries begin to lose water and deteriorate rapidly. Bacteria and yeasts tend to increase and, if berries are held too long in hot weather, fermentation may begin.

Berries should be delivered to the cleaning shed or processing plant as soon as possible after raking. Deliveries should be made twice daily if possible.

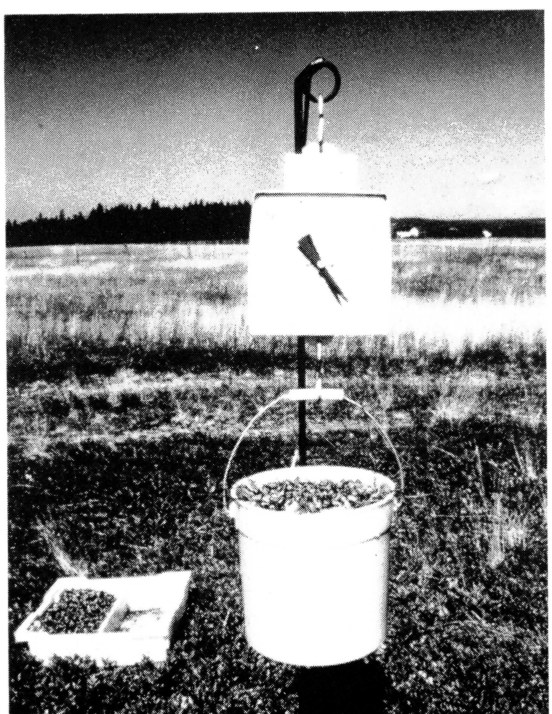
Over-filling of shipping boxes can cause quality problems. The berries are never mounded in the boxes. Boxes should not be stacked over ten high in the field and should be stacked properly to allow air circulation prior to loading onto the truck. The filled shipping boxes have to be handled carefully in the blueberry fields as rough handling damages the fruit.

Typical raking crew scenes in the 1950's.

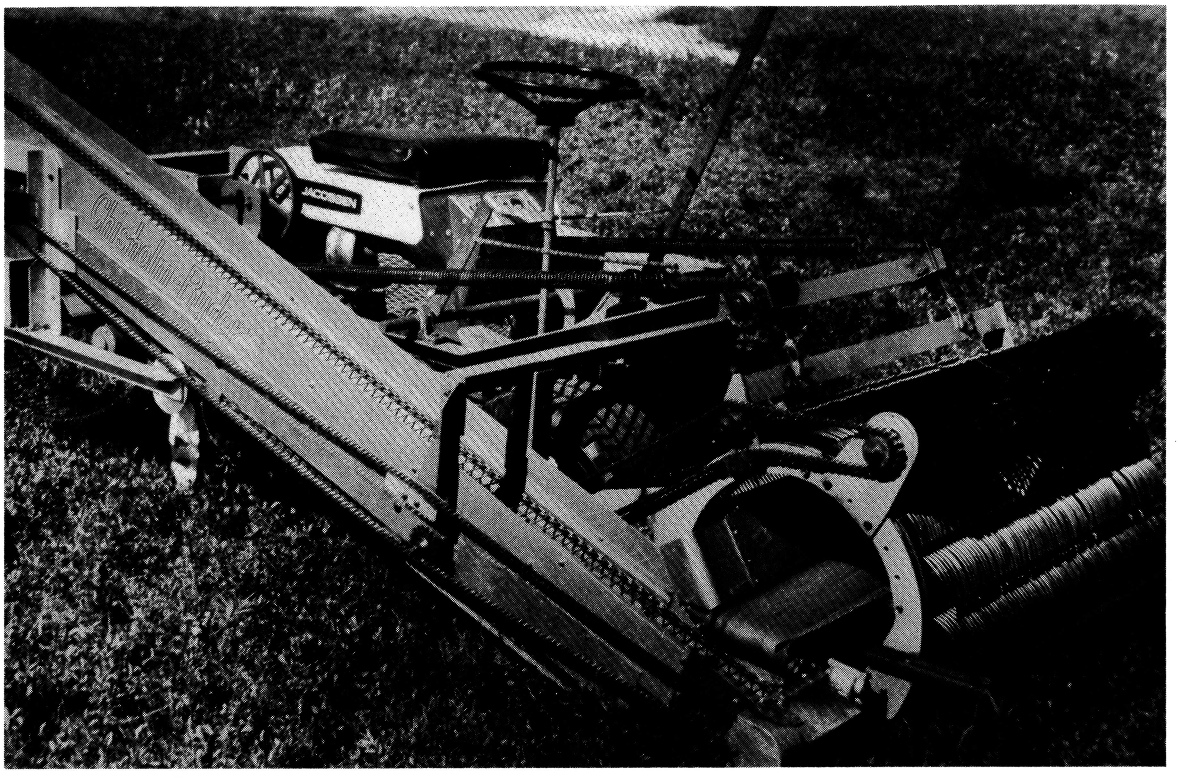
Typical raking crew scenes in the 1950's.



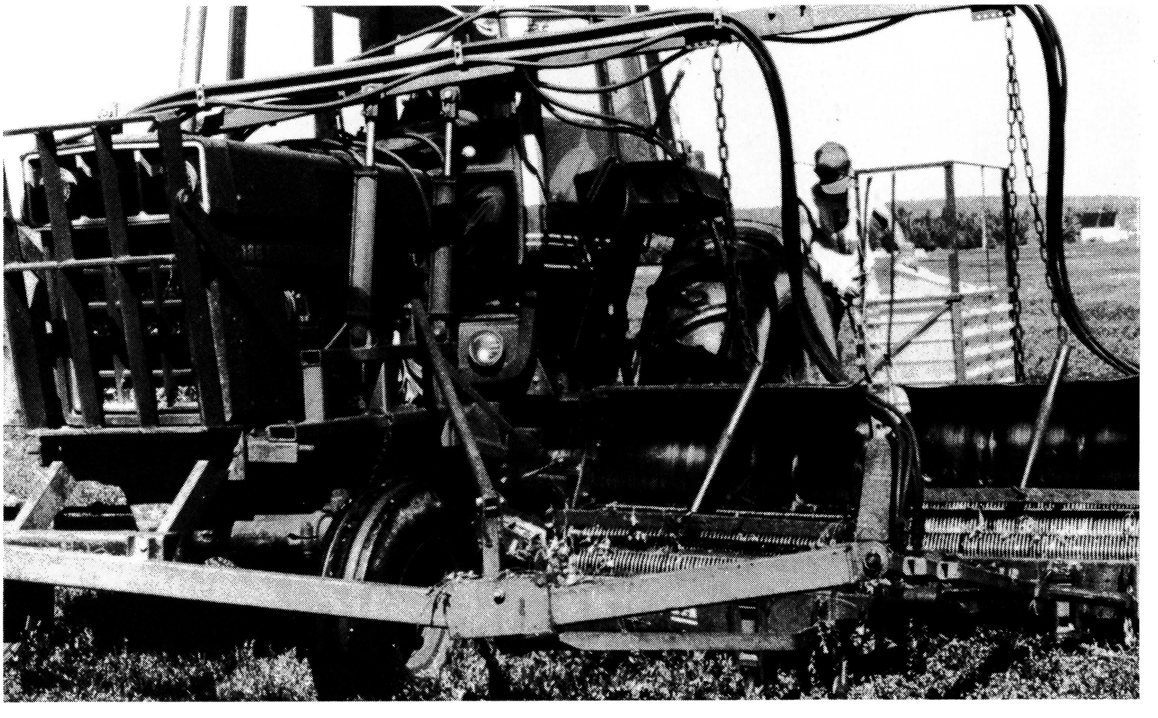
Early hand blueberry rake.



A pail of "raked" berries being field weighed.



First commercially produced lowbush blueberry mechanical harvester. Produced by Chisholm Ryder in 1969.

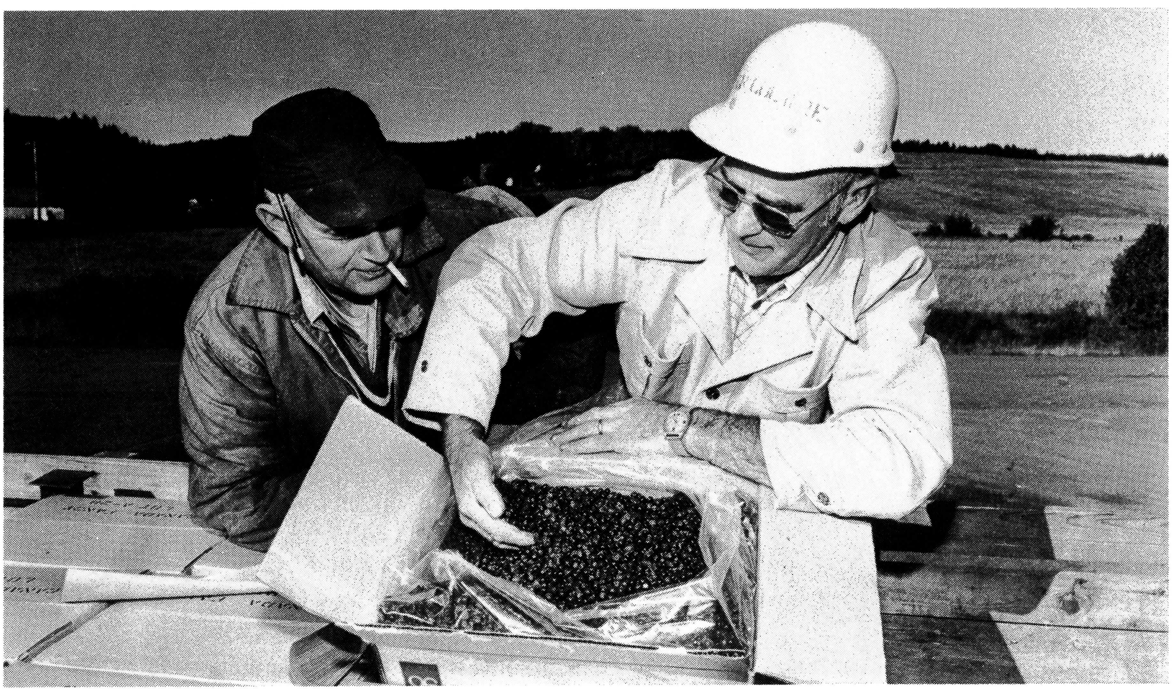


Double Headed Mechanical Lowbush Blueberry Harvester, developed and manufactured by Doug Bragg Enterprises, Collingwood, N.S.

Berries being "field cleaned" using an enclosed fan winnowing machine.

Blueberries being air cleaned at Receiving Station.

A typical Blueberry Receiving Shed in the 1950's. Cobequid Mountain Blueberries, operated by Chelsey Walsh & Son, Collingwood, Nova Scotia.



Inspection and Grading of 30 lb. cartons of lowbush blueberries by Agriculture Canada Inspector.

Chapter 15

PROCESSING

15.1 Fresh and Canned

Marketing starts at the blueberry field and ends at consumption. The harvested fruit must be taken to the processor as quickly as possible.

Malagash Canners, Malagash, Cumberland County, was established in 1932 under the direction of Herbert H. Large. This company packed blueberries in water or syrup and also made a pie fill. The size of cans they normally used were 15 oz., 20 oz. and 105 oz. This company would process as many as 30 tons of blueberries per year. They would also can other fruits and vegetables. The cannery was lost in a fire in 1963 and wasn't rebuilt.

Tor Bay Canning Company, Larry's River, Guysborough County, started to can blueberries in 1934 and, until the company went out of business in 1962, blueberries were the number two canned crop following canned lobster. A small freezer was built in 1954 at Whitehead, Guysborough County, and for eight years Tor Bay Canning Company sold frozen as well as canned blueberries.

Bonda Foods Ltd., Yarmouth, used their fish plate freezer to freeze blueberries in the 1950's. They operated from 1950 to 1968. They would handle a minimum of 200,000 to 400,000 pounds of Yarmouth County berries annually. The berries were sold in 12 or 20 pound cartons and 20 pound pails to the Boston-New York area markets. They sold their blueberry operation to M. W. Graves in 1968.

Canada Foods, Kentville, a subsidiary of M. W. Graves, Berwick, was looking for new product lines in 1956. They held a meeting with approximately 40 blueberry growers who assured the processor they could supply all the blueberry needs for Canada Foods.

In the spring of 1957, Canada Foods Fruit Division purchased and set up processing equipment to can blueberries in muffin mix tins (3.5 oz.). That year they supplied Duncan Hines of Omaha, U.S.A., with 50,000 cases of 96x3. oz. muffin tins. They also sold to Py-O-My, a large buyer in Chicago, and many other U.S.A. buyers. The small blueberry muffin tins were placed in a muffin mix box which already had a muffin mix container. Canned blueberry lines were also established for larger can sizes and in various packs.

In 1959, Canada Foods started to pack a 50-pound multi-wall bag of frozen blueberries. These were shipped to E.D. Smith, Ontario, as well as to Pepperidge Farms of the U.S.A.

Canada Foods had a severe fire in 1964 which destroyed the major portion of the production area. The blueberry line was moved to their new freezing plant built in 1962 at Hillaton, near Canning, Kings County.

In the late 50's and early 60's it became evident that 78 per cent of North America's blueberry crop — cultivated and wild — was picked before Nova Scotia started to harvest, and the crop and price by then were already established. In a short crop year in North America, Nova Scotia grower price was good, but in a good crop year the price paid to the growers would be low. Nova Scotia growers and processors were at the buyer's mercy as they had to sell their harvested blueberries within 24 hours, as they had very limited freezing and canning facilities. See Appendix A.2, page 146.

15.2 Freezing

Production of wild blueberries in Canada had been increasing with Nova Scotia's crop increasing at the fastest rate due to more land being brought into production as the industry was set up on a sound basis, and the adoption of the latest cultural and management plans. Although several small canning plants were operating in the province, this process was declining in popularity because of the higher quality and faster packaging provided by freezing.

It became evident to the Nova Scotia producer organization and the Nova Scotia government that there was a need to build modern freezing facilities, and for these facilities to have sufficient storage capacity to hold the annual production. There was an adequate supply of fresh blueberries of first quality for the freezers and these freezers, when built, could put on the market a high quality product, as lowbush blueberries are an excellent product if their natural quality is preserved. Nova Scotia producers would market their berries instead of selling fresh to the Maine processor.

For a blueberry freezing and storage plant to be economical, it was established that between 2,000,000 and 3,000,000 pounds of blueberries per year should be frozen, if the freezer plant could utilize at least one other crop of equal value, and that the storage space could be rented. The freezer plant would have to be designed so it could be expanded according to design plans of construction and management phases, so that it may operate with decreasing unit cost as the production increases.

A market existed for frozen blueberries in Nova Scotia and Maine and it was felt this market would increase. Sale prices seem to follow relatively closely the fluctuations in the prices paid to the pickers, inasmuch as the quality of the finished product is rigorously controlled.

Another essential aspect to be considered was the element of rural economics. Great production variations can occur from year to year; however, as the mean value to the farm does not always vary inversely to the quantity produced, it can be deduced that several other factors, such as competition, affect the price paid to the pickers.

Nova Scotia's total production at the farm shows the importance of this crop to the economy, if one considers that such a revenue incurs only moderate expense to the producers, that the production is concentrated in very definite areas, that it is obtained during a period of less than a month, and that it uses family labour. In addition, the rise in price paid to the pickers, where there are small crops, is a stabilizing element of the product. The decrease in revenues to the pickers is thus not directly proportional to the decrease in volumes of production.

Until 1960, rapid commercial freezing of blueberries was done as (a) air blast, (b) contact plates, or (c) immersion in brine. The evolution of individual quick freezing, (I.Q.F.) was done by use of conveyer belts that move continuously in a blast of cold air (below -25^{0}F) in an enclosed tunnel. The berries are instantly and individually quick-frozen.

Improvements to this method were developed in which the six inch layer of berries is maintained in suspension on a fluidized bed of very cold air (-35^{0}F to -40^{0}F), which ensures a maximum exposure of all the surfaces to cold air. The berries are agitated slowly and remain in the tunnel while being carried slowly by flotation to an exit trough.

In 1950 Arthur Doyle, Mt. Stewart, P.E.I., commenced buying small lots of wild blueberries on behalf of Cam McLean, then General Manager of Central Farmers Co-op in Prince Edward Island. All fresh blueberries were frozen in freezer plants in P.E.I. During the winter months the blueberries were cleaned and recleaned for sale to the Ontario food processors. This buying operation expanded to Nova Scotia in the Parrsboro area in the 1952 crop year. The operation in the two provinces continued with expansion in 1960 to freezing facilities in Ontario. Blueberries were sent to Ontario freezers and then recleaned by P.E.I. crews during the winter months. Sales during this period expanded to the northeast United States to large pie manufacturers and other U.S. food processors.

Campbell M. McLean resigned from Central Farmers Co-op in 1961 and incorporated C. M. McLean Limited. He built the first modern world standard blueberry freezing and processing facility in Springhill, Nova Scotia. Construction began in 1961. C. M. McLean Limited, at that time, handled the freezing and processing of dessert strawberries as well, which were also processed at Springhill thereby reducing the overhead cost at the plant. The McLean plant opened for processing in the crop year of 1962.

The McLean plant was the first plant designed and built in North America to wash, I.Q.F. freeze and de-stem blueberries and set a new standard for quality and efficiency of production. Processing capacity on the I.Q.F. freezing belt was 4,000 pounds per hour based on a 20 hour freezing day, seven days per week. The plant opened in mid August for the freezing of blueberries and continued freezing to late September with Newfoundland blueberries as a later season source. During the first season additional freezing facilities at Charlottetown, Moncton and Saint John were utilized to handle the volume of blueberries packaged by the McLean company. These outside storage facilities were utilized in the peak harvest period.

In 1965, due to the ill health of Cam McLean, Mitchell McLean, his son, returned to the family business. A second I.Q.F. freezing tunnel was installed in 1966, increasing the plant capacity to 10,000 pounds per hour based on a 20 hour working day, seven days a week.

During this period the company also developed a blueberry juice product which was frozen and sold for U.S. processing for the juice and dye market. This was the first time in many years a new blueberry product was introduced to the market and thereby increased the saleable yield from Nova Scotia blueberry harvest.

Total plant cold storage was only 2.5 million pounds; however, due to the marketing expertise of the McLeans, some clients took delivery over the processing season of in excess of one million pounds each. In the late 1960's, C. M. McLean Ltd. was processing and handling seven million pounds of wild blueberries per year from the Atlantic area.

In the late 1960's the McLeans began purchasing fresh blueberries from the state of Maine in order to start their plant at Springhill, Nova Scotia, in early August. This was a process that most people said could not be done.

During the period 1962 to 1979, McLean blueberries were sold and shipped from Springhill Nova Scotia to literally all over the world. Some of the areas sold to included Japan, many countries in Europe, Scandinavia, 20 states of the United States, eastern Canada and Manitoba.

The plant normally cleaned and packaged blueberries seven to nine months per year creating steady work for a very reliable work force. The community of Springhill was loyal to the plant and helped set high quality standards. In fact, C. M. McLean Limited was the first fruit processor in

Canada to grade and deliver, under USDA inspection services and standards, to the United States market.

The McLean operation was well known in the industry for its capacity to freeze at many storages and sell the blueberries. On a number of occasions this capacity was well utilized when big crops occurred in the early years of the industry's development.

In August 1979 the McLean family sold its shares in C. M. McLean Limited to Cavendish Farms Ltd., Moncton, N.B., in the fall of 1980. Cavendish Farms bought, froze and sold wild blueberries worldwide until 1984 when they ceased their blueberry operations.

Christy Crops Ltd., Halfway River, Cumberland County, built a freezer addition to their receiving shed in 1967. This facility provided increased freezer and storage facilities; however, even with the addition of the McLean and M. W. Graves freezers, there wasn't adequate freezer and storage facilities in Nova Scotia to handle the increased production.

In 1967, some 5,200,000 pounds of blueberries had to be shipped fresh to Maine for freezing and millions of pounds of blueberries weren't harvested due to the lack of provincial freezing capacity. In addition, thousands of dollars worth of processing strawberries went unpicked.

Growers received 24 cents per pound in 1965, 16 cents in 1966 and in 1967 they were offered 7 cents. On September 8, 1967, 50 per cent of the crop had been left unpicked and the growers were concerned their price was three cents below the grower price in Maine. At a meeting on October 20, 1967 in Leamington, Cumberland County, one of the largest growers meetings ever held, growers met to discuss the past season's crop, the low grower price, the development of new picking machines, the early opening of schools which resulted in a shortage of pickers, and the lack of freezing facilities in Cumberland County.

In response to the shortage of freezer capacity, Oxford Frozen Foods Ltd., Oxford, built a new freezer plant in 1968. John Bragg is the company's President and Chief Executive Officer. The plant was 80 feet by 268 feet (21,400 square feet) and had a storage capacity of 2,000,000 pounds of berries. By 1988, this plant had undergone its eighth major expansion in 20 years. It was a plant of 135,000 square feet. By 1989, it could freeze 35 million pounds of product (blueberries, carrot-s, onion rings); it employed 450 seasonal workers and 100 full-time workers. Further expansion usually occurs yearly.

Four large Nova Scotia freezers (M.W. Graves, Hillaton, Kings County; C.M. McLean, Springhill; Christy Crops, Halfway River; Oxford Frozen Foods, Oxford — the last three plants are located in Cumberland County) handled the blueberry crop in the 1970's. Limited amounts of fresh Nova Scotia blueberries were going direct to U.S. freezers. The modern Nova Scotia plants, with excellent I.Q.F. facilities, could freeze 14,000,000 pounds of berries during the harvest season. They had a holding storage capacity for 9,000,000 pounds. These plants employed approximately 500 during the blueberry freezing season.

Oxford Frozen Foods Ltd. purchased the Christy Crops Ltd. receiving shed and freezer, Halfway River, in 1982. This facility has been increased in capacity by approximately 300 per cent.

In 1982, Oxford Frozen Foods Ltd. purchased the A. L. Stewart and Sons processing facilities in Cherryfield, Maine, plus their blueberry land.

Oxford Frozen Foods Ltd. owns, leases and provides service for 9,000 acres of blueberry land in the Maritimes. In Maine, they own or provide service for 10,500 acres, or a total of 19,500 acres in the Maritimes and Maine. They have a total freezer storage capacity of approximately 40,000,000 pounds. All the fresh blueberries collected in one season can be delivered to the freezers during a period of approximately 25 to 30 days, and the plants have the capacity to freeze individually all the fresh blueberries received during this period.

In 1990, there were two blueberry freezers in Nova Scotia — Oxford Frozen Foods Ltd., Oxford, Cumberland County, and Cobi Foods plant, Hillaton, Kings County.

The Nova Scotia blueberry industry, in conjunction with the provincial government, devoted a lot of attention to new product development for blueberries. This has assisted in the diversification of the market base and it has also encouraged the further processing of Nova Scotia blueberries in the province and neighbouring provinces. The value-added benefits have accrued to the Canadian industry.

15.2.1 Freezing Procedures

Freezing techniques have been refined and by 1990 most blueberries usually go through 13 steps before they are ready for the consumer. In order to provide the highest quality fruit the berries are not allowed to remain in the field or processing plants for long periods before they are frozen. Freshly harvested berries are kept under cover as soon as possible as sun and heat start to break down the berry. The berries are frozen within 48 hours after harvest and preferably within 24 hours. Some buyers now request their berries to be frozen within 8 to 10 hours after harvest.

As the berries are brought from the field to the plant they are weighed and winnowed. Winnowing removes foreign material (rocks, moss, sticks, clusters, etc.). Field winnowing (cleaning) used to be a standard practice or, if not done there, it was done in the receiving station. Recent research has shown that to produce the highest quality I.Q.F. blueberries, the fruit should not be subjected to high drops when harvesting, winnowing or processing, and the former practice of field cleaning or receiving shed cleaning is being eliminated.

Minimizing damage to the fruit membrane (skin) is essential to maintain the highest quality I.Q.F. blueberry. Ruptures in the membrane that occur during pre and post-processing handling lessens berry quality while in frozen storage. These changes include a loss in internal sugars, a toughening of the blueberries and an increase in drip loss (loss in liquid from blueberries upon thawing).

Once the berries have been cleaned they go into a shaker where the whole berries will drop through to a water tank where the good berries sink. The "sinkers" go into a sugar tank with a brix reading of 17. The sugar increases buoyancy which helps to remove moss, immature berries, etc. The "good" berries are put through water to wash the sugar mix off, the berry is then put through a shaker, and pre-cooled to 28 to 32^{0}F, the berries go through the I.Q.F. tunnel or flo-freeze I.Q.F. tunnel where the temperature is -45^{0}F to -50^{0}F.

Immediately after freezing, the berries enter a "squirrel cage". This is a perforated, cone-shaped, metal cylinder, and as it rotates small and split berries are ejected. It also removes the stems off the frozen berries. The berries go through a small blower, then to a shaker where very small berries are removed. The next step is a colour sorter which works on the basis of colour and a round shape. They then pass by a metal detector to ensure no metallic objects are processed. The fruit is then picked over for foreign material on a horizontal moving belt. The berries are then ready for packaging, storage and shipping.

Temperature of frozen storage is extremely important in maintaining the quality of I.Q.F. blueberries. The fruit should be kept at a temperature of -20^{0}C or lower. Studies also show that temperature fluctuations in frozen storage must be minimized to avoid adverse chemical and physical changes in blueberry quality. These changes include (1) a migration of sugar from the center of the berry to the periphery, (2) increased drip loss), (3) toughening and (4) increased block freezing.

15.3 Blueberry Products — 1986

Blueberry processing in Nova Scotia consists of:

	Firm	Products
1)	Cobi Foods P. O. Box 340 Berwick, N.S. B0P 1E0	(a)Frozen IQF – wild blueberries – Canada Fancy – 600 g sleeve – poly bag (b) Blueberry cocktail – glass 12x1.36 L (48 fl. oz.) (c) Jams and jellies, bulk and retail (d) Pie filling — 12x19 oz.
2)	Oxford Frozen Foods P. O. Box 220 Oxford, N.S. B0M 1P0	IQF wild blueberries — Canada Fancy — 600 g tubs — 2 kg — 4.5 kg — 10 kg — 13.5 kg — also, a 10 kg pack under the McCain label
3)	Sarsfield Foods Ltd. P. O. Box 368 Kentville, N.S. B4N 3X1	Ready-to-bake blueberry pie — 14 oz. (10") — foodservice — 24 oz. (8") — retail — 24 oz. (8") — in-store bakery — 5 oz. (4") — lunch-box
4)	Peninsula Farms Ltd. RR#3 First Peninsula Lunenburg Co., N.S. B0J 2C0	Blueberry yogurt — 175 g — 500 g — 1 L — 4 L pail — 15 L pail

	Firm	Products
5)	Farmers Co-operative Dairy Ltd. P. O. Box 8114 Station A Halifax, N.S. B3K 5L8	Blueberry yogurt — 2 kg — 500 g — 175 g Blueberry ice cream
6)	Brookfield Foods Ltd. P. O. Box 768 Truro, N.S. B2N 5E8	Blueberry ice cream

Three standard wholesale containers have been used in the past — a 20-pound enameled tin, a 60-pound multi-walled paper bag with polyethylene liner, and a 30-pound paper corrugated carton with polyethylene liner. The first two containers were not being used in the 1980's. The frozen berries can also be packaged immediately into 10-pound boxes, mono-cup (600 gram), or whatever container the buyer has requested.

The majority of the berries are put into large totes (bins) (1200 to 1600 pounds) to be repackaged during the winter.

Examination of two totally different processing methods indicated that processing wasn't as important in maintaining I.Q.F. blueberry quality as handling at harvest and freezer storage temperature were.

Further observation indicated that fruit which is higher in moisture before and after processing provides better quality I.Q.F. blueberries in terms of colour, texture and sugar content over time in storage. These results must be balanced against the effect excess swelling of the fruit can have on the quality grade of the fruit.

Approximately 80 per cent of the blueberries meet the top grades while 20 per cent are called shrink. A small percentage of these "shrink" berries can be marketed for a very low price.

Processors initiated an industry-wide harvest scheduling program in 1990 for the first time. Growers were given a schedule indicating which days the receiving sheds and processing plants would be accepting fruit. Although there was a considerable amount of initial apprehension among growers, the system worked quite smoothly. The plan helped greatly to even out the flow of berries to the processing plants and dramatically increased the percentage of Grade A product that was packed.

A project was started to develop a stable blueberry yogurt product and a method of processing this product to prevent coagulum breakdown and skin toughening of blueberries. The study was conducted by the Agriculture Canada research station at Kentville.

A local manufacturer of Swiss-style, stirred yogurt had introduced a blueberry yogurt to the market and received very favorable responses. He predicted this product would use 50,000 pounds of frozen blueberries in its first year. Unfortunately, the yogurt had to be removed from the market as it was found to be unstable past three to five days. Furthermore, the yogurt coagulum became watery and lost its gel-like structure.

As a result of the investigation the three major stability problems which were identified were toughening of the blueberries, syneresis in the yogurt surrounding the blueberries, and microbial spoilage of the yogurt. Results of tests showed the extent of berry toughening to be primarily a factor of the blueberry size and size distribution, and the pH of the yogurt. Syneresis of the yogurt could not be prevented using thawed, uncooked blueberries. The microbial spoilage was dependent on the microbial status of the blueberries prior to use and therefore difficult to consistently control. Based on these results, it was apparent that a cooked blueberry product was required to obtain a constant, high quality blueberry yogurt with a good shelf life. A number of cooked formulations and novel products were tested and evaluated, from which the processor chose three for further tests. A final formulation was chosen, and an industrial scale process was developed and established on site using their existing process equipment. A shelf-stable blueberry yogurt was released in October and is presently one of the producer's best sellers.[72]

Chapter 16

MARKETING

16.1 The Marketing System

In marketing, lowbush blueberries are referred to as wild blueberries because they are harvested from natural stands.

The bulk of Nova Scotia's annual lowbush blueberry crop is sold to processors and frozen for eventual resale to blueberry product manufacturers. A well-defined marketing system has evolved for getting the crop from the field to the end user. To help in describing this system, there are several terms which should be defined.

1. A **grower** is a person who grows and harvests blueberries. He may or may not be a buyer or processor.

2. A **buyer** is a person who buys blueberries from the grower and sells to the processor. He is usually, but not necessarily, a grower himself.

3. A **processor** is a person who buys blueberries from the buyer or directly from the grower. He processes (freezes) these berries at this plant. They are then either resold immediately or stored and held for future sales. Some processors are also large growers.

4. A **manufacturer** is a person who buys blueberries (mostly frozen but sometimes fresh) for use in the manufacturing of blueberry pies, tarts, muffins, etc., or other manufactured products.

The buyer, or middleman as he is sometimes called, is an important link in the marketing chain and has done a lot to develop the blueberry industry in Nova Scotia. He has helped to create a ready market for many small growers and has also provided them with a great many necessary custom services. There are approximately 30 buyers in the province of Nova Scotia at present (1990). Most of these buyers are also large growers.

Most buyers supply the necessary harvesting and marketing equipment, such as rakes, pails and field cleaners, to growers. Sometimes, they provide picking crews (paid for by growers) to harvest the crop. Boxes for harvesting and transporting the berries are provided by the processor. Most buyers and processors own burners and flail mowers and will custom-prune fields. Many buyers and processors also provide services such as weed control work, spraying and fertilizing, hives for pollination, etc., on a custom basis. All of this, of course, means that each grower does not have to invest a lot of money in supplies and equipment.

Most buyers have collecting points or receiving stations set up where they received the blueberries. At these stations the berries are weighed, cleaned and then shipped to a processing plant. All of the Nova Scotia production does not go through buyers. A considerable amount is grown by, or sold directly to, the processor, and some blueberries are sold fresh on the retail consumer market.

Marketing of Nova Scotia production was slow as the price dropped to record lows in Boston in 1962. Nova Scotia berries faced heavy competition from Maine blueberries that had been cleaned and recleaned in loose pack (I.Q.F. — individually quick frozen) in 20 pound tins. Accentuating the downward pressure on prices was the dearth of freezing facilities in Nova Scotia.

In order for this export business to be held and improved by Nova Scotia producers, better insect control, cleaning and grading, freezing facilities and merchandising must be improved. U.S. Food and Drug Administration reported there was much room for improvements in quality. Canadian authorities must pay considerable more attention to the inspection of the berries as they come from the field and are field cleaned, and at the time of freezing.

The adequacy of and access to freezing facilities are concerns that were only now being overcome. M. W. Graves, Berwick, built a new freezer in Hillaton and C. M. McLean had built a freezer in Springhill — both freezers were built in 1962. It was recognized in the trade that an ever increasing percentage of blueberries will be reaching the markets as frozen.[30]

The production of lowbush blueberries increased steadily throughout both eastern Canada and Maine from 1960 to 1990. The chief factor regulating production was the price to the grower in the field. This has fluctuated widely depending upon the availability of fruit and the carry-over of processed blueberries and competing fruits from the previous year. In the 1960's the blueberry industry suffered from a lack of aggressiveness in disposing of the crop. This could be remedied by an effective organization with strong government support. No mechanism for selling the crop existed, and few steps had been taken to promote its acceptance in distant markets. A highly palatable fruit with many uses, there was no reason why it could not be effectively marketed throughout continental North America. Additionally, Europe, which has only the tart bilberry, *Vaccinium myrtillus L.*, and limited highbush plantings in competition, could be developed as a major market.[5]

Maine had always led in production and processing capacity. While there was some commercial production in Canada since the turn of the century, most of the crop for many years was either sold fresh or transported to Maine for processing, first for canning and later as a frozen product. Maine processors depended upon Canadian berries to extend their processing season and to protect them against local crop failures. Canadian growers, on the other hand, relied on Maine processors to take a large portion of their crop.

However, increased production in eastern Canada made it necessary to develop more processing capability there and two new freezing plants were established in Nova Scotia in 1962. These facilities took some of the pressure off the Maine plants and collectively they were able to accommodate some of the dramatic increases in production of wild blueberries. Coincident with expanded processing, there was an increase in marketing efforts by Nova Scotia processors.

By 1967, market conditions had deteriorated to the point where 50 per cent of the best blueberry crop in years in Nova Scotia was unpicked by September 10, 1967. The grower price was seven cents per pound in Nova Scotia compared with ten cents in Maine. [15] As a result of a glut of blueberries on the market and the grower price dropped below the cost of production of eight cents.

Table 16.1: Main Blueberry Producing Areas in Nova Scotia — 1967

Area	Producing Acres	% of Total Acres	Number of Growers
Cumberland County	10,815	68.3	352
Central N. S.	2,591	16.2	98
Western N. S.	1,117	7.0	39
Eastern N. S.	1,356	8.5	34
Total	15,879	100.0	523

16.2 Marketing Survey

Following the chaotic marketing situation for lowbush blueberries in 1967, a marketing survey was undertaken in co-operation with Marinus Van de Sande, Marketing Branch, Nova Scotia Department of Agriculture and Marketing, Truro.

The objectives of the survey were to determine:

1. the production of lowbush blueberries in each county;
2. the destination (both immediate and eventual) of these berries;
3. the freezing and holding capacity available in the province; and
4. the percentage of berries that are shipped fresh from Nova Scotia to be frozen and stored elsewhere.

Questionnaires were prepared for growers and processors and every grower, buyer and processor in the province was contacted. The report was completed and published early in 1968.

The following is a summary and recommendations of the report.

1. In 1967, 11,700,000 pounds of lowbush blueberries were harvested in Nova Scotia. In addition, 2,800,000 pounds were not harvested which represent approximately 20% of the total crop. The combined total of harvested and non-harvested berries amounted to 14,500,000 pounds.
2. About 8420 acres were harvested in 1967 with an average yield of 1,600 pounds per acre.
3. There were four main producing areas in Nova Scotia. Table 16.1 shows the total acreage, percentage of the total acreage and number of growers in each area.
4. Ten per cent of the growers produced 52% of the total crop. There were 0.7 per cent of the growers producing over 500,000 pounds each, and their total production amounted to 18.3 per cent of the total Nova Scotia production.
5. Fifty-four point three per cent of the blueberries were sold to buyers who in turn sold to processor(s). Forty-five point four per cent of the berries were sold direct from the grower to the processor and 0.3 per cent were sold on the fresh market. There were 25 buyers and processors purchasing blueberries in 1967.

6. In 1967, there were five processors in Nova Scotia, three of which had I.Q.F. plants, and they processed 97.3 per cent of the berries handled by Nova Scotia processors. The total freezing capacity of Nova Scotia processors was about 8 million pounds during the season and their holding and storage capacity was about 5.8 million pounds.

7. Fifty-nine per cent of the total crop was handled by Nova Scotia processors, 21 per cent went to processors elsewhere in Canada, and 20 per cent of the crop was handled by United States processors.

8. Approximately 70 per cent of the Nova Scotia crop eventually moved to the United States to be manufactured, the other 30 per cent was manufactured in Canada.

9. The average price paid to growers in Nova Scotia in the previous 15 years was 11.9 cents. The average price paid in 1967 was 7 cents per pound.

10. Growers do not keep accurate production and harvesting costs. It appears that the average cost of production per pound was 7 to 10 cents per pound. Processor marketing costs average 10 cents per pound.

11. A small fresh fruit market was developing in Nova Scotia and in the eastern United States.

12. The future of the blueberry industry seems favourable if those involved in the industry are willing to accept their responsibilities and do their part. One year of low prices should not be the end but rather should create more efficiency for those who want to continue. It should be realized that there are no guarantees attached to production and marketing, but with closer co-operation of those involved (grower, buyer and processor) and greater efficiency, a suitable return on investment and labour can be realized.

16.2.1 Recommendations and Suggestions

1. All growers of lowbush blueberries join their county, regional or provincial association in order to become united in one group and as a large single unit combine their efforts to find solutions to existing and future problems in the production, harvesting and marketing of blueberries.

2. That the members of the Association(s) be responsible for the election of responsible and knowledgeable people to the executive who in turn will act on behalf of their members in making proper representation and sound decisions for the welfare of all growers in Nova Scotia.

3. That in the future a committee, made up of responsible and knowledgeable people, meet with the processors on a regular basis, if necessary, and at these meetings the members of such committee act on behalf and for the best interest of all the growers in Nova Scotia with regard to the marketing of blueberries as to price, available markets and general market information.

4. That all Blueberry Associations in Nova Scotia, whether provincial, regional or county associations, become members of the North American Blueberry Council for the promotion of

blueberries and the industry as a whole, and to work in unity with all the blueberry producing areas in North America toward finding solutions to common problems in the production, harvesting and marketing of blueberries.

5. That the Provincial Association of blueberry growers engage the services of a person, probably on a part-time basis from May 1 to October 31, who would possess adequate knowledge of production and marketing and who would act on behalf of the growers as a co-ordinator between themselves and the processor, and who would also be fully informed on market conditions in North America and generally act as a promoter of the blueberry industry in Nova Scotia, his wages and expenses to be borne by the Association by way of a contribution of 1/10 of one cent per pound harvested by each and every blueberry grower in the province of Nova Scotia.

6. That growers meet with buyers or processors, depending on whether they want to sell directly or indirectly, at least 30 days prior to time of harvest and enter into agreement with the buyer or processor to sell their whole crop or part thereof to a buyer(s) and/or processor(s) when harvest commences, leaving price open for further negotiation at time of harvest. The buyer and processor could then pre-sell or make arrangements for processing while the grower would be assured of a market before he commences harvesting.

7. That the smaller growers (25,000 pounds or less) pool their production on an area basis in order to obtain sufficient volume for the interest of the buyer and processor and thereby creating more efficiency without the duplication of efforts.

8. That each grower keep accurate cost of production records from year to year on their operation so that they will know the exact production cost per acre and harvesting cost per pound. The use of such records will result in greater efficiency and better management.

9. That the fresh markets for blueberries in both Nova Scotia and the United States be studied more closely and, if feasible, that these markets be capitalized upon. Some information is available now which can be used by those growers interested.

10. That the processors take a closer look at the markets in Nova Scotia for frozen blueberries and supply these markets with their product if the demand is there. Markets in this case would be bakeries, restaurants and other institutional trade such as universities and hospitals.

11. That all persons connected in any way with the blueberry industry of Nova Scotia promote the industry through the use of films, radio, television, newspaper or other news media or in any other way in order to increase the consumption of blueberries and thereby creating additional markets.

12. That consideration be given to featuring a special blueberry booth at local, provincial or regional exhibitions to promote the industry and stress its economic importance to Nova Scotia.

The blueberry industry has used these recommendations and the majority of them were implemented.

A frost of 24^{0}F occurred in the central part of Cumberland County on June 10, 1968 with some farmers escaping completely while others lost 50, 75 or even 100 per cent of their crop. Before the frost hit, estimates for the provincial crop were 11,950,000 pounds.[16]

Nova Scotia's 500 commercial blueberry producers, who had 80 per cent crop loss that year, received financial help of $25 per acre to a maximum of $500 per grower. This policy was announced by provincial Agriculture and Marketing Minister, Harvey Veniot. This policy would pay for about half of the production cost. The June frost, plus summer drought, reduced the crop to 2,100,000 pounds. Blueberry grower returns in 1968 were $357,000, the lowest since 1955. [17]

"Nova Scotia blueberry production will show an average increase of 40 per cent over the next four years," Marinus Van de Sande, Markets Representative, Nova Scotia Department of Agriculture and Marketing, told the 60 blueberry growers at a one-day short course held at Nappan, N.S., in June 1968. He estimated that the average predicted crop for 1968 to 1972 will be around 10,752,000 pounds per year. Gordon Kinsman, Nova Scotia Department of Agriculture and Marketing, told the growers they would have to adopt more sophisticated marketing methods to sell these increased crops profitably. Kinsman said that 78 per cent of the North American blueberries were harvested weeks before the Nova Scotia berries came to market. Nova Scotia growers are always in a buyers' market situation, except for years where there are production failures in earlier producing regions.[18]

A one-day short course on marketing lowbush blueberries was held at the Experimental Farm, Nappan, N.S., on March 21, 1968. There were over 75 growers present. The majority of the growers were ready to put a concentrated effort into promoting and marketing their crop.

16.3 Inspection Services

Curtis Wilson, Officer-in-Charge, Inspection Branch, Agriculture Canada, Halifax, told 90 blueberry growers in Cumberland County in 1969 they must become more interested in all phases of marketing and the main responsibility is with the grower. He must harvest a quality crop and deliver it to the processor with the least possible delay. Blueberries must be free from insect infestation.

Seven federal inspectors were employed in the late 1950's and 1960's throughout the blueberry harvesting season, in processing plants and shipping areas in the province at the request of the growers. They inspect for insect-infested berries and the berries that are free are provided with a certificate of inspection. Berries shipped into the United States require such a certificate.

The Orff and Cushing receiving station, Parrsboro, was the first receiving station to have Agriculture Canada fruit and vegetable inspectors. The first two blueberry inspectors, before 1957, were Arthur Wood and Arthur DeWitt.

Maggot inspection service for Nova Scotia lowbush blueberry receiving stations was considerably curtailed towards the end of the 1969 harvest season because of increased costs.

A number of receiving station operators were quite concerned over this announcement and, as a result, a meeting of several dealers and processors from various parts of the province was held at Leamington, Cumberland County, on April 1, 1970 to discuss the maggot inspection situation. The consensus of this meeting was that the maggot inspection service was essential to the lowbush blueberry industry. Consequently, it was decided to prepare a brief outlining the value of the service and requesting its continuation on a level equal to that provided prior to the 1969 harvest season. This brief was signed by all concerned dealers and processors and forwarded to the Director of the Fruit and Vegetable Division at Ottawa. The brief also requested the implementation of grades for fresh, canned and frozen berries. Such grades have been prepared and were proposed several years ago.

A reply to this brief was received shortly after its submission. Growers and dealers were informed that the inspection service would be continued if all those who used it complied strictly with the regulations and did not abuse the service provided.

The inspection service continued on until 1979 when Agriculture Canada removed its maggot inspectors due to government cutbacks. The Agriculture Canada District Inspector said the industry should be encouraged to do its own testing, with government overseeing it. The Blueberry Producers Association of Nova Scotia sent a letter to the federal Minister of Agriculture, Director of Fruit and Vegetable Division, Agriculture Canada, Ottawa, to continue the federal inspections again. The federal government, however, would not agree.

16.4 Import & Export Restrictions

In mid August 1971 the U.S. government announced a 10 per cent import surcharge on many products entering the U.S.

A number of meetings were attended regarding possible assistance to blueberry growers as a result of the imposition of this 10 per cent surcharge on berries sold in the U.S.A. In order to protect themselves in competition with U.S. processors, processors in Canada lowered the grower price by 2 to 3 cents per pound. Letters pointing out this situation to the federal Department of Agriculture authorities were sent by the Blueberry Producers Association of Nova Scotia, as well as grower groups in other provinces.

On November 15, 1971, a meeting of grower representatives and government officials from the three Maritime provinces was held at Moncton. Jack Sibley, Provincial Blueberry Specialist, attended this meeting along with John Bragg, who represented the Blueberry Producers Association of Nova Scotia. A brief was drafted which would be presented to Hon. Mr. Olson, the federal Minister of Agriculture. A general petition had already been presented to Olson by the Canadian Horticultural Council relating the effect of the surcharge on several horticultural commodities, including blueberries.

An assistance policy of 1.5 cents per pound on all berries shipped through bona fide dealers or processors was announced on November 18, 1971.

On March 1, 1985, the E.E.C. notified Canada and the G.A.T.T. that it intended to take retaliatory action against Canada because of the import quotas imposed on beef and veal being shipped to Canada by the E.E.C. Among the retaliatory tariffs scheduled to be imposed was a 25 per cent duty on frozen blueberries from April 15 to December 31, 1985. Such a duty would, in essence, have shut the door on one of the biggest markets for Nova Scotia blueberries — a market which has been developed at considerable effort and expense over the past ten years. Both the provincial government and the Blueberry Producers Association worked hard to have the proposed duty revoked. After much negotiation the threat was removed.

16.5 International Marketing

For many years, sales of wild blueberries were essentially limited to the North American continent. There was a reasonable balance of supply and demand and there was no particular need to look beyond the domestic market. However, as the production base increased, particularly in the province of Nova Scotia, the situation began to change and Nova Scotia processors started looking overseas in 1972 as an option to the well-supplied U.S. market. In a country like Canada, which has a small population and the potential for high production of a natural resource such as wild blueberries, export is a must. The interest of Nova Scotia processors in exporting off-shore was supported by Maine processors who saw a potential for increase in their own productivity.

Initial market penetration was made to European markets in 1972 and 1973 when small quantities were sold. Over four million pounds of Canadian blueberries were sold in Europe during the 1974 season.

Christy Crops, Halfway River, Cumberland County, had been looking at marketing some of their frozen blueberries to Europe for some time. In 1973 they shipped 200,000 pounds of frozen blueberries to Sweden by boat from Parrsboro. In September 1974 1,100,000 pounds of frozen blueberries were shipped by boat from Parrsboro to Rotterdam and Copenhagen. In October 1974 they loaded 1,250,000 pounds of frozen blueberries on a freezer freighter for Holland and Germany. Christy Crops was supplied by about 100 growers and they also owned approximately 1000 acres in blueberry production. [19]

In September 1980 the M.V. South Pole left Parrsboro for Cuxhaven, West Germany, with a cargo of 1,500,000 pounds of frozen blueberries, packed in 30-pound corrugated containers. The frozen berries were re-processed in Rheinim pax, a Hamburg, West Germany, firm. Christy Crops had been selling to this company for six years. [94] Initial response in Europe to the Canadian blueberries was excellent. European buyers indicated they preferred the Canadian berries as the most satisfactory substitute for the dwindling supply of Polish bilberries. This new outlet provided a welcome alternative to selling on the United States market, a market on which Nova Scotia producers must sell at the tail end of all United States production.

Working in co-operation with the federal Department of Industry, Trade and Commerce, a promotional trade mission to Europe was organized to promote wild Canadian blueberries on European markets. The mission was co-operatively arranged by the Blueberry Producers Association of Nova Scotia, the Nova Scotia Department of Agriculture and Marketing, and the federal Department of Industry, Trade and Commerce.

Five mission members went to Europe in 1974. They were Jack Sibley; Gary Chapman, President, Blueberry Growers' Association of Nova Scotia, Springhill; Lad Javorek, Export Manager, M. W. Graves and Co., Berwick; John Bragg, President, Oxford Frozen Foods, Oxford; and Cam M. McLean, President, C. M. McLean Ltd., Springhill, N.S.

Their objectives were: (1) assessment of present and future marketing opportunities for frozen lowbush blueberries in Europe, especially West Germany and Sweden; (2) assess competitive position of Canadian blueberry exports relative to U.S. cultivated blueberries and Polish bilberries; and (3) promote 'wild Canadian blueberries' in Europe as the alternative to the Polish bilberry.

They visited users of blueberries in southern Germany and southern Sweden, blueberry importers and agents in the Hamburg area, Germany, and met with the Netherlands largest importer of blueberries.

The mission was well received in all countries and the opportunity to discuss the Canadian blueberry industry and its market potential in Europe was appreciated everywhere.

There are several important differences between the North American market demand and the European market demand for blueberries.

1. In North America the biggest usage of blueberries is in the bakery trade; in Europe, the biggest usages are fruit juices, syrups, wines, liquors, dairy products, and fresh or bottled consumer packs.

2. European consumers prefer the darker blue colour and the stronger acid taste of the European bilberry to the lighter colour and sweeter flavour of the Canadian blueberry.

3. Cultivated highbush blueberries, because of their extreme lack of flavour and colour for processing, are presently totally unacceptable on the European processing market.

Canadian processors were able to sell on European markets in the early 1970's only because of a shortage in regular supplies of European bilberries from Poland, Sweden and eastern Europe. It appeared that this shortage of supply would continue and probably become more acute over the next several years. As the standard of living rise in the supplying countries there is less and less incentive for people to gather wild fruit to supplement their income.

There was, therefore, a developing market for an alternative to the European bilberry. Large manufacturers of juices, liquors, dairy products, jams, etc., are committed by an established consumer demand to large usage of bilberries. Canadian processors had the opportunity to ship blueberries to Europe and gradually convert consumers to use ever increasing amounts of Canadian blueberries.

The quality of Canadian berries shipped to Europe in 1974 was excellent. European buyers were impressed by the quality product and also by the unified marketing approach presented by this trade mission. Canadian processors realized they must maintain this quality image and combine it with a solid and reliable marketing system. If this was done they would gain a permanent foothold in the European market.

The price received for Canadian blueberries in Europe is regulated by the prices established by European suppliers. Some European countries (notably Poland) regulate this price according to their foreign currency requirements as well as current market conditions. Because of the established consumer preference for European bilberries, Canadian blueberries must be on a good competitive basis price-wise, in order to establish and gradually increase their share of this market.

16.5.1 Recommendations of the Trade Mission

1. That the unified marketing approach for Canadian blueberries in Europe, as established by this mission, be maintained. A follow-up trip should be made in mid July of 1976 to consolidate Canada's position as a major and continuing supplier to this market.

2. That through the co-operative efforts of blueberry exporters, the Government of Canada and the provincial governments of blueberry producing provinces, some form of on-going export promotional effort be established.

Missions have been made yearly to Europe following the initial trade mission in 1974 — Poland, Finland, Norway, France and England. Norway and Finland imported Nova Scotia blueberries in 1975. These countries are big users of blueberries. France is also a large user of blueberries.

Brokers, agents and end users in all the countries visited by later missions were eager to learn about how Canadian blueberries were grown, handled and marketed. Buyers and users of Canadian 'wild' blueberries in Europe continue to praise the high quality of the product they have received over the past few years.

From 1977 to 1982, over 60 per cent of each year's crop was sold in Europe. Small quantities were sold in Japan in the late 1970's and this market increased steadily for about five years. Since then there has been a levelling off of demand.

Table 16.2: Canadian Exports Frozen Blueberries ('000)

	Canada and U.S. (lbs)	Off-Shore (lbs)	Total (lbs)	Total $
1972	10,464	41	10,505	3.8 M
1973	8,346	2,725	11,071	4.8 M
1974	7,636	6,628	14,264	5.6 M
1975	4,572	9,965	14,537	6.2 M
1976	6,077	6,834	12,911	6.4 M
1977	9,271	2,672	11,943	9.3 M
1978	11,503	4,146	15,649	13.0 M
1979	4,291	6,971	11,262	8.0 M
1980	6,743	14,773	21,516	16.0 M
1981	5,902	23,092	28,994	16.0 M
1982	4,804	21,434	26,238	27.4 M

The interesting facts shown in Table 16.2 are the off-shore exports. In the blueberry industry, Canada and the United States are considered one market and off-shore as another. Off-shore movement was practically nothing in 1972 but by 1982 Canada was shipping 21,434,000 pounds into 20 countries with sales over 27 million dollars.

Shipments to European markets declined substantially from 1983 to 1985 because of the strength of the Canadian dollar in relation to most European currencies. More favorable currency exchange rates returned in 1986 and resulted in a revival of European sales. In most cases, shipments to overseas markets are made by refrigerated containers through the ports of Halifax or St. John.

Since 1975, the $15,000,000 export industry has offered the largest dollar return of all fruits grown in Nova Scotia. Lad Javorek, Manager, Export Sales, M. W. Graves and Co., Berwick, said that Nova Scotia blueberry growers are very dependent on foreign markets. The foreign market is fragile because of monetary, economic and political changes.

The problem with marketing the 10 million pounds of blueberries per annum, said Javorek, is they are for the most part a specialty item — a luxury not a commodity. However, in France, blueberry extract is used in pills and throat lozenges.[21]

To obtain a better understanding of the overall European bilberry situation and how it might affect future development in the Canadian blueberry industry, a marketing and technical mission, composed of various government officials, was dispatched to Europe to gather pertinent data on the European situation. The results of this mission were very favorable for the further development of the European market by Canadian wild blueberries.[1]

16.6 Refrigerated Containers

The Nova Scotia Fruit Growers Association (NSFGA) began to ship their apples in their 20 forty-foot refrigerated containers they had purchased in 1973. NSFGA couldn't get refrigerated shipping out of the port of Halifax. The container lines didn't want to invest in containers so they agreed to rent the NSFGA containers on a daily basis when they weren't being used by the Association. So successful was this initial venture that in 1975, together with the Blueberry Producers Association of Nova Scotia, they bought an additional 20 units. A further 20 units were purchased in 1978 which brought their joint total to 60. The last 40 refrigerated containers were bought with assistance from the Nova Scotia government and the federal Department of Regional Economic Expansion. The 60 refrigerated containers were a joint venture between the Nova Scotia Fruit Growers Association and the Blueberry Producers Association of Nova Scotia.

Overseas markets for Nova Scotia produce were steadily increasing but their customers demanded that the fruit reach them in excellent condition. Containers holding the IQF blueberries are maintained at 0^0F to prevent the berries thawing and re-freezing which would make them unacceptable to their customers.[20]

16.7 Pricing Study

It was suggested at the 1974 meetings of the Atlantic Horticultural Crops Committee that government workers connected with the blueberry industry were lacking impartial information sources on the blueberry market situation and pricing structure.

The Atlantic Horticultural Crops Committee recommended that a study of the pricing mechanisms for blueberries be undertaken and that a blueberry price monitoring service be established within the Atlantic provinces. This recommendation was received by the Atlantic Agricultural Economics Committee whose executive requested that the Marketing and Trade Division of the Economics Branch of Agriculture Canada assist with the study. Following discussions between Doug Byers, Secretary of AAEC, and R.W. Anderson, A/Head, Horticulture and Special Crops, Marketing and Trade Division, it was agreed that the Horticulture and Special Crops Unit would assist with a study. During the summer of 1975, Dr. Anderson arranged for weekly telex reports from Agriculture Canada, Ottawa. These reports gave the current blueberry prices being paid in each province. He also organized an Atlantic Blueberry Study Team with a representative from each of the Atlantic provinces and Quebec.

To get the study started, the Horticulture and Special Crops Unit agreed to provide an analysis of the factors believed responsible for variations in the price of blueberries. Once this analysis was complete, the Unit circulated their results to provincial representatives for discussion and comment. A meeting was held on Monday, October 20, 1975, at Charlottetown to discuss the full context of the study and the analytical results.

Attending this meeting were representatives from the provincial Agricultural Departments of Quebec, New Brunswick, Nova Scotia, Newfoundland and Prince Edward Island, Dr. R. W. Anderson and Doug Byers of Agriculture Canada's Economic Branch.

The meeting agreed that the pricing information telex service begun by Agriculture Canada during the 1975 season should be expanded to include more information, and that this information should be provided to each provincial representative on the pricing committee. Dr. Anderson agreed to follow up on this so that an improved pricing information service would be available for 1976.

16.8 Promotional Efforts

In April 1978 a blueberry booth was constructed for use at the Provincial Exhibition, Truro, and the Atlantic Winter Fair, Halifax, N.S. The booth was designed to familiarize consumers with the various ways blueberries are used and had as its theme "Blue Magic". The booth was divided in three functional areas. The first area, in keeping with the theme, featured a magician who performed periodically during the day. The centre area featured a film entitled "Blue Magic" promoting blueberries through a series of meal and snack time suggestions. The third area of the booth featured free blueberry muffins and blueberry recipes, as well as a product display showing various blueberry products which are available to the consumer. The booth was staffed by knowledgeable people who knew the industry as well as home economists who could talk to the consumers about food preparation. An invitation was sent to a number of growers who had been selling fresh fruit to indicate what type of containers they had available for this season so that we could publicize where fresh blueberries could be obtained in season.

The booth was extremely successful. The magician attracted large crowds, and the displays of blueberry products and the free gift of hot blueberry muffins were highly praised by the general public.

The Blueberry Connection cookbook was published by Beatrice Ross Buszek of Granville Centre, Annapolis County, in 1979. The Blueberry Connection is dedicated to "Nova Scotians in exile". This book has nearly 300 recipes with "flavor, fact and folklore" in blue, tucked between the sketches and cookery directions. This cookbook did a lot to acquaint Canadians and Americans with lowbush blueberries.

By 1980 there was a growing domestic market for locally produced frozen blueberries. There was a job to educate the public to the fact that blueberries are not seasonal. The Nova Scotia Department of Agriculture and Marketing, Marketing and Economics Branch, in co-operation with processor and major chain stores, had 20,000 pounds of frozen blueberries in 10-pound packages in metro stores and they sold quickly. Store managers said there was a good consumer response to the product.

In 1981, 10-pound boxes of frozen berries were sold in the five principal retail food stores throughout the province. About 63,000 pounds of berries were sold. This program of store sales was continued through the 1980's.

Since 1975, annual trade and promotional trips to Europe had been organized by the Nova Scotia Department of Agriculture and Marketing in co-operation with the Blueberry Producers Association of Nova Scotia and the federal Department of Industry, Trade and Commerce. Participants in the annual missions included representatives of the major blueberry processing firms in the province, and a representative from the Nova Scotia Department of Agriculture and Marketing. This group was extremely successful in projecting a unified and sound marketing approach backed up by a quality product and reliable delivery and customer service. The Nova Scotia processors had firmly established themselves as the principal suppliers on the huge West Germany market, and in 1979 shipped about 7.5 million pounds of blueberries to that country. In addition, some sales have been made over the past several years in Scandinavia, Italy, Switzerland and France.

By 1979 the blueberry industry recognized that there was a need in Canada for a strong national organization representing the total blueberry industry, which would exchange information on all production and marketing matters, and provide a united promotional thrust on a regional, national and international basis, for the increased consumption of blueberries and blueberry products in

Canada and abroad.

Again in 1980, over 7 million pounds of Nova Scotia's processed blueberry crop were sold in Europe. The importance of these annual promotion and sales trips in consolidating and expanding the European market for Nova Scotia blueberries cannot be over-emphasized. Each year the world market presents a different set of circumstances to be dealt with. Follow-up calls to importers and end users are essential in maintaining the established outlets, and the development of new markets requires that all potential market areas be visited and carefully assessed.

The Nova Scotians were very successful in marketing wild blueberries in western Europe, partly because they were accepted as a substitute for decreasing supplies of Polish bilberries, and partly because they offered a new unique taste. Regularity in supply was another favourable attribute and the European market continued to grow. In 1981, Canada and Maine together exported about 33.7 million pounds of frozen wild blueberries to Europe. Canada also took the lead in developing an important new market in Japan. Altogether, Canadian processors have exported to about 20 countries and are continuing to look for new opportunities overseas.

Personnel from Norfrys A.B., one of the largest blueberry and lingonberry processing companies in Sweden, visited Nova Scotia on June 13, 14 and 21, 1983. This company has been a valuable contact with regard to exchanging information on the crop situation in Scandinavia over the past several years. They visited the blueberry areas and some processing plants in Nova Scotia, Maine and Prince Edward Island. They were impressed by the government support of the blueberry industry and the high degree of industry co-operation in Nova Scotia.

The Japanese Wild Blueberry Queen, Masako Hayashi, a university student in Tokyo, led a delegation in August 1984, accompanied by a food editor, a public relations person and three companions, to film wild blueberry production in Nova Scotia. The trip, which included a tour of Oxford Frozen Foods and a luncheon featuring many blueberry delicacies, was sponsored by the Wild Blueberry Association of North America with Executive Director George Wood.

Miss Hayashi said that blueberries are very popular among young girls. This is due in part to the deep purple color and the clean, sour taste with its touch of sweetness.

Sachiko Ikeda, manager of Life Science Information Inc., said blueberries are a fashion in Japan.

A seven-page spread in a popular Japanese teen magazine chronicled the Japanese Blueberry Queen's tour including her first experience picking Nova Scotia wild blueberries.

Sales to Japan have leveled out to approximately 2,000,000 pounds due to the low quality jams introduced in the market by the mid '80's — jam was the major use of 70 to 80 per cent of wild blueberries. Japanese prefer to eat fruit fresh, instead of using them as ingredients in baked goods.

"Blueberries have been my life..." so says Fern Walker, the "Blueberry Lady", and the leading edge of wild blueberry promotion in Ontario and beyond. Fern grew up on a blueberry farm in Nova Scotia and she has taken her knowledge of the industry and her enthusiasm to Ontario where she resides. Her father, Carvell Stonehouse, was a pioneer and leader in the production of wild blueberries.

Fern's promotional programs include cooking demonstrations, television and radio appearances, interviews for numerous newspapers and food magazines, mall appearances and a network of fund-raising activities featuring sales of frozen wild Nova Scotia blueberries. She is the author of "Basically Blue", a collection of 60 popular blueberry recipes.

Fern started her promotional work in 1983 when she sold 20,000 pounds of blueberries. By 1990, her sales were over 70,000 pounds, all to non-profit groups.

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The blueberry industry is fortunate to have Fern Walker setting the pace, and applauds her efforts in spreading awareness of wild blueberries.

16.9 Marketing Organizations

16.9.1 North American Blueberry Council – (N.A.B.C.)

Highbush blueberry growers from North Carolina, New Jersey, Oregon, British Columbia and Washington met in Atlantic City, New Jersey, in 1964. The purpose of this meeting was to bring blueberry producers together so they could discuss mutual problems, compare culture techniques, as well as to see if there was a common bond to form a group, who could meet annually, discuss common research needs, and exchange crop and market information.

D. Craig, Agriculture Canada, Kentville, N.S., and G. Kinsman, Nova Scotia Department of Agriculture and Marketing, Truro, N.S., attended these meetings. They were the only ones representing the Canadian lowbush blueberry producers and industry.

At these meetings, it was decided to form the North American Blueberry Council (NABC). The purpose of this organization was to become involved in generic blueberry promotion. NABC doesn't distinguish between wild and cultivated blueberries. They provide a limited line of promotional materials including school films, cookbooks and recipes.

The NABC meets annually in various states and provinces. They met in Halifax, N.S., in 1978. The organization is now composed of highbush and lowbush blueberry growers from all over North America. Its present principal objective is the promotion of the blueberry industry through the media, trade shows, educational institutions, fairs, expositions, etc. NABC has been very active in the development of new overseas markets for blueberries.

The blueberry production ratio in 1978 was lowbush 30 per cent and highbush 70 per cent. By 1990, the production ratio was 50 per cent lowbush and 50 per cent highbush.

The Blueberry Producers Association of Nova Scotia and several Nova Scotia processors joined the NABC and they have taken an active part in this organization.

The Calyx award was initiated on the 25th anniversary of the Council and it was presented to three selected leaders of the North American blueberry industry and the Council's past presidents.

Two Nova Scotians, Gordon Kinsman, Truro, and John Bragg, Oxford, were honoured at the 25th annual meeting of the North American Blueberry Council held at Poipu Beach, Kauai, Hawaii, January 27–31, 1990, when they received the new Calyx award.

Gordon Kinsman was one of the three selected leaders. The award was presented to honour his long association with the North American Blueberry Council, a long-time promoter of wild blueberries, and a major contributor to the successful development of the industry in Atlantic Canada.

John Bragg was honoured as past president of the Council and for his development of export sales as well as support for the aims of the Council.

16.9.2 Wild Blueberry Association of North America — (W.B.A.N.A)

Marketing thrusts have not been entirely similar in Maine and Canada. Maine processors were primarily interested in the U.S. domestic market which has the potential to absorb all of the Maine crop. Canadians have supplied their own domestic market and concentrated on off-shore markets to take their surplus production. Certainly, there are some inconsistencies; Maine also has some exports to Europe and Japan, and Canada has increased sales to the U.S. when European markets were soft. These movements, however, are due to exceptional supply-demand problems or unfavourable exchange rates and are not seen by either country as part of a long-term strategy.

The wild blueberry industries in Maine and Canada are very closely inter-related and it is easy to understand why there has always been a policy of international co-operation. Some producers own land and harvest crops in both countries, some produce in one country and process in the other, one processor has freezing facilities in both countries and berries move across the border in both directions for processing. The lack of tariffs on either side is recognition of the international status of the wild blueberry industry. Research on management, crop protection and new product development is carried out by government agencies in both countries and new information is regularly exchanged and made available to all. And, more recently, the growers and processors in Maine and Canada have united to carry out a common promotion program within an international organization.

The **Wild Blueberry Association of North America** was formed in March 1981. It is incorporated in both Maine and Canada, but it has a common executive and board of 19 directors that represent the blueberry-producing provinces of Canada and the state of Maine as follows: Quebec (3), New Brunswick (2), Nova Scotia (3), Prince Edward Island (1), Newfoundland (1) and Maine (9). There is one full-time employee, located at Fredericton, New Brunswick, who serves as co-ordinator of activities in both countries.

The objectives and purpose of the Association are stated as:

1. to promote the utilization and marketing of wild blueberries,

2. to enhance communication among North American wild blueberry producers,

3. to encourage new product development, and

4. to serve other needs of the industry.

In order to meet these objectives and fulfill its purpose, the Association operates under a single budget and carries out its activities through four major committees: overseas promotion and marketing, Canadian domestic promotion and marketing, U.S. domestic promotion and marketing, and research and development. In all of its activities, attention is given to regional input and the special interest of each province or state. The first two committees are presently Canadian in make-up, the U.S. domestic committee includes only representatives from Maine, and the research and development committee is chaired by an American but includes some input from the Canadian side. The annual general meeting and regular board meetings alternate between Maine and Canadian locations. Similarly, the office of President alternates between a director from Maine and a Canadian one. The intent and the result is to have equal input and mutual benefit.

Financial inputs from the two sides of the border are also balanced, even though funding procedures differ. The American section of the Association receives an annual contribution from the Maine Blueberry Commission which, in turn, receives its funding through a state tax on all blueberries grown, purchased, sold, handled or processed in the state. Voting membership is obtained by an additional nominal fee. Canadian funding is obtained through voluntary dues on a volume basis directly from producers and processors, from grower associations or co-operatives and from cost-shared programs with Canadian provincial and federal governments. The objective of these programs is clearly to encourage and expand the use of wild blueberries in domestic and export markets and, therefore, the benefits are gained by the total industry and not just the Canadian component.

Government support is perceived as a positive input into the wild blueberry industry by interests in both Maine or Canada. Encouragement and some financial assistance was provided to Canadian growers for land expansion at a time when the demand was believed to be almost limitless, but because technology has increased our production capacity at a faster rate than anticipated, and since the marketing picture is now a little clearer, this policy has changed. Present emphasis in Canada is on land improvement, more efficient management and promotion.

American support for the wild blueberry industry is also available in terms of research, extension and marketing assistance. In addition, the U.S. government has become a major purchaser of blueberries and provides them to its military establishments and to a national school lunch program. The purchase of 14 million pounds of blueberries in 1984 and 1985 has been a real boon to the industry by helping to lower record inventories. It is important to understand that the impact of programs like this is to improve the position of the whole blueberry industry, not just the U.S. component.

How successful has the co-operative approach been and what are some of the accomplishments of the international association? To begin with, the wild blueberry industry has been able to carry out promotional programs on a scale that would not have been possible if left to the resources of its separate components. By joint action, this relatively small industry has been able to spread the awareness of its product across this nation and around the world. It has also developed good trade relations and maintained a strong position in overseas markets.

And, perhaps even more important, the leaders of this industry in Maine and Canada have been provided with a forum where they can sit together to try to resolve their common problems. Individual companies will remain competitive but, collectively, they agree that the future of the industry lies not in creating impediments to trade, but rather it will be in the expansion of markets and development of more products that use wild blueberries. These goals can best be achieved through a united effort that pays no heed to the international border and the imposition of trade barriers.

The free movement of wild blueberries between the two countries works to the advantage of the total industry and is continuing as a cross-border trade policy.

The Wild Blueberry Association of North America (WBANA) has been very active in promoting wild blueberries worldwide.

In terms of promotions, WBANA's efforts include:

- attending national and international food-related shows in areas with concentrated population;
- printing promotional material including recipes, posters, table tents, technical fact sheets and nutritional information in several languages;
- advertising in national trade magazines;
- providing promotional material and assistance for provincial promotions;
- conducting missions in countries unfamiliar with blueberries to create awareness of the product and its uses;
- conducting joint promotional ventures with companies such as Kellogg's;

- co-operating with retail food chains and foodservice associations in promoting wild blueberries; and
- organizing receptions for potential purchasers of wild blueberries during which a range of product uses is demonstrated.

The Association is involved in awareness creation; it has no mandate to sell.

Their efforts are focused on markets with high concentrations of population, both domestically and overseas.

A wild blueberry market brochure was prepared and it received such commendation in all quarters that it is now published in seven languages.

North Americans consume between three to eight ounces of blueberries per year. This low consumption rate was of concern to WBANA. Per capita consumption of wild lowbush blueberries in this country increased by 47 per cent (from 7.0 to 10.3) ounces between 1980 and 1984 — and a significant part of this increase can be attributed to promotional activities. A unique project — the first in Canada — was formed in June 1982 when blueberry producers, processor, provincial and federal governments agreed to jointly finance a three-year $405,000 promotion program.

16.10 Processing Markets

By 1985, the quantity of blueberries going for processing had increased considerably during the last decade. Over the same period, the quantities of other fruits going for processing (e.g. raspberries, strawberries, cherries, apples) did not increase as rapidly as blueberries. The highest proportion of processed blueberries consists of frozen ones. This proportion has increased during the last decade, while the proportion of other forms (e.g. canned blueberries) is declining.

Blueberries are also used in secondary processing in the bakery trade (pie fillings, etc.); dairy processing (yogurts, ice cream, etc.), and in confectioneries (jams and jellies), and in beverages (drinks, aperitifs, wines, etc.). AppendixB.1, page 147 presents a list of blueberry products available in Canada.

In 1985, a study was made to test market the sale of Nova Scotia frozen wild blueberries from the back of refrigerated trucks directly to consumers in Toronto. The 40,000 pound load was to consist of 4 kilogram, 2 kilogram and 600 gram packages.

Toronto locations weren't available and a site was located at Knob Hill Farms store in Oshawa, which is the largest food outlet in the world. Point-of-sale material was used and a Nova Scotia Department of Agriculture and Marketing recipe publication distributed. Sales were made from this site for two days and approximately 6000 consumers approached the sales area. Due to an error, only 4 kilogram packs were available. Over half the consumers indicated they did not know what blueberries were or how to use them.

It was agreed by the wholesalers/retailers that the two and five-pound poly packages, much like frozen French fries or frozen vegetables, would be the best size to retail. The blueberries should be available for $1.00 per pound. Recipe books should be in flashy colours and printed on gloss paper. There is a market in Toronto for frozen wild blueberries which are packaged properly, priced reasonably, and promoted aggressively. [88]

The blueberry market was much stronger for the 1986 crop than it has been for the past two years. There had been an increased usage of blueberries and blueberry products due to strong promotion and marketing efforts during the past couple of years. There was a slightly lower total North

American crop. The uncertainty over supplies from Scandinavia and eastern Europe was a result of the Chernobyl nuclear disaster. There was a return to a favourable currency exchange rate in Europe. Farm gate value in 1986 was $6,484,942.

Blueberry markets were strong in 1987, 1988, 1989 and 1990. Nova Scotia growers received 60 cents per pound in 1987 and the total farm gate value of the 1987 crop was $8,115,033. Grower price in 1988 was 55 cents per pound and the total farm gate value was $12,102,766. The 1989 grower price was 55 cents per pound and the total farm gate value was $9,257,358. The 1990 crop was 27,994,286 pounds and the growers received 42 cents per pound for a provincial farm gate value of $11,757,700.

In 1990, 75 per cent of Nova Scotia's production was processed by Nova Scotia processors, and about 24 per cent was shipped fresh by buyers to processing plants outside Nova Scotia (mostly in the state of Maine). Local fresh sales accounted for about 1 per cent of total production. Up until 1972, approximately 70 per cent of the total Nova Scotia processed pack was usually sold to United States manufacturers, while the other 30 per cent was sold to manufacturers in Canada. Beginning in 1972, increasing amounts of Nova Scotia berries were sold to European countries such as West Germany, Sweden, Norway and the Netherlands. From 1977 to 1982, over 60 per cent of each year's crop was sold in Europe. Small quantities were sold in Japan in the late 1970's and this market increased steadily for about five years. Since then, there has been a levelling off of demand. Shipments to European markets declined substantially from 1983 to 1985 because of the strength of the Canadian dollar in relation to most European currencies. More favorable currency exchange rates returned in 1986 and have resulted in a revival of European sales since that time. In most cases, shipments of overseas markets are made by refrigerated containers through the ports of Halifax or St. John. A well-defined marketing system has evolved for getting the crop from the field to the end user.

The present (1990) total blueberry market world-wide will absorb about 170,000,000 pounds of blueberries (combined highbush and lowbush production). Production has been at this level for the past three years. Any sudden upsurge in production beyond this figure could cause serious marketing problems.

16.11 Fresh Markets

In the past, many blueberry shippers, mainly from Hants, Colchester and Cumberland counties, made regular rail express shipments to Boston, Montreal and Toronto markets. Their berries were put in wood veneer quart boxes and placed in 32 quart crates. They used this system until the late 1950's. Yarmouth County blueberry shippers shipped their 32-quart crates to Boston and New York by boat until the mid 1960's.

The construction of freezing facilities in Cumberland and Kings counties, in the early 1960's, meant that most of the harvested blueberries were processed in Nova Scotia or shipped fresh to Maine processors, and fresh shipments, in 32-quart crates, were discontinued.

The marketing set-up for lowbush blueberries had been very unstable from 1964 to 1966, mainly because of a heavy dependence on the New England processing market and a lack of local freezing and holding facilities. Almost all of the Nova Scotia production had been shipped for processing to the United States, during this time with no attempt being made to develop a local fresh fruit market.

During and following the 1966 marketing season, attempts were made to interest several grower groups in the fresh marketing of this crop. It was felt that fresh berries could be marketed very successfully on the Boston and New York markets, as this was presently being done with strawberries, raspberries and highbush blueberries.

Four blueberry producers, Dave Perrin, and brothers Cecil, John and Aubrey Gammell, in Dean Settlement, Halifax County, agreed to establish the Dean Produce Co-operative in 1967. These men had been working together for the past number of years and they were putting out a premium fresh pack. Their berries were put over a winnowing machine, onto a highbush blueberry sizer, and then on a slow-moving horizontal belt where six or seven workers quickly removed damaged or green berries, clusters and twigs. A partitioned rotating wheel was placed at the end of the pick-over belt, and this routed the berries into pint or quart containers.

All containers were mounded when filled. A printed cellophane wrap was placed over the top of each container and held in place with a rubber band. This made an attractive pack and prevented loss of berries, bruising or having the berry bloom rubbed off.

In 1967, almost seven tons of these berries were shipped, over a two-week period, by Air Canada to Boston. Price to these growers on these shipments was 22 cents to 25 cents per pint. The growers were satisfied with their returns.

A sample pack was taken to a local chain store outlet and they were offered 28 cents to 30 cents per pint. They were extremely encouraged by the consumer response on the Halifax and Sydney markets to their new pack.

Plans were made to concentrate on the local markets in 1968. They marketed their entire crop of five tons as fresh fruit, selling pints, quarts and ten pound freezer boxes. Demand for the ten pound freezer box was excellent. This co-operative has been selling fresh fruit on the Nova Scotia market for the past 23 years.

Don Wheaton, Parrsboro, in 1968 set up a number of fresh fruit stands. In Halifax, Parrsboro, Truro, New Glasgow and Trenton he sold fresh blueberries to stores in these towns. He sold approximately 11.5 tons as fresh fruit.

Bud Weatherhead, Upper Rawdon, Hants County, started in 1978 to sell washed fresh blueberries. The first year he sold 9 tons, the second year 18 tons, and the third year 36 tons. By 1987 his sales had climbed to nearly 100 tons. A local pie manufacturer took more and more tonnage each year thereafter, so his sales on the fresh market went down to less than 75 tons in 1990. In 1988 he purchased an electronic sorter to sort his berries. This machine has worked well.

Cross Roads Blueberry Co-operative Ltd., located near Parrsboro, undertook to market 10 pound boxes of fresh blueberries in 1984 to 24 retail food co-operatives in a 300 kilometer radius from their plant. They found there was a potential market for at least two million pounds of fresh blueberries in the Maritime provinces. Price to the grower should run to 40 cents per pound for field-run berries. They found they needed to get new picking equipment, better containers, and their graded and packed berries must be stored and handled properly.[26]

In 1984 Casey van Dyke, Caledonia, Queens County, established a fresh fruit picking line. He sold 10 tons the first year to an annual high of 35 to 40 tons. He sold, mainly in 10 pound boxes, to the major food chain stores in Halifax and to farm markets.

An assessment of the effects of processing machinery and methods on the quality of lowbush blueberries packed in Nova Scotia for the fresh market was undertaken in 1978. [92] They found the most important factor affecting the quality of blueberries was the harvesting operation. Modified raking and handling techniques should be employed. Grade standards for fresh blueberries should be upgraded. Field cooling as well as optimum packing, storage and display temperatures should be studied.

A study was conducted in 1986 to assess the problems of organizational structure, packing, storage, quality control and distribution of fresh lowbush blueberries, using ground and air transport into the Toronto and Montreal markets. Results showed there is a potential market if they have quality (good size and dry berries), packaged and marketed to meet or beat their competition. [71]

A small percentage of the annual lowbush blueberry crop is sold each year on the fresh market. There are about a dozen commercial operations marketing fresh fruit in Nova Scotia in 1990.

The fruit is packaged in either 10 pound boxes, 5 pound boxes, pint or quart containers. Sales are mostly to retail store chains or fruit stands. Some packers work with service clubs or other groups who sell 10 or 5 pound boxes of fresh blueberries as a fund-raising project.

Selling berries on the fresh market requires more labour and special materials and equipment to do a proper job. There is, however, a good opportunity for development of substantial sales if a producer is willing to expend some time and effort to set up an efficient operation, develop a marketing system and put out a high quality product.

Another method of handling fresh lowbush blueberries is to allow the public to rake or pick their own. Berry boxes can be provided and their cost included in the per-box price; or customers can bring their own containers and buy by weight. A cleaner (if used) and scale should be set up near the exit. This method of handling is better suited for fields that are easily accessible and in areas where rakers are hard to obtain. Newspaper and radio advertising will help attract customers. Many families welcome the opportunity to get out and harvest fresh fruit on their own. This method hasn't been widely accepted.

Between 1978 and 1984, fresh fruit sales were estimated at 100 tons. It was in the period from 1985 to 1990 that a larger tonnage of berries was sold as fresh. (Table16.3) In 1990, fresh fruit sales in Nova Scotia were 1.6 per cent of Nova Scotia's total production.

Table 16.3: Nova Scotia Fresh Fruit Sales

Year	Tons
1985	170
1986	238
1987	208
1988	246
1989	167
1990	184

Chapter 17

EXTENSION

17.1 Early Extension

In 1928, provincial legislation popularly known as the "Blueberry Act", was passed, which provided for the leasing of Crown land to blueberry grower associations. Over a period of a few years leases were issued covering thousands of acres, confined largely to southwestern Nova Scotia, principally in Yarmouth County. The berries were hand-picked and mostly sold to the Boston market.

After World War I, interest in blueberry growing started in Cumberland County and this area was developing quite quickly as the blueberry land was former farm land; it was privately owned and the producers saw it as an opportunity to develop it into a cash crop. Their crop yields were very high in comparison to yields from hundreds of acres of old fire barrens in southwestern Nova Scotia.

The Nova Scotia Department of Lands and Forests became increasingly concerned, in the late 1940's and early 1950's, that tens of thousands of acres of Crown land in southwestern Nova Scotia were being kept barren by blueberry fires — without producing many berries. A smaller area, known as the Eden Lake Barrens, located partly in Pictou and partly in Guysborough counties, was being kept barren by persons unknown setting fires in dry periods. Because of this it was decided that the Nova Scotia Department of Lands and Forests staff would see if they could eliminate wild fire, reduce fire fighting costs, and determine what land was suitable for blueberry culture and what land was better suited for growing trees. Fires in the Eden Lake and the Yarmouth areas were controlled and Nova Scotia Department of Lands and Forests started to plant pines in the Eden Lake area and other species were planted in Yarmouth County with satisfactory success. [25]

L. Hawboldt, Nova Scotia Department of Lands and Forests, wrote "Blueberries: Cash From Idle Acres" — the first provincial extension bulletin on lowbush blueberries. [56]

The Nova Scotia Department of Agriculture and Marketing had employed the author (Gordon Kinsman) as a summer student in 1948, and a considerable amount of his time was spent meeting and working with blueberry producers. He was hired May 1, 1949, by the Nova Scotia Department of Agriculture and Marketing as a Berry Crops Specialist in the Horticulture and Biology Branch, and one of the crops he was assigned was lowbush blueberries. He spent a lot of time learning about the industry, getting to know the producers and their concerns.

The Nova Scotia Department of Agriculture and Marketing felt their Department should have the responsibility for blueberry extension. Staff of the Department would work with Nova Scotia Department of Lands and Forests personnel in matters of mutual interest such as spring burning, timing of burning, and fire safety controls. The Minister of the Nova Scotia Department of Agriculture and Marketing was also Minister of the Nova Scotia Department of Lands and Forests at that time, and in 1952 he ruled the extension work should be done by the Department of Agriculture and Marketing. These two Departments have worked together amicably on blueberry projects through the years.

One of the first things completed was the establishment of a lowbush blueberry extension team. The team consisted of Endel Karmo, Apiarist; Don Palfrey, Weed Control Specialist; Vernon Vickery, Entomologist; and the author. Karmo, Kinsman and Palfrey did extension work throughout their working life. Vickery transferred to Macdonald College, St. Anne's, P.Q., in the 1960's.

Kinsman was the first lowbush blueberry extension specialist in Nova Scotia. He acquired a great knowledge and understanding of lowbush blueberry technical information, and he had the ability to motivate people to learn the new skills and use them effectively in developing the industry. He kept continually tuned to grower problems and needs and excelled at adopting new knowledge and ideas for the benefit of the blueberry industry. His interest in the blueberry industry has been instrumental in the development of many of the government programs presently available to blueberry growers. [14]

Karmo's work was on the beneficial effects of using honey bees to supplement native pollinators in lowbush blueberry fields. His excellent work is written up under "Pollination". He owned blueberry land and gained recognition as a highly qualified and respected blueberry grower.

Palfrey worked on the early development of herbicides for lowbush blueberry weed control. Information was very limited. Many herbicides had to be tested, and registrations obtained before specific recommendations could be made. He spent a lot of time in helping to develop specific blueberry herbicide equipment. His earlier work is explained under "Weeds".

Vickery was concerned with the lack of knowledge regarding the insects attacking lowbush blueberry plants, their life cycles, and how to control them. The use of hand or power dusters was very limited so he spent a lot of his time on how to properly apply the recommended insecticides.

Jack Sibley joined the extension specialist group as a Blueberry Specialist on May 1, 1965 as Kinsman assumed more administrative responsibilities. Sibley has always been dedicated to getting the latest information out to the blueberry industry through newsletters, radio, field days, meetings, producer organizations or personal calls. He recognized the many cultural and management changes the industry needed to adopt and he led the way in seeing they were used. He went on many of the early trade missions to Europe in order to develop these export markets. He has been very interested in sharing his knowledge, not only in Nova Scotia, but he has been invited to share his knowledge with lowbush blueberry producers in other eastern Canadian provinces, Saskatchewan and the state of Maine. He owns and operates blueberry fields in Pictou County.

Several extension objectives were established by the Department of Agriculture and Marketing extension team:

1. the blueberry industry was to be controlled by the producers. In other provinces, outside interests had bought up the acreage of most of the producers and the producers had lost the control of their industry.

2. A growers organization would be established as soon as possible and this organization could be used as a "sounding board" regarding policies as well as for educational purposes.

3. Every effort would be made by staff to see this industry was established as soon as possible with the latest extension and research programs and methods.

In 1952, the first blueberry field day, with over 100 producers attending, was held in Glenmore, Halifax County, at Glenmore Industries (Bob Burgess) farm. Extension and research workers spoke to the producers about the latest cultural, insect and disease controls, as well as demonstrating new equipment. Annual summer field days have been held since the early 1970's.

A Nova Scotia blueberry newsletter was soon started and this was sent to all producers, extension and research workers on a regular basis during the growing season. The latest information on culture, management, meeting notices, disease and insect controls was contained in these newsletters. This newsletter has been continued and is still an important part of the lowbush extension program.

A Lowbush Blueberry Insect and Disease Calendar was issued annually and this calendar was updated yearly with the latest information.

A lowbush blueberry growers organization was formed in the early 1950's.

The author and E. A. Karmo, Apiarist, Nova Scotia Department of Agriculture and Marketing, were invited to speak on several occasions to the Maine blueberry producers at their annual spring producers conference held at the University of Maine in the 1950's and 1960's.

Agriculture Canada operated a lowbush blueberry research station at Tower Hill, New Brunswick. The state of Maine operated a lowbush research station at Jonesboro, Maine. The heads of these two stations, Dr. G. Dow, University of Maine, and E. Eaton, Agriculture Canada, Kentville, N.S., each summer would invite their research workers for a joint information exchange session lasting several days. These meetings would alternate between Jonesboro and Tower Hill for a number of years in the 1950's and 1960's. Nova Scotia extension workers were also invited to these meetings.

It was recognized that the blueberry crop has many problems and at meetings such as these many workers were working on the same problems. Discussion of these problems improves the quality of work being done and helped to eliminate overlapping and duplication. The main objective was to concentrate on the prime problem areas. Initially, two prime problems were weed control and all aspects of marketing.

Lowbush blueberry research and extension workers and industry representatives still meet annually. At these meetings all research and extension workers have a chance to meet the complete blueberry research teams from Maine, New Brunswick and Nova Scotia. Individual workers have the opportunity to discuss their programs with others doing similar work. Government workers and industry personnel are brought up to date on the latest research findings and extension programs. It offers an opportunity for greater co-operation, co-ordination and communication for research, extension and industry personnel. Periodically in the 1980's there would be a special session on market development. There were 75 to 100 present at these meetings in the 1970's and 1980's.

The author assumed the position of Director of Horticulture and Biology Branch in 1962 and he continued to do the extension work for lowbush blueberries. Bob Murray, Berry Crops Specialist after 1962, assisted in the lowbush blueberry extension program. On May 1, 1965 Jack Sibley was hired to work as a lowbush blueberry crops specialist in the Horticulture and Biology Branch, under the new Agricultural Rural Development Agreement (ARDA), which was a five year agreement and due to end on 31 March 1970. This program was to deal with the nine eastern counties of Nova Scotia. Sibley has held this lowbush berry crops specialist position ever since, although his responsibilities were changed to encompass all of Nova Scotia. Bob Murray continued extension work on all other berry crops.

Yearly producer short courses have been held, usually in the spring. Timely topics of interest are dealt with. A new film on blueberry harvesting was prepared in 1966 and was widely used for the next couple of years to show growers how they may reduce berry loss and quality through proper harvesting methods.

17.2 Modern Extension

In 1966 two surveys were completed. C. M. Collins did a survey of the lowbush blueberry potential in western Nova Scotia. He felt there could be a potential for a total of 7,786 acres in production with 1,667 acres in production within 10 years and another 6,119 acres with future potential. A survey was also carried out to see what policies should be implemented in the nine eastern counties, incentives needed to encourage residents in these counties to specialize in this crop, and to survey the current concerns of the producers.

The first ARDA workers conference was held in 1967 with 32 in attendance from all provinces eastward except Prince Edward Island. Reports were presented on all phases of the lowbush blueberry work being carried out by ARDA in each province. A stimulating talk was given by Frank Soukup, Canada Foods Ltd., Kentville, N.S., on the world situation in regard to blueberry marketing. Marketing was beginning to be recognized as a concern. The 1968 meeting was held in Quebec City.

A blueberry meeting was held in Bridgewater on April 23, 1968 for interested growers in Lunenburg and Queens counties and eight growers attended. Blueberry development was just beginning in this area. A general meeting on lowbush blueberry production was held in Yarmouth on May 2, 1968 with four growers in attendance. These four represented most of the county's production.

Prince Edward Island had formed a blueberry co-operative in 1968 which had 1200 acres of blueberry land in the western end of P.E.I. They visited the Parrsboro area that year to tour production areas and freezing facilities.

Short courses on lowbush blueberry production and marketing were held in Truro and Lawrencetown in 1968 for extension workers. Extension workers had seen the possibility of increased blueberry production in their areas and they were interested in learning more about the industry and the part they might play in it.

The five-year ARDA program increased the production considerably; several industry surveys had been completed; approximately 2100 hives per year were used for pollination. Assistance provided for several new fresh fruit marketing organizations, harvesting techniques reviewed, and crop loss was reduced through educational methods. The blueberry business, like all other phases of agricultural production, was becoming more specialized and complex each year. It was a continuing job to make growers aware of the latest production and marketing techniques, and more especially, of a well managed production and marketing program.

Extension workers in the Maritimes and Maine were often asked to speak at other jurisdiction workers' meetings and to tour their production areas in the 1970's and 1980's. This gave them an opportunity to know other extension personnel's production areas very well and to know what the current producers concerns were.

By 1971 the overall outlook for this segment of the agricultural industry was good. During the ten year period from 1962 to 1971, the average grower price had been 15 cents per pound and average annual production had been 7.2 million pounds. Adequate processing and holding facilities were present in the province, with four IQF freezing plants packing lowbush blueberries. There was a continuing trend toward consolidation of grower holdings into larger units. However, there were still several hundred small-size holdings which provide a profitable and (as agricultural enterprises go) a reasonably stable income for many rural Nova Scotians. Producer demand for more information on blueberry culture, management and marketing in the 1970's required that one-week short courses were usually held in the late winter months at the Nova Scotia Agricultural College. These meetings were designed to update the knowledge of growers already in the blueberry business and to train persons who wish to enter blueberry production. Most of the trainees were sponsored by Canada Manpower.

In addition, a series of evening short course meetings were organized and held throughout the province in areas requesting them. These were organized to reach growers who, because of regular job commitments, were unable to attend the Manpower short courses.

Assistance for transportation of honeybees used for lowbush blueberry pollination is outlined in the section dealing with pollination.

Two video tape presentations on the lowbush blueberry industry were prepared by Gordon Boutilier, Technician, Nova Scotia Department of Agriculture and Marketing, in 1972. Tapes were prepared by Central Cablevision in Amherst for the Blueberry Harvest Festival were edited into a production which could be used for short courses or training meetings. Up-to-date slides have been annually used for meetings; meetings and general extension work must be constantly updated.

A land clearing assistance policy was introduced in 1973 that has proven to be very successful and it is still in place. It provides for a grant of $200 for each acre cleared for lowbush blueberry production.

The Lowbush Blueberry Crop Insurance program was introduced in 1973 and it is still in place.

A tour on August 9, 1973 of the large blueberry areas in Washington County, Maine, was made. This tour was sponsored by the Maine Plant Food Educational Society. Once again, Nova Scotia blueberry extension specialists came away with the impression that Nova Scotia's blueberry industry was every bit as progressive as that of Maine. These workers also felt that the possibilities for increased yields from Nova Scotia established fields were greater because the fields are cleaner.

Also, in 1973 a one-year grant was made to extend the airplane runways in Parrsboro and Collingwood in order for aerial spraying to be continued in a safer manner.

Dr. Amr Ismail, Blueberry Extension Specialist, Maine, told the group that the next five years could see dramatic changes in yields from established and weed-free fields.

Jean-Pierre Potvin, a marketing specialist with the Quebec Department of Agriculture, spent two days in Nova Scotia in 1974. Mr. Potvin was interested in how blueberries are marketed in this province as compared with Quebec. He was shown receiving sheds and processing plants in operation and he had the opportunity to talk with several persons involved directly in blueberry marketing. Our people were able to benefit from this exchange by gaining some firsthand and up-to-date knowledge on the Quebec blueberry industry.

By 1976 there were 17,000 acres in production with a total of 560 growers. The Nova Scotia Department of Agriculture and Marketing introduced other policies to increase the land acreage and increase production.

In the 1970's and 1980's there was a continuing interest in the purchase and development of potential blueberry land. This came both from new growers and those well established in the business. Land appraisals were often requested by a buyer or seller. Occasional appraisals were made by the Blueberry Specialist for the Nova Scotia Farm Loan Board who were concerned with financing a farm sale involving blueberry land.

The 1976 lowbush blueberry crop was 6.8 million pounds, the lowest since the disaster year of 1968 when only 2.1 million pounds were harvested. Severe winter damage in some areas, a widespread outbreak of tussock moth in Colchester and Cumberland counties, and a poor growing season for new sprouts in 1975 were the main reasons for the poor crop.

Grower price in 1976 was 30 cents per pound. This was the highest price ever received by growers up until that time. The extremely strong market was due to low inventories from 1975 and an increasing demand from the European market. Processors made increased efforts this year to get fruit from other areas, to supplement short supplies from Nova Scotia.

Every attempt continued to be made by extension workers to provide an up-to-date information and consulting service for all phases of the blueberry industry.

Jack Sibley, Blueberry Specialist, Nova Scotia Department of Agriculture and Marketing, spoke to a Bankers Conference held in Truro 28-30 November 1977 on "Lowbush Blueberries in Nova Scotia — Outlook, Trends, Financial Requirements and Profitability". The following are highlights from that talk:

Outlook: Probably no other agricultural commodity produced in the province has as bright an outlook as lowbush blueberries. Large scale commercial development began in the early 1950's. Today lowbush blueberries are Nova Scotia's number one fruit crop both in terms of export sales and "on farm" value. The "on farm" value of the 1977 crop was in excess of 5 million dollars, while the value of export sales was about 6 million dollars. The industry has a strong "grass-roots" base of independent growers, a strong and active producers association, and has good support from government research and extension programs. Also, a good proportion of growers are young, aggressive individuals with the interest and capability to keep their industry healthy and growing. The market potential for lowbush blueberries in Europe is tremendous. Trade missions visited over a dozen countries throughout Europe in 1975, 1976 and 1977. Blueberries, or bilberries as they are called in Europe, are a much sought after fruit and are used in enormous quantities for making juices, wines and yogurt and pastries.

Financial Requirements and Profitability: The financial requirements for a lowbush blueberry operation, with the exception of the initial purchase of land, are usually not too great. The equipment for a small operation is very minimal as most buyers or processors will supply almost everything needed, and many of the production operations can be contracted on a custom basis. Most small or medium-sized growers (5 acre to 100 acre units) would not need to invest more than $1,000 in specific blueberry equipment. In addition, many buyers and dealers will carry production expenses (burning, insect and weed control, etc.) for a grower until his crop is harvested.

The price of lowbush blueberry land varies from $100 per acre to $1,000 an acre depending on its productivity, location and other factors.

Over the past ten years, lowbush blueberries have been a consistently profitable crop for many part-time operators.

M. Fuller, Agricultural Representative, Nova Scotia Department of Agriculture and Marketing, Yarmouth County, initiated an Innovative Demonstration Project in 1978 to revitalize the blueberry industry in Yarmouth County.

Provincially, blueberry acreage continued to expand throughout the province annually and in 1978 approximately 597 acres were cleared under the land clearing policy.

Lowbush blueberry production developed mainly in the northern and central counties of the province. It was felt there was potential for development in other areas and efforts were made in the late 1970's to encourage industry development in the eastern counties of Antigonish, Pictou and Guysborough, as well as Yarmouth, Lunenburg, Queens and Annapolis counties and Cape Breton Island.

On June 22, 1979, a one-day training session was held at Springville, Pictou County, for workers employed under the job creation program to work on clearing and development of blueberry land in Pictou County. This session was held at the request of a number of employers in the county who were developing and improving blueberry acreage under the task force for employment program. Each employer brought his or her crew in and helped with organization, transportation, etc., for the day's program.

A small nucleus of growers in 1979 in the Bridgewater area made good progress in developing blueberry acreage. In Yarmouth County, Mac Fuller, Nova Scotia Department of Agriculture and Marketing, organized an exciting project making use of the Task Force for Agricultural Employment program. There are 200 to 250 acres were in various stages of development under his programs.

On Cape Breton Island, at least two promising sites had been cleared and were being readied for production in 1981. Both areas were inland and were not expected to be subject to the harsh climatic factors which had previously discouraged production on some parts of the island.

An evening short course for new blueberry growers in the West Colchester area was held on March 14, 1979. Thirty new or prospective producers attended — again indicating interest in developing blueberry land.

Sibley's 1979 annual report states "the lowbush blueberry industry is blessed with a good nucleus of progressive producers, a strong producers' association, modern processing and storage facilities, and expanding overseas markets. The strong prices in the past few years have stimulated tremendous interest and enthusiasm in the industry."

Some important developments which took place in 1980 were:

1. Yarmouth County — Mac Fuller, Agricultural Representative, Nova Scotia Department of Agriculture and Marketing, organized another excellent summer work force under the Provincial Employment Program. The crews continued to clear good potential blueberry acreage and started a weed control program on acreage which was cleared or redeveloped in 1979 and 1980. Well over 200 acres were cleared or cleaned under this program.

   An Innovative Demonstration project for the "re-establishment of commercial blueberry production in western Nova Scotia" was approved. This project provided funds to purchase some equipment and to demonstrate new technology as well as assist in setting up a grower-control organization for the area. A field day to demonstrate equipment, cultural and harvesting methods was held August 11, 1979 at Kempt.

2. Annapolis County — Arrangements were made with the Nova Scotia Land Survey Institute to do a pilot survey of potential blueberry acreage in that county using sophisticated aerial mapping techniques combined with observation flights. This project was completed in October with a follow-up ground survey. Unfortunately, very little potential blueberry acreage was found.

3. Hants County — Steady development continued in the Gore-Rawdon area which had a good nucleus of 10 to 12 interested growers. Some major expansion and/or development work was carried out by Bud Weatherhead, Clyde Blois, Junior Anthony and Ralph Grant.

4. Guysborough County — A series of four spring meetings designed as information sessions for new growers were held at Goshen, Guysborough County, in the spring of 1980. Attendance was good (30 to 35 growers at each session) and the enthusiasm and interest shown by those who attended was encouraging. There is an obvious need for a great deal of training and education regarding cultural practices, particularly weed control.

5. Cape Breton — The Innovative Demonstration project which had been set up to demonstrate cultural techniques for blueberry production to producers on Cape Breton Island proceeded on schedule. That spring of 1980, acreage was burned at Marion Bridge (Mira Co-op group), Ferguson Lake (Orm McCuspie), and Arichat (Clarence Calder). The death of Rollie Langille prevented the burning of acreage which he was developing in the Mt. Young (Lake Ainslie) area.

   Renewed interest was shown in developing blueberry acreage in the Strathlorne, Inverness County, area. There was a small blueberry co-op group there some years ago, and some of the landholders involved have indicated an interest in reviving their group. A meeting was held on September 30 at Mabou to reorganize the co-op and organize a development plan for this area.

   Considerable time was spent by the Horticulture and Biology Branch, Nova Scotia Department of Agriculture and Marketing, and other concerned extension workers to try and provide service and information to a rapidly expanding industry with many new and inexperienced growers. Vernon Murray, Regional Agricultural Representative, Antigonish, was particularly helpful in co-ordinating projects and extension efforts. John Thomson, District Weed Inspector, Nova Scotia Department of Agriculture and Marketing, Truro, assisted continually with instructions and guidance on weed control programs.

   A rejuvenation of the blueberry industry was continued in Cape Breton in 1981.

   The Mabou Blueberry Co-op group which was active a number of years ago was reactivated by Leo Cox, Agricultural Fieldman, Nova Scotia Department of Agriculture and Marketing, Mabou. Two meetings were held with this group in 1981 and the response was excellent. Twenty-four people attended an information session held at the Hillsborough Hall on February 23. This group was given a winter employment program grant and hired a crew to clear blueberry acreage. However, result were disappointing, the group did not seem to be able to work together, and interest seemed to wane as the year progressed.

   The Mira Co-op group continued to clear and burn new acreage at Marion Bridge. This group is in charge of the equipment purchased under the Innovative Demonstration Program for use in developing new production areas on the island. In 1981 they burned acreage at Marion Bridge, Ferguson Lake and Arichat. A mini field day was held at the Mira Co-op site on June 19, 1981 to review cultural practices and discuss future development of the area. Clarence Calder of St. George's Channel negotiated leases on fields in the Lake Ainslie area and at Ferguson Lake, to increase his production potential. Assistance was provided to Calder in organizing a fresh fruit marketing program. This was fairly successful with about three tons being sold fresh in 10 pound boxes at the field.

In total, over 16,000 pounds were harvested in Cape Breton in 1981 (Mira Co-op — 7,400 pounds; Clarence Calder, grower — 9,000 pounds plus).

Jack Sibley organized and presented blueberry courses for new and potential producers in Truro in 1983. He went to Newfoundland in 1983 to put on a production course for their blueberry growers.

By 1984, changes were occurring rapidly in the wild blueberry industry. New cultural innovations included the widespread use of pre-emergence herbicides for greatly improved weed control, new fungicides for disease control, the use of flail mowers as an alternative to burning, and the introduction in 1984 of the first successful tractor-mounted mechanical harvester. The new herbicides Atrazine and Velpar revolutionized weed control in wild blueberry fields. Most growers applied a pre-emergence treatment of one of these herbicides in the spring of the sprout year. This resulted in very good weed control throughout the cropping cycle. Some touch-up work to control escape weeds was sometimes necessary during the sprout year or following harvest in the crop year.

The year 1984 also saw more involvement in blueberry research activities by faculty of the Nova Scotia Agricultural College.

Starting in 1987, a series of winter extension meetings was held in various counties. In 1988, nine winter meetings were held in eight counties with a total attendance of 208. Similar meetings were held in 1989 and 1990.

Provincial Departments of Agriculture are the primary source of expertise to blueberry producers on how to implement improved crop management practices, field tests, new varieties, etc. Nova Scotia has devoted more provincial resources in this area than any of the other provinces. In addition, certain provinces have provided assistance for export market development through mission sponsorship.[29]

A series of meetings was held in 1989 to explore the introduction of a tripartite stabilization program for lowbush blueberries in Canada. These meetings were attended by the blueberry specialists along with representatives from the Blueberry Producers Association of Nova Scotia. The proposed plan was explained to growers at the annual winter information meetings. In due course a mail-in vote was conducted by the producers association and Nova Scotia growers voted against participating in such a plan if it was implemented.

In 1989, growers were able to apply for assistance for stump and rock removal, using industrial equipment, as well as drainage and fire break construction on blueberry acreage. Over 533 acres were developed, using heavy industrial equipment, under this policy.

Growers moved rapidly to adopt flail mowers for pruning and mechanical harvesters for harvesting. The use of these two machines cut production costs dramatically. Level land, free of stumps and rocks, could be pruned by flail mowing for about one-third the cost of rough land which had to be burned. The use of mechanical harvesters cut harvesting costs by 50 per cent. Much of the seasonal pressure on both pruning and harvesting operations was eliminated. Because of these advantages, interest in levelling blueberry land and removing stumps and rocks soon reached a fever pitch throughout the industry. Bulldozers, discs, excavators and rollers were being used to level acreage and various combinations of existing and new specialized machinery were being adapted for use in stump and rock removal. Several research studies were initiated to assess these new techniques and evaluate their impact on production.

Trans Canada Highway sign near Oxford, Nova Scotia.

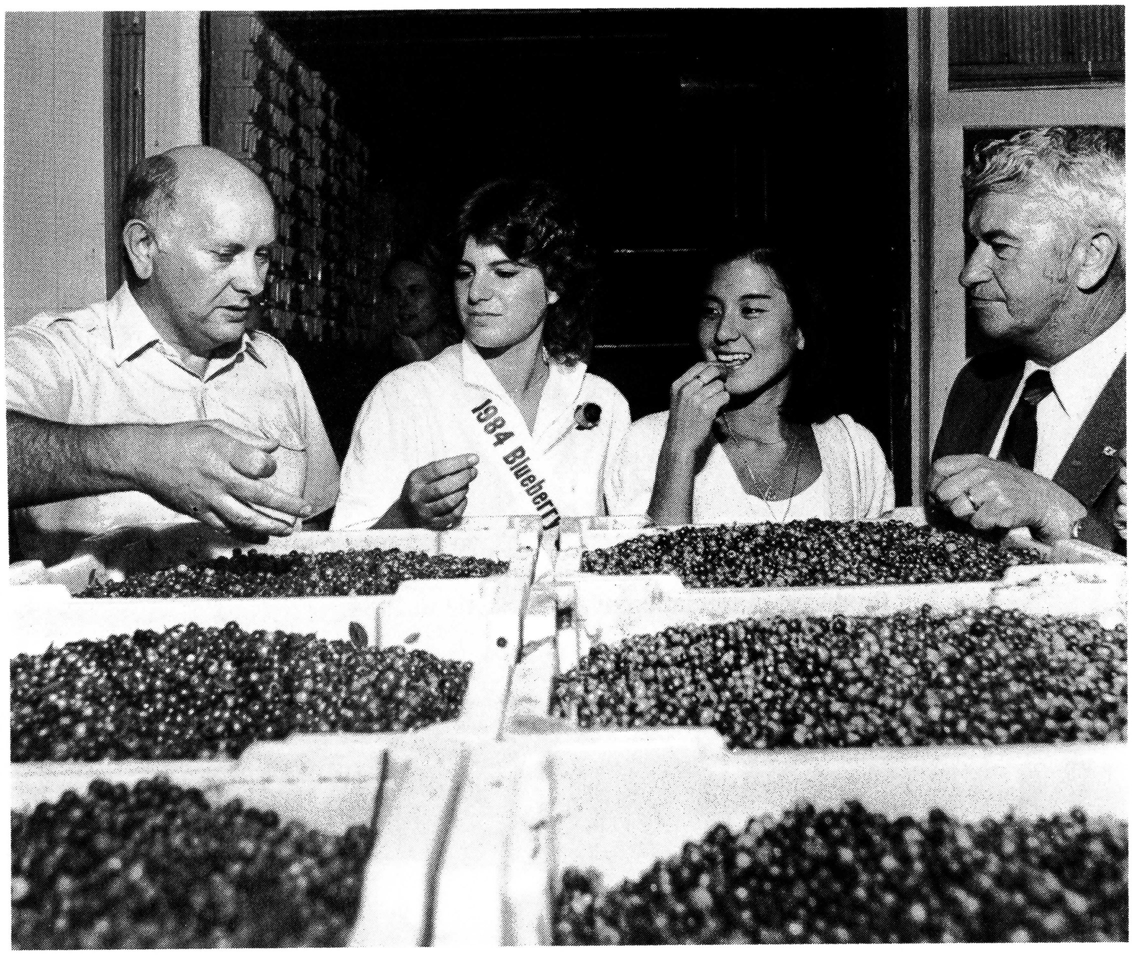
Promoting Nova Scotia Wild Blueberries on World Markets.
Anuga Trade Fair, Cologne. 1981
L. To R: Rainer Will (Georg Boden & Co., Hamburg), Gordon Kinsman & Peter Rideout (NSDAM).

Walter Burns, Agriculture Canada and David Dickinson at an A.R.D.A. conference on the Blueberry Industry held in Truro in 1967.

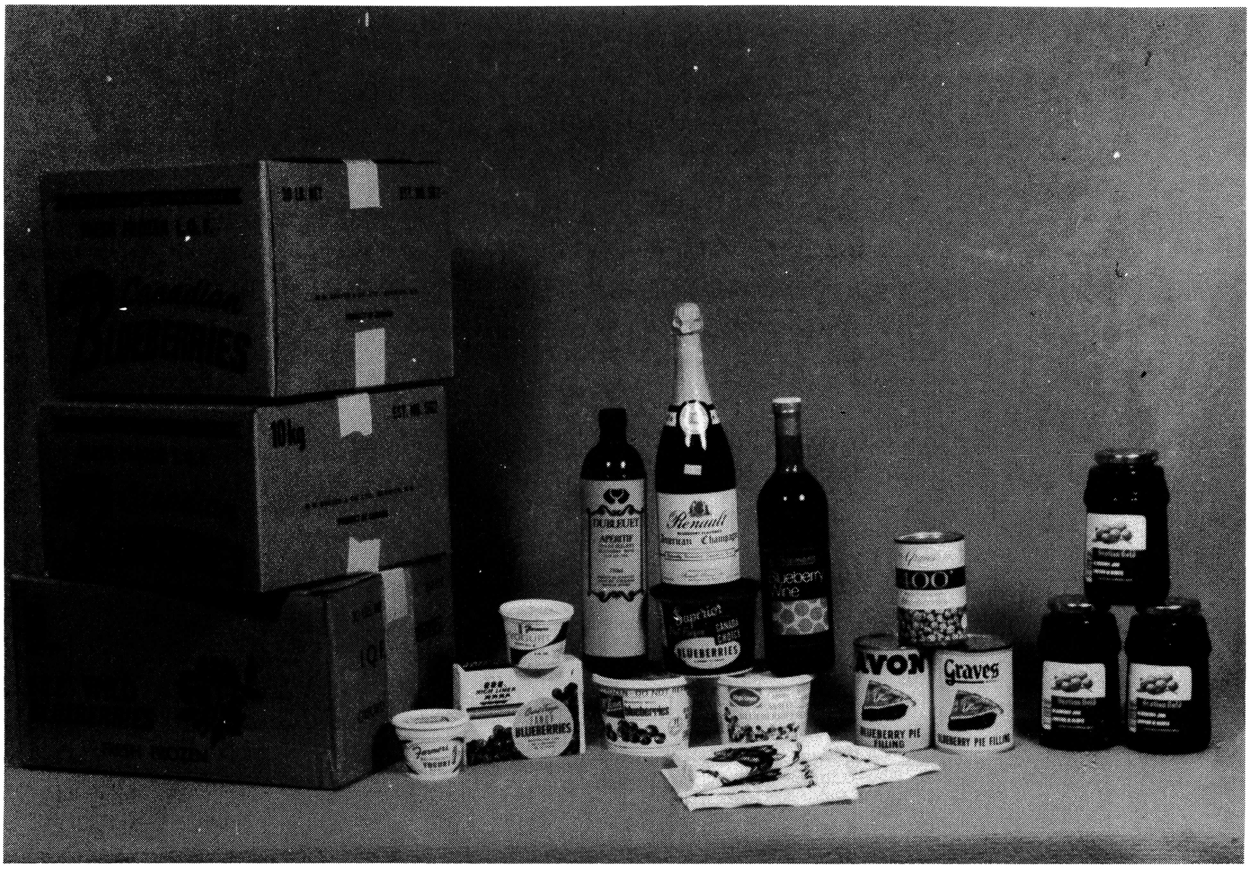
Roy Hoeg, Chelsey Walsh, Sr., and John Bragg at an A.R.D.A. conference on the Blueberry Industry held in Truro in 1967.

Display at "The Blueberry Patch", an information booth established at the N.S. and N.B. border by the Blueberry Producers Association of Nova Scotia in 1984.

Shipment of 1000th blueberry container from Nova Scotia.



Blueberry Harvest Festival Queen, 1984, visiting processing facilities of Oxford Frozen Foods.

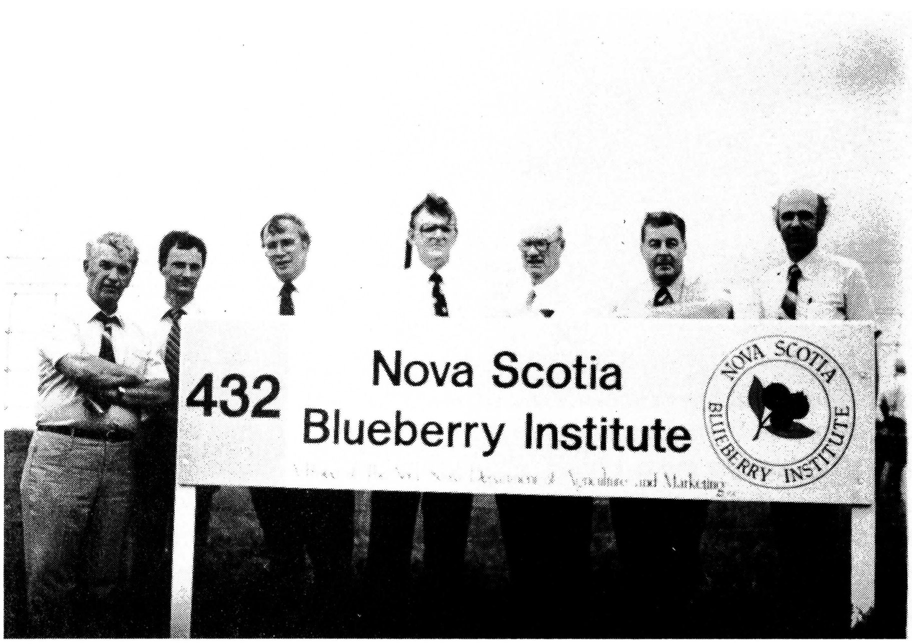


A range of blueberry products.

Chris Gaklis, one of the first processors and exporters of Nova Scotia blueberries.

Oxford Frozen Foods processing plant built in 1968.

Field Station of the Nova Scotia Blueberry Institute, Debert, Nova Scotia.



Participants in the opening ceremonies of the Nova Scotia Blueberry Institute, 1983. L to R: Hon. Roger Bacon, N.S. Minister of Agriculture; Dave Sangster, Director of Horticulture and Biology, NSDAM; Walter Grant, Deputy Minister, N.S.D.A.M.; Carvell Stonehouse, President of the Blueberry Producers Association of Nova Scotia; Ernie Lunn, Manager of the Debert Industrial Park; Charlie Embree, former Director of Horticulture and Biology, N.S.D.A.M.

Blueberry select clones in field trials.

Chapter 18

RESEARCH

18.1 The Tower Hill Field Station

The Tower Hill Blueberry Sub-station was established by Agriculture Canada as a sub-station of the Experimental Farm at Fredericton, N.B., at Central Tower Hill, Charlotte County, N.B., in 1949 to investigate problems peculiar to the culture of the lowbush blueberry. It was located in an area largely devoted to this native crop and it was designed not only to serve the growers in Charlotte County, but all other areas in the Maritime provinces where blueberries are grown commercially. The property consisted of 50 acres of blueberry land, together with a residence and suitable buildings.

Directing the work was a six-man research committee composed of research officers from the Botany and Plant Pathology Division, Science Service, Kentville; the Entomology Division, Science Service, Fredericton; the New Brunswick Department of Agriculture; and the Experimental Stations at Kentville, Charlottetown and Fredericton. An advisory board to this research committee was made up of growers and other research officers and met on call to discuss general problems related to blueberry culture. Administration was centered at the Experimental Station, Fredericton, N.B.

All buildings were updated in the first four years. A barn was converted into two rooms, one for laboratory and the other for general storage. From 1949 to 1953, many general improvements in the facilities were made, including an analytical laboratory for tissue analysis, a farm pond, a carpenter shop, a small plastic greenhouse, as well as other improvements to buildings and grounds.

Making a soil survey and a farm plan were among the first undertakings. The Fruit Insect Section of the Science Service, Fredericton, had moved its local Field Laboratory and staff to the Sub-station. The Plant Pathology Laboratory, Science Service, Kentville had its own research officers conducting projects at and from the Sub-station. Close liaison had thus been established between the Experimental Farms Service and Science Service, and with the various unit of the provincial Department of Agriculture.

Staff from the Kentville Experimental Station were assigned as personnel. Personnel as of December 1953 included E. L. Eaton, Senior Horticulturist (Native Fruits), and J. F. Hockey, Officer-in-Charge, Plant Pathology Laboratory. E. Eaton was chairman of the six-man Research Committee. The Advisory Board consisted of the Research Committee plus staff from the Experimental Farm Service and Science Service. I. V. Hall, Assistant Botanist, and C. L. Lockhart, Assistant Pathologist, staff members from Kentville, were appointed as representatives to the 12 member Advisory Board.

Close association was started with other blueberry research and extension workers. Annual work conferences brought together practically all of the blueberry research and extension workers on the northeastern seaboard of North America. These have provided frequent opportunities to evaluate the research and extension programs at the University of Maine and various Canadian institutions. The total numbers of research and extension workers up to 1959 would be approximately 12. [96]

The Dominion Blueberry Sub-station, Tower Hill, N.B., was closed in 1965.

18.2 The Kentville Research Station

The Kentville Agriculture Canada lowbush blueberry researchers were originally assigned to do their work at Tower Hill, N.B., but distance from Kentville and family obligations precluded it. Local research sites were established at Steam Mill near Kentville, N.S.

The lowbush blueberry industry was fortunate that, in most cases, the researchers were young, enthusiastic, well trained, and they had a great interest in this industry. Most of them spent the greater part of their working life working for the blueberry industry.

Ivan Hall joined Agriculture Canada in Kentville in 1949. He had a great interest in studying the blueberry plant and its ecology. He was responsible for many profitable changes in this industry. He studied plant populations in blueberries, pollination and fruit set, physiology of the blueberry plant, and cultural management. He retired in 1987.

Chesley Lockhart joined the Kentville Agriculture Canada station in 1950 as a plant pathologist. He spent many years studying blueberry disease.

Lewis E. Aalders joined the Kentville Agriculture Canada Research Station in 1953. His contributions in the area of genetic research were very valuable to the lowbush blueberry industry. He and Hall worked closely together, particularly in the area of genetics and plant improvement. He resigned from Agriculture Canada in 1982.

Lloyd Townsend, Chemist, joined the Agriculture Canada Kentville Research Station in 1944 and he retired in 1979. He worked with Hall on fertility nutrition of lowbush blueberries.

Tibor Fuleki joined the Kentville Research Station in 1961. He worked in the food technology section. He became interested in the immense resource of wild blueberries. He developed a process of juice extraction, amelioration, and fermentation using a selected strain of Burgundy yeast, which produced a wine with high quality and industrial potential. The wine was inevitably popular and interested commercial enterprises in Truro, N.S., and Moncton, N.B. [45] The latter company (Chateau-Gai) eventually adopted the product but unfortunately only for a limited period since it gave way to the more traditional, high volume "vin ordinaires". The juice extraction methods he developed to optimize yields resurfaced 20 years later to form the base for aspects of research by the Station group into uses for a contemporary surplus of blueberries. He left the Station from September 1963 to the fall of 1966 to study for his PhD degree. He resigned in 1967 to assume a position with the International Atomic Energy Commission in Vienna.

Roger Blatt joined the Kentville Agriculture Canada Research Station in 1964 as a chemist. In 1972 he transferred to the Berry Crops Section and became involved in studies relating to the management and nutrition of genetically selected lowbush blueberry plants.

In 1975, Klaus I. N. Jensen joined the Research Station to work on herbicides. He has studied the fate and behaviour of herbicides in plants and soils. He has developed a number of weed control programs for lowbush blueberries.

Lloyd Jackson, Nappan Experimental Farm research officer, retired in 1979; however, he worked for the blueberry industry for the last 10 years of his career. He and others at the Nappan and Kentville Research Station helped assemble the pieces to find an effective, low-cost way to remove the competing weeds from blueberry fields. The idea of his involvement in herbicide testing originated at the Kentville Research Station. Mr. Jackson's location at Nappan gave him close proximity between the field workers and the blueberry growers in Cumberland County. These men found, after years of testing, about six materials which effectively reduced the weed population without harming the blueberry plant. One of their finds was that Velpar herbicide applied to blueberry stands decreased the weed competition and increased yields dramatically. Since herbicide use increased in the '70's, production has escalated dramatically.

Nancy Nickerson joined Agriculture Canada in 1977. Her research orientation is to plant pathology. For her doctoral thesis she studied the biology and taxonomy of the fungus-causing red leaf disease of blueberries. She developed a plant tissue culture propagation research facility for the Kentville Research Station, from which she had produced micropropagated select lowbush blueberry clones. She was the first to discover the requirements for propagating select clones in vitro.

George Wood, entomologist, Fredericton Research Station, was assigned to Tower Hill, N.B., to study blueberry insects. He was called on many times to identify new blueberry insect pests in Nova Scotia, to study their life cycles and to establish recommended pesticides for their control. He left Agriculture Canada in 1983 to be the executive director of the Wild Blueberry Association of North America. Willis Neilson, entomologist, worked on blueberry insects, mainly in N.B., and he was transferred to the Kentville Research Station in 1965 to work on other entomological problems. After George Wood retired, Neilson again began working on blueberry insects.

Hugh P. Bell, formerly head of the Botany Department, Dalhousie University, Halifax, N.S., on his retirement joined the Nova Scotia Research Foundation in the '40's. By 1957, he and his associates had published six research papers on the botany of the lowbush blueberry. He and Hall collaborated on research related to the morphology and anatomy of ericaceous plants, especially Vaccinium species, which includes the blueberry.

18.3 Select Clones

Many growers suggested that superior clones be developed combining high yielding characteristics with prolific rhizome growth for rapid spread. The Agriculture Canada Research Station, Kentville, began a breeding program in the 1960's to fully exploit the genetic potential of this crop. The program was based initially on approximately 1000 clones selected from commercial fields throughout Quebec and the Atlantic provinces. Fruit yields up to 11.4 tons per acre were obtained in biennial harvests of experimental plots.

By 1967, select clones were planted in pilot commercial plantings on farms in six locations in Nova Scotia — Upper Nappan, West Brook and Westchester Station, Cumberland County; Dean, Halifax County; Aylesford, Kings County; Digby; and East Mines, Colchester County; besides the Agriculture Canada Sub-station, Sheffield, Kings County. A total of 1100 plots had been planted by 1967.

The first seedling populations were grown from open-pollinated fruits from 16 good, select clones in the transplant fields. Twelve selections were made in 1969. Three clones were selected and were named Augusta (1975), Brunswick (1977) and Chignecto (1977).

While this work suggested the prospect of a ten to twenty-fold increase in fruit yield, additional problems existed. Rooted cuttings were expensive to produce and about 10,000 were required to plant an acre. When they were set in a field, frost heaving caused a large mortality the first year. Heavy mortality did not always occur, but it often caused severe losses. Three selected cultivars were planted in 1981 in Quebec, Nova Scotia, New Brunswick, Prince Edward Island and Maine. [2]

Well cultivated land and free from weeds was essential before attempting to establish a planting. A good mulch is important for at least the first winter to prevent plants heaving. Careful cultivation, it was found, was necessary for the first year and for three growing seasons until the plants become established and begin to spread. Plants planted three feet by two feet, under good management and the right soil conditions, give a satisfactory row five years after planting. Yields were encouraging. Based on a plant spacing of 7250 plants per acre, yields of 1000 pounds per acre were received in the second year after planting and 4000 pounds in the third season after planting. In co-operation with Henry Knol, Jr., Oxford, Nova Scotia, a project was initiated in 1970 to test a commercial program for propagation of selected clone cuttings.

Nova Scotia Department of Agriculture and Marketing supplied materials for a mist line and bottom heating cables. Cuttings were supplied by Agriculture Canada through Hall at Kentville, and Knol supplied the facilities and labour for the project.

On June 24, 1970, 17,000 cuttings were taken from the Agriculture Canada Sheffield Farm selected clone plots. These were transported in coolers to Oxford and were potted and put out in greenhouse beds and benches on June 25 and June 26. Several projects were combined in this first large scale commercial trial. Comparisons were made between bottom heat versus no heat; indoor and outdoor propagation; three inch and four inch pot sizes versus bed propagation; and other variable factors which could affect such a commercial operation. Mr. Knol kept accurate and detailed labour records and other costs involved.

Cuttings in the ground beds were potted during the week of September 20. Close to 100 per cent of these cuttings rooted and growth was very good. All plants were gradually hardened off by reducing the night temperature about 5^{0}F each week until below freezing temperatures were reached. The plants were placed outdoors under a mulch of sawdust for the winter. Mr. Knol had one and one-half acres of plants ready for planting in 1971.

The pilot commercial plantings, established in 1966 and 1967, were gradually phased out as experimental plots. A great deal of information was obtained from these plots.

During June 1975, 8,000 seedlings, supplied by the Kentville Research Station, were transported to River Philip, Cumberland County, in 3" peat pots and placed directly outdoors for the remainder of the growing season. An artificial soil mix commonly used in greenhouses replaced the standard 1:2:1 mixture of soil-peat-sand mix which the Kentville researchers had been using previously. The cultural research on the trial planting at River Philip involved testing several herbicides for continued weed control and obtaining yield data from several of the five year old plants set originally at this site in 1971. Results with several herbicides were very encouraging. It appeared that various combination treatments using the herbicides Amitrol, Simazine, Sinbar and Atrazine would ensure satisfactory weed control at reasonable cost. Yields taken from several of the best five year old plants indicated a production potential of two pounds of fruit per plant or 8,000 pounds per acre at the plant spacing used in this trial. This compares with average yield figures of about 2,000 pounds per acre on present good commercial fields.

In 1973 a transplanting project was established at Pigeon Hill, Cumberland County. The object was to determine the feasibility of transplanting "plugs" of blueberry plants from an established field into a potential blueberry field where no plants are present. Although this procedure had been tried before with only limited success there was renewed interest in it. A field at Windham Hill, Cumberland County, which was transplanted and after ten years of growth had a good stand of plants.

A five-year program was established in 1977 to evaluate the feasibility of large scale commercial plantings of select clone lowbush blueberries. Research was carried out on propagation, cultural systems and costs, relative to established wild stands, were evaluated. Ten acres were field planted in 1977. The project objective was to establish 30 additional acres of 10 acre plantings in years two, three and four of the project. Eight acres were actually planted in 1978 and seven acres in 1979 for a total of 25 acres — five short of the original estimated acreage. Plantings were at Pigeon Hill and Valley Road in Cumberland County and Scotsburn in Pictou County.

In May 1979 a series of counts was done to determine the amount of winter survival of select clone plantings set out in 1978 at Scotsburn, Pictou County, Valley Road (near Springhill), and Pigeon Hill, both in Cumberland County. It was discovered that plants not protected by mulches or heavy weed cover suffered high losses, especially due to winter frost heaving.

This prompted the establishment of a select clone planting in 1979 at Scotsburn to compare mulches (sawdust, wood chips and straw) against no mulch. Seedlings and rooted cuttings were planted at 1.5 feet spacing in a Westbrook sandy loam soil in 1979 and 1980.

A mulching project (using sawdust, straw and wood chips) was established in the fall of 1979 and repeated in 1980 on these cuttings. All three mulches significantly reduced winter heaving compared to control plots. As the project was put out, it was expanded to compare plants with paper pots to those with paper pots removed, and those in styrofoam trays to those grown for one year in outdoor beds.

Counts in late August 1979 indicated that there was a fairly high rate of mortality during the summer, particularly in the younger plants, which were only six months old and had poorly developed roots.

It was recommended that any planting of select clones use mulches, especially during the first two years after planting.

18.4 Planning and Priorities

A series of meetings was held in 1979 to prepare a Report of the Berry Crop Planning and Priorities Committees for the Eastern Region. Provincial blueberry specialists were invited from Nova Scotia, New Brunswick and Quebec.

Berry crops (strawberries, raspberries, blueberries, etc.) produce the largest dollar net return (per unit land area) of all the local crops grown outdoors. Because of the high labour component in berry crop production, it seems safe to assume that at least 70 per cent of all monies generated by a berry crop would initially be retained in the region.

The lowbush blueberry is an indigenous crop of the region. It is a crop which is well suited for the export trade and excellent markets are open in Europe and Japan as well as in North America. Blueberry growers are well organized and processing and shipping facilities are adequate. It is the best horticultural crop earner of foreign dollars.

The crops were grouped in three levels of research staff priority — one being lowbush blueberry and strawberry; two being red raspberry and cranberry; and three being highbush blueberry, grape, lingonberry and black currant. Research priorities were established, presented and documented for each crop priority. Based on these research priorities, the current Agriculture Canada staff allocation was found to be inadequate and recommendations regarding staffing increases were made. The first was research in fruit breeding which recommended an increase from 1.0 person years to 2.0 person years. Priorities in entomological research also required the addition of 1.0 person years to berry crop research. It was further suggested that weed control research be strengthened by 0.4 person years and engineering research by 0.7 person years.[13]

There were approximately 50 acres of select clones established in Nova Scotia in 1980 with an additional 150 acres in Ontario. The high cost of the plants, the limited supply, and the intensive care needed during the first couple of years reduced the total acreage planted and the interest in this crop in Nova Scotia.

In 1983, field studies by the Berry Crops and Food Processing sections, Kentville, N.S., showed the feasibility of harvesting lowbush blueberries mechanically.

18.5 The Nova Scotia Blueberry Institute

The idea for the Nova Scotia Blueberry Institute was conceived and first proposed by Carvell Stonehouse, the first Manager of the Blueberry Producers Association of Nova Scotia. He envisioned it as a co-operative body to allow for closer co-operation and consultation between the producers and government. There would also be a physical facility to encourage and assist research in the blueberry industry, as well as provide a demonstration site for industry technology. Carvell worked closely with Charles Embree and then Dave Sangster, Directors of Horticulture and Biology Services, Nova Scotia Department of Agriculture and Marketing, to make this concept a reality.

A project of the Nova Scotia Blueberry Institute was to establish a collection of all blueberry publications, reports and papers. This project was headed up by Ivan Hall, Kentville, and Leonard Eaton, Truro, and the material is kept in the Nova Scotia Agricultural College Library. Since Hall's retirement, this work has been carried on by Eaton.

The Nova Scotia Blueberry Institute (NSBI) was officially opened on August 6, 1983. The Institute was comprised of three representatives from the Blueberry Producers Association of Nova Scotia, three from the Nova Scotia Department of Agriculture and Marketing, and two each from the Nova Scotia Agricultural College and Agriculture Canada. The functions of the Institute were stated as follows: to act as a co-ordinating body for investigative research, to provide assistance to the blueberry industry through demonstrations and educational programs, and to provide field sites for plot research and demonstrations. A block of land (about 17 acres) in the Debert Industrial Park, Colchester County, was deeded to the Nova Scotia Department of Agriculture and Marketing for use in research and demonstration projects of the Blueberry Institute. This area was initially covered with tree growth but showed a solid mat of blueberry vine under the tree cover. A total of 13 acres was subsequently cleared for producing blueberry acreage.

Gary Brown, Berry Crops Technician with the Horticulture and Biology Branch, was appointed manager of the field operations at the Institute site. Activities of the Institute have included the following:

- participation in a number of off-site research projects, with personnel from both Agriculture Canada and the Nova Scotia Agricultural College;

- continuing work on a weed garden in co-operation with the Nova Scotia Agricultural College personnel;

- several co-operative nutrition projects with Dr. Leonard Eaton and Dr. Hal Ju of the Nova Scotia Agricultural College;

- a mowing versus burning research project with Agriculture Canada;

- a blight control research project with personnel from the Kentville Agricultural Centre; and

- ongoing projects to clean up the producing acreage on site and improve and modernize buildings and demonstration equipment.

In 1987 the NSBI carried out a number of different projects in co-operation with: Prof. Glen Sampson, Nova Scotia Agricultural College — weed research; Prof. Leonard Eaton, Nova Scotia Agricultural College soil nutrition; Prof. Hal Ju, Nova Scotia Agricultural College — soil nutrition; and Kevin Sibley of the Atlantic Farm Mechanization Institute for research on different straw spreaders for possible use in spreading straw on blueberry fields.

Gary Brown, Field Manager, resigned in April 1989. Andrew King, Berry Crops Technician with the Department of Agriculture and Marketing, was appointed Field Manager in August 1989. Jim Goit, Director of the Plant Industry Branch of the Department of Agriculture and Marketing, became Chairman of the Institute in 1990.

Work continued in 1989 on development of the field site and physical facilities of the Institute in Debert. Regular maintenance work at the Debert site involved weed, disease and insect control on producing acreage; building repair; maintenance of on-site research plots and demonstration areas; and harvesting 9,000 pounds of blueberries.

A number of research projects were assisted by providing grower contacts or assistance with plot work during the 1989 season. Most involved a co-operative effort between the researcher, extension personnel and the Nova Scotia Blueberry Institute. A few of the principal projects were:

1. a study of the effects of mulching on regeneration of blueberry plants in areas which have been disced and rolled for land levelling (Researcher: Dr. Leonard Eaton, NSAC);

2. a number of research trials to evaluate herbicides for use against bunchberry and spreading dogbane (Researchers: Glen Sampson, NSAC; John Thomson, NSDAM);

3. insect control studies (Researcher: Lorne Crozier, NSDAM);

4. a project to determine factors which contribute to higher yields on a number of lowbush blueberry fields (Researcher: Dr. Leonard Eaton, NSAC);

5. long-term nutrition studies (Researcher: Dr. Leonard Eaton, NSAC);

6. minor element nutrient studies (Researcher: Dr. Hal Ju, NSAC);

7. an evaluation of heavy machinery which can be used for rock and stump removal from established lowbush blueberry fields (Researchers: Agricultural Extension Engineering staff and Horticulture and Biology staff, NSDAM);

8. a continuation of the project at Rodney, Cumberland County, to evaluate and compare land levelling techniques (Researchers: Agricultural Extension Engineering staff, NSDAM, and Nova Scotia Blueberry Institute);
9. a study to assess the effects of land levelling and rolling on soil compaction in lowbush blueberry fields (Researcher: Delmar Holmstrom, Agriculture Canada);
10. minor element nutritional studies (Researcher: Dr. Hal Ju, NSAC); and
11. a study of the effects of mulching on regeneration of blueberry plants in areas which have been disced and rolled for land levelling (Researcher: Dr. Leonard Eaton, NSAC).

18.6 Federal New Crop Development Fund

This fund helped in selling wholesale price guarantees to co-ops under the Agricultural Products Co-operative Marketing Act.[1] This fund also supported product promotion under CAMDI, and the financing of a study which involved the development of the commercial propagation and cultural system for selected clonal plantings in Nova Scotia.[85]

18.7 External Affairs

This Department financed, through their PEMD program (1972-1975), matched industry money to finance export marketing programs for lowbush blueberries. Activities such as product promotion, intelligence and sales missions to foreign markets were elements of this program.

18.8 Agriculture Canada

Under their Marketing and Economics Branch Export Expansion Fund, they helped sponsor a European offshore mission of their staff to gather export lowbush blueberry market intelligence in the early 1970's.

[1]Commodity Markets, July 1985.

Chapter 19

GROWER ORGANIZATIONS

19.1 Nova Scotia Blueberry Growers' Assoc.

The Nova Scotia Department of Agriculture and Marketing recognized, when they started to do extension work on the lowbush blueberry industry, that one of their first objectives would be to encourage the establishment of a blueberry organization that was to be grower run, open to all blueberry producers in Nova Scotia, and served an educational role. The first lowbush blueberry growers organization was formed in Parrsboro, N.S., in October, 1954. The following were officers of the Nova Scotia Blueberry Growers' Association:

1954		
Officers	President	Karl Dickinson, West Brook, N.S.
	Vice President	Robert Pettigrew, Parrsboro, N.S.
	Sec./Treasurer	Elton Lewis, West Brook, N.S.
	Directors	Stanley Jackson, Steam Mill, N.S.
		Fred McQuire, Parrsboro, N.S.
		Chesley Walsh, Collingwood, N.S.
1955		
Officers	President	Robert Pettigrew, Parrsboro, N.S.
	Vice President	Ray Nix, Collingwood, N.S.
	Sec./Treasurer	Elton Lewis, West Brook, N.S.
	Directors	Fred McQuire, Parrsboro, N.S.
		Chesley Walsh, Collingwood, N.S.
		Gordon Maybee, Truro, N.S.
1956		
Officers	President	Ray Nix, Collingwood, N.S.
	Vice President	Walter Wells, Amherst, N.S.
	Sec./Treasurer	Elton Lewis, West Brook, N.S.

	Directors	Edwin Davidson, Halfway River, N.S.
		Karl Dickinson, West Brook, N.S.
		Maurice Crowley, West Brook, N.S.
1957		
Officers	President	Walter Wells, Amherst, N.S.

The Nova Scotia Blueberry Growers' Association operated in 1957 but discontinued in 1958.

The second blueberry growers organization was formed in the mid 1960's — the Cumberland County Blueberry Growers' Association (CCBGA). This organization did a lot of good work for the growers and the industry. T. P. Murray was President in 1967 and the CCBGA had 83 members. Maurice Crowley was President in 1968 and that year they had 133 members. The CCBGA ran into organizational problems in 1969 and in the spring of 1970 they couldn't get enough members to form a quorum so it folded. Records of this organization aren't available.

19.2 Blueberry Producers' Association of Nova Scotia (BPANS)

Efforts soon started in the spring of 1970 to form another blueberry grower organization. It was agreed that if a new organization was formed then the initiative must come from the growers and they must want a genuinely strong, well organized grower group.

A meeting was held at Nappan on May 13, 1970 to see if a new blueberry organization might be formed. About 15 growers attended plus representatives from the Nova Scotia Department of Agriculture and Marketing. The growers expressed strong interest in forming a new organization and they stressed they wanted to work closely with Nova Scotia Department of Agriculture and Marketing personnel.

A steering committee was formed at this meeting to develop a set of by-laws. Nova Scotia Department of Agriculture and Marketing advisors to this committee were Jack Sibley, Harold Higgins and Paul Grimm. The steering committee met five times, and on October 5, 1970 they met with the original grower group who started the move to re-organize the blueberry growers. Those present were Hedley Stewart, Murray Rushton, Clayton Rushton, Ken Matheson, Paul Grimm, John Bragg, Harold Higgins, David Dickinson, Ken Canning, Jack Sibley and Harold Quinn.

At the October 5 meeting, Jack Sibley presented a summary of the Steering Committee's activities and a sheet outlining the proposed by-laws for the new organization. A proposed set of by-laws was accepted and it was decided that a general growers meeting would be held to form a new blueberry association. It was also agreed that other areas of the province would be visited including Hants, Pictou, Colchester, Halifax and Cumberland counties to see if interested blueberry growers would take an active part in the new association.

A meeting was held on November 17, 1970 at Leamington, Cumberland County, and the Blueberry Producers' Association of Nova Scotia (BPANS) was formed with Tom Murray as its President.

Any blueberry producer in Nova Scotia is eligible for membership in BPANS. The objectives of the Association, as outlined in their by-laws, are to:

- promote and encourage blueberry production, blueberry consumption and research affecting blueberry producers;

- help provide the producers with an adequate return to management, labour and capital, and to disseminate information on the production and marketing of blueberries;

- acquire by way of grants, gift, purchase, bequest, device, or otherwise, real or personal property and to use and apply such property to the realization of the objectives of the Association; and

- buy, own, hold lease, mortgage, sell and convey such real and personal property as may be necessary or desirable in the carrying out of the objectives of the Association.

List of Presidents of BPANS 1970–1990

1970	Tom Murray, Lakelands, Cumberland County
1971	Clayton Graham, Wharton, Cumberland County
1972	Clayton Graham, Wharton, Cumberland County
1973	Gary Chapman, Windham, Cumberland County
1974	Gary Chapman, Windham, Cumberland County
1975	Ancil Mills, Southampton, Cumberland County
1976	Ancil Mills, Southampton, Cumberland County
1977	David Dickinson, West Brook, Cumberland County
1978	David Dickinson, West Brook, Cumberland County
1979	Gordon MacMillan, New Minas, Kings County
1980	Gordon MacMillan, New Minas, Kings County
1981	Carvell Stonehouse, Truro, Colchester County
1982	Carvell Stonehouse, Truro, Colchester County
1983	Aubrey Atkinson, Truemanville, Cumberland County
1984	Charles Harrison, Halfway River, Cumberland County
1985	Casey van Dyk, Caledonia, Queens County
1986	Casey van Dyk, Caledonia, Queens County
1987	Ronald Weatherhead, Upper Rawdon, Hants County
1988	Ronald Weatherhead, Upper Rawdon, Hants County
1989	Gary Chapman, Windham, Cumberland County
1990	Gary Chapman, Windham, Cumberland County

Executive Directors of BPANS 1983–1990

1983 – 1984	Carvell Stonehouse
1984 – 1987	Aubrey Atkinson
1987 – present	Raylene Nash

BPANS has been very active in supplying information to their members through newsletters and by extension meetings. They have done a good job in promoting blueberries and obtaining support for specific research or demonstration projects. The Association has been very active in working with the provincial and federal governments on programs, research, extension, new ERDA agreements and keeping the lines of communication open. They work closely with Jack Sibley, Blueberry Specialist, and other Nova Scotia Department of Agriculture and Marketing berry research and extension workers.

A cross-section of some of their programs in the past 20 years are as follows:

- annual meetings are held with Agriculture Canada research workers to discuss programs and projects. This has proven a good way to foster better communications and understanding between researchers and growers;
- seven to nine area extension meetings per year are held in co-operation with Nova Scotia Department of Agriculture and Marketing;
- support for the upgrading of roads necessary for spring and harvest work seasons;
- establishing a research and development committee to co-ordinate BPANS efforts as it works with governments on research and development projects. This committee also took part in working on the Agricultural Development Agreement I and II as it applied to lowbush blueberry production;
- set up a joint agreement with the Nova Scotia Fruit Growers Association to purchase 60 refrigerated containers. In 1983 they set up a new committee, Bluecon, to manage the 30 reefer containers when they took over half the containers and assets from the Nova Scotia Fruit Growers Association;
- BPANS was the prime mover in setting up the Blueberry Institute, Debert, N.S., which opened in 1983;
- a BPANS director is on the Nova Scotia Voluntary Planning Board;
- BPANS annual field day, which may attract up to 200 growers, extension workers and researchers from the Maritime provinces as well as the state of Maine;
- prepared briefs and submissions to government and other groups concerning their industry's problems; and
- have worked with the Cumberland School Board regarding school openings in the county and the availability of school children regarding the blueberry harvest.

The activity of the Nova Scotia Department of Agriculture and Marketing, working with BPANS, varies somewhat each year; however, the areas listed below show a cross-section of what some of the activities are:

- operation of the "Blueberry Patch" kiosk at the Nova Scotia/New Brunswick border;
- participation in many food shows, in-store promotions held throughout Nova Scotia, and the ApEx show for the hospitality industry which has been held in some years in Moncton, N.B. The purpose of these activities is to increase blueberry consumption;
- a coupon campaign with school home economists regarding use of Nova Scotia blueberries;
- development and printing of various promotion materials including brochures for The Blueberry Patch, Blue Magic cookbooks, Out of the Blue posters, recipe cards;
- supplying promotional materials at several blueberry festivals throughout Nova Scotia;
- representation at various Families Feeding Families programs throughout Nova Scotia;

- operation of the Blueberry Institute; and
- semi-annual and annual BPANS meetings. Attendance ranges from 100 to 140 per meeting.

The Amherst and District Planning Commission, at the request of BPANS, initiated a pilot project in 1978 to map in detail all the blueberry fields in Cumberland County. These maps are of use for BPANS, extension and research workers. BPANS and Nova Scotia Department of Agriculture and Marketing staff co-operated with the Planning Commission in this project. This work was completed in 1979.

19.3 Market Study

BPANS contracted in 1985 with Price Waterhouse management consultants to develop an Industry Strategy for Nova Scotia Grown Wild Blueberries. The study was completed in March 1986. The study recommended that BPANS undertake the following activities:

1. Freezing Capacity — That a Maritime Blueberry Co-operative be formed that is made up of interested growers primarily in Nova Scotia and New Brunswick. They might look at available fishery freezing plants that are idle.

2. Industry Associations — The various blueberry associations continue to exercise their mandates and co-operate in the development of the lowbush blueberry industry. These associations should take a leadership role in stimulating technological and marketing research locally and in central Canada.

3. Promotional Activities — BPANS should conduct a promotional campaign.

4. General — Production and Marketing — Five production and marketing issues needed to be addressed by BPANS. [24]

19.4 Blueberry Festival

The first annual blueberry harvest festival was held in Amherst for three days in September 1972. The festival was unique in that it promoted an industry which, although worth hundreds of thousands of dollars to the province, had received little public notice.

The Blueberry Producers' Association of Nova Scotia, the Amherst Chamber of Commerce, and other organizations co-operated in the six months of planning which went into the project. Activities centered around the Amherst Stadium, but other centres such as church halls were used. As part of the promotion "Mr. Blueberry", wearing a specially designed costume, was present at every event before and during the three-day affair.

Feature events in the program included the Don Messer show; the selection of a queen; pancake breakfasts; home-made supers; baseball tournaments; pie-eating contests; horseshoe pitching championships; golf tournaments; six-mile road race; street parade, old time fiddlers' championship; harvest ball and a teen dance.

The event received the financial support of most municipal units in the county, as well as the support of the Nova Scotia government as a means of extending the provincial tourist season.

The Blueberry Festival has been held ever since and events now occur at various points throughout Cumberland County. As part of the festival, the Blueberry Producers' Association of Nova Scotia usually sponsor a display booth, a float in the parade and a blueberry raking contest. The original three-day event has been extended to cover over a week of activities and by 1989 it was 10 days long.

The festival has been successful in focusing public attention on the importance of the blueberry industry to Nova Scotia.

19.5 Crop Insurance

Nova Scotia has the distinction of having the first and only Crop Insurance Program for lowbush blueberries in Canada. In the fall of 1972, the Blueberry Producers' Association of Nova Scotia requested that the Nova Scotia Crop Insurance Commission [1] develop a crop insurance plan in co-operation with a committee of growers comprised of Clayton Graham, John Bragg and David Dickinson. Jack Sibley, Blueberry Specialist, Nova Scotia Department of Agriculture and Marketing, was added to this committee.

The blueberry growers well remembered the 1968 crop year when spring frost reduced the crop significantly and they were anxious to have a crop insurance plan in place for the 1973 crop year. In March 1973 the Crop Insurance Commission implemented a crop insurance plan for lowbush blueberries [2] with the co-operation of the federal Crop Insurance staff, who agreed to cost-share the program on the understanding that it be recognized as an experimental program until there was more experience with regard to production records and the risks involved.

Over the years the Commission and the Blueberry Producers' Association of Nova Scotia worked together to make improvements to the plan in order to provide as much protection as possible to the growers.

The features of the crop insurance plans are many. The designated perils include wind, frost, drought, disease, excessive moisture, hail, insect infestation, wildlife and winter kill. As for type of insurance, each insured crop is guaranteed a specific yield based upon the past yield records of each insured. When an insured has no past production records available, a benchmark is used, based on either provincial or industry averages. With regard to premium discounts and surcharges, the base premium rate for all crop insurance plans, with the exception of forage, is adjusted by giving a discount when indemnities paid are less than the premium paid or by adding a surcharge when indemnities paid exceed the premium.

Table 19.1: Summary of the Lowbush Blueberry Crop Insurance Plans (1973 – 1990)

No. Years	No. Claims	Total Premium	Claims Paid	Loss Ratio
18	230	$561,072	$213,610	$0.38

[1] Name changed in 1978 to Nova Scotia Crop and Livestock Insurance Commission

[2] The plan was amended in 1989 to include highbush blueberries. The plan is presently named the Crop Insurance Plan for Blueberries.

Approximately 125 to 150 growers per year take out crop insurance on approximately 4000 to 5000 picking acreage.

19.6 Canadian Horticultural Council (CHC)

A blueberry committee of the Canadian Horticultural Council was formed in March 1980 and had representation from all blueberry-producing areas in Canada. BPANS President Gordon MacMillan represented the organization at the first meetings and has continued to represent BPANS each year at the CHC meetings. BPANS agreed in 1982 to join the Canadian Horticultural Council and be represented at their annual meetings.

19.7 North America Blueberry Council (NABC)

BPANS members have attended many of the annual meetings of the North American Blueberry Council. BPANS joined this organization in 1974.

19.8 Wild Blueberry Assoc. of North America (WBANA)

BPANS has been a member of WBANA since it was formed in 1981. Some of its members have held various positions in this organization. John Bragg, Oxford, was President of WBANA.

19.9 Recognition Book

In 1980 BPANS proposed to establish a Recognition Book containing biographies of persons who, in the opinion of the organization, have made an outstanding contribution to the development of Nova Scotia's lowbush blueberry industry. Blanche Creelman undertook the job to secure the book and she, with some help, did most of the work for many years in getting the photographs and doing the write-ups of the persons BPANS recognized.

Persons recognized to 1990 were:

1. David Seymour Dickinson, West Brook, Cumberland County
2. Karl Laurence Dickinson, West Brook, Cumberland County
3. Clarence Charles Logan, Parrsboro, Cumberland County
4. Chesley Walsh, Collingwood, Cumberland County
5. William Black Wells, Amherst, Cumberland County
6. Gordon Barss Kinsman, Truro, Colchester County
7. Endel A. Karmo, Onslow, Colchester County
8. Carvell Lorenzo Stonehouse, Bible Hill, Colchester County
9. Kenneth Vere Canning, Parrsboro, Cumberland County

10. Fred Thomas Armstrong, Yarmouth, Yarmouth County
11. Campbell Mitchell McLean, Charlottetown, P.E.I.
12. Terrence Alexander Meister, Westchester, Cumberland County
13. John Thomas MacAulay, Bible Hill, Colchester County
14. Clayton Lorrison Graham, Wharton, Cumberland County
15. Roger Stuart Bacon, Upper Nappan, Cumberland County
16. Ivan Victor Hall, Kentville, Kings County
17. John Peter Thomson, Bible Hill, Colchester County

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Appendix A

A.1 NOVA SCOTIA CLIMATE INFORMATION

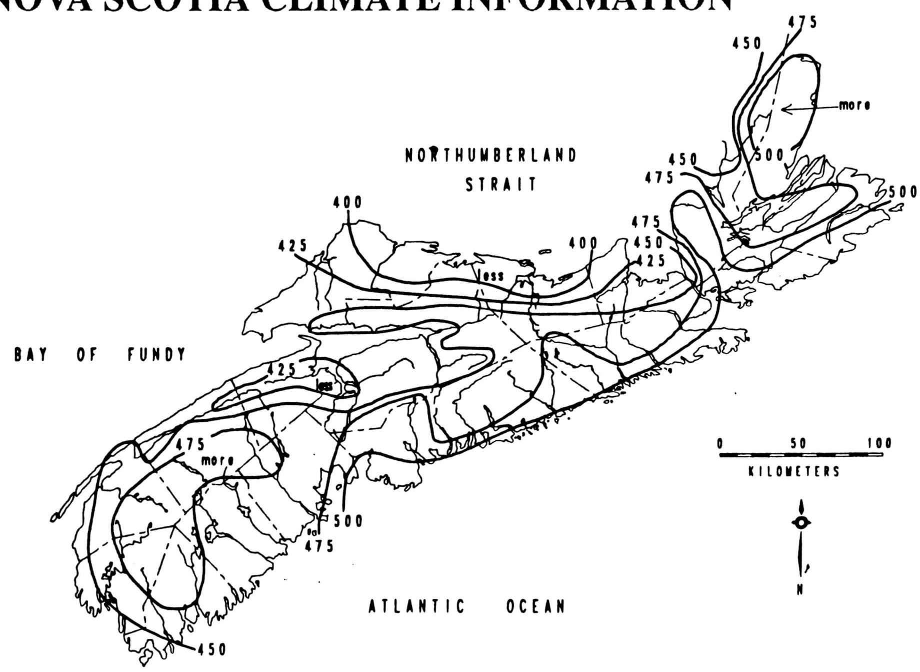


Figure A.1: May to September (inclusive) Total Precipitation (mm)

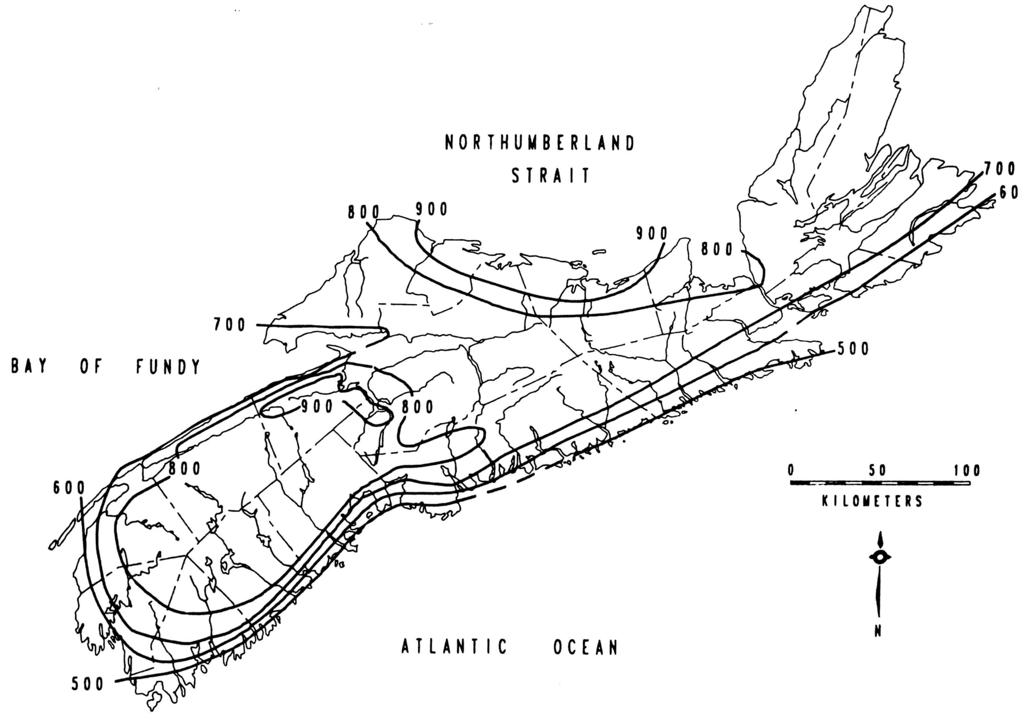


Figure A.2: May to September (inclusive) Total Degree days above 10^0C

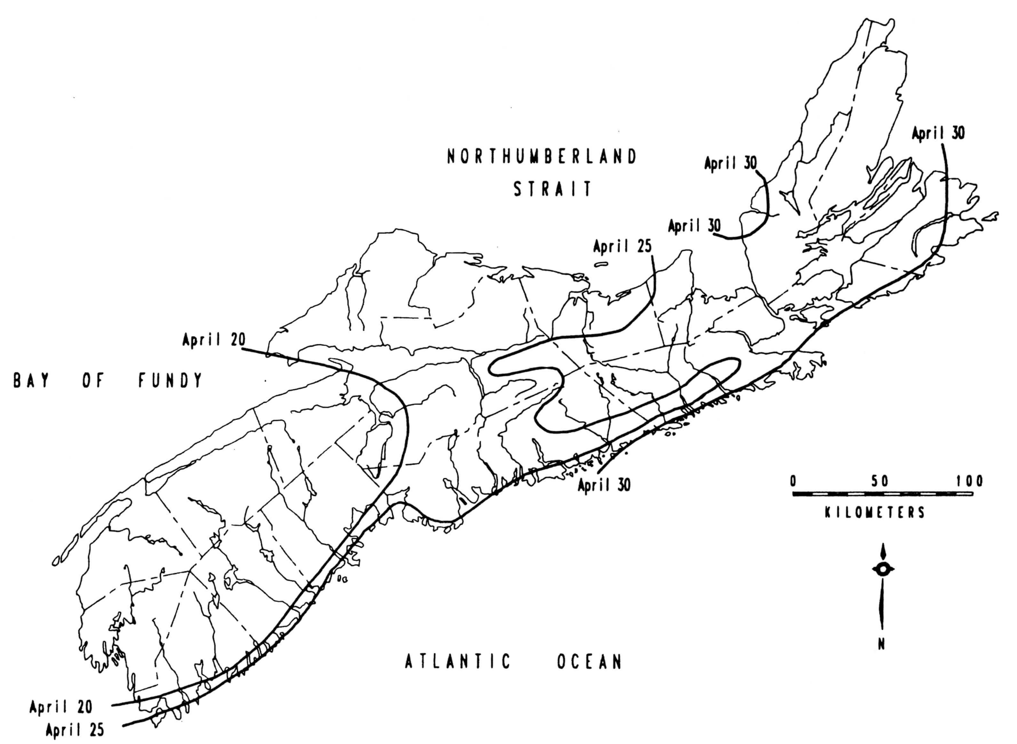


Figure A.3: Start of Growing Season

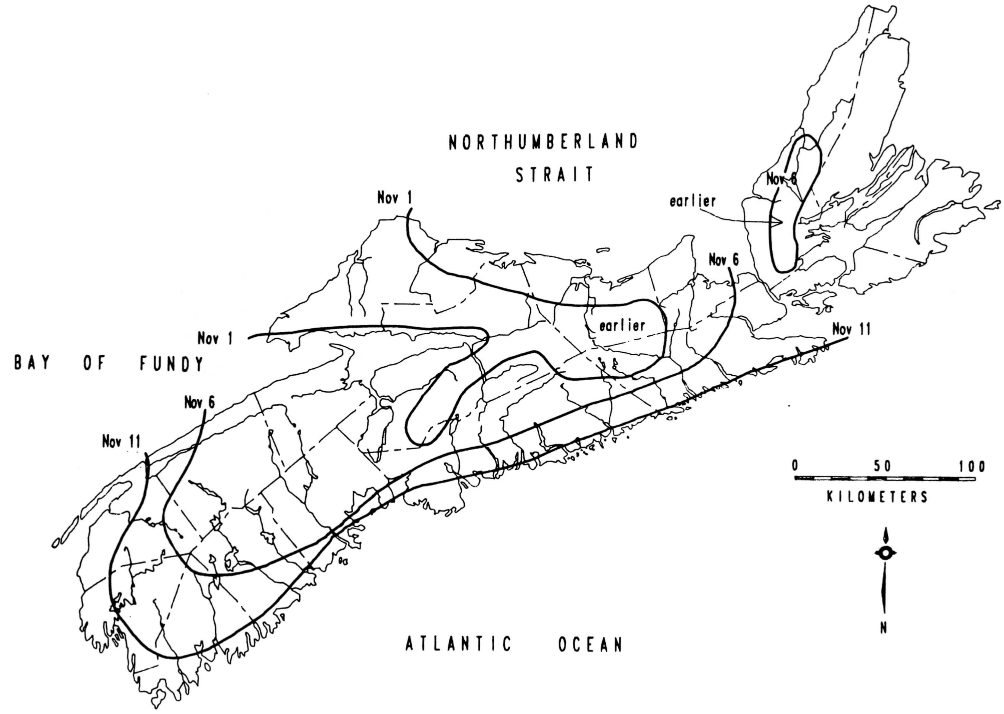


Figure A.4: End of Growing Season

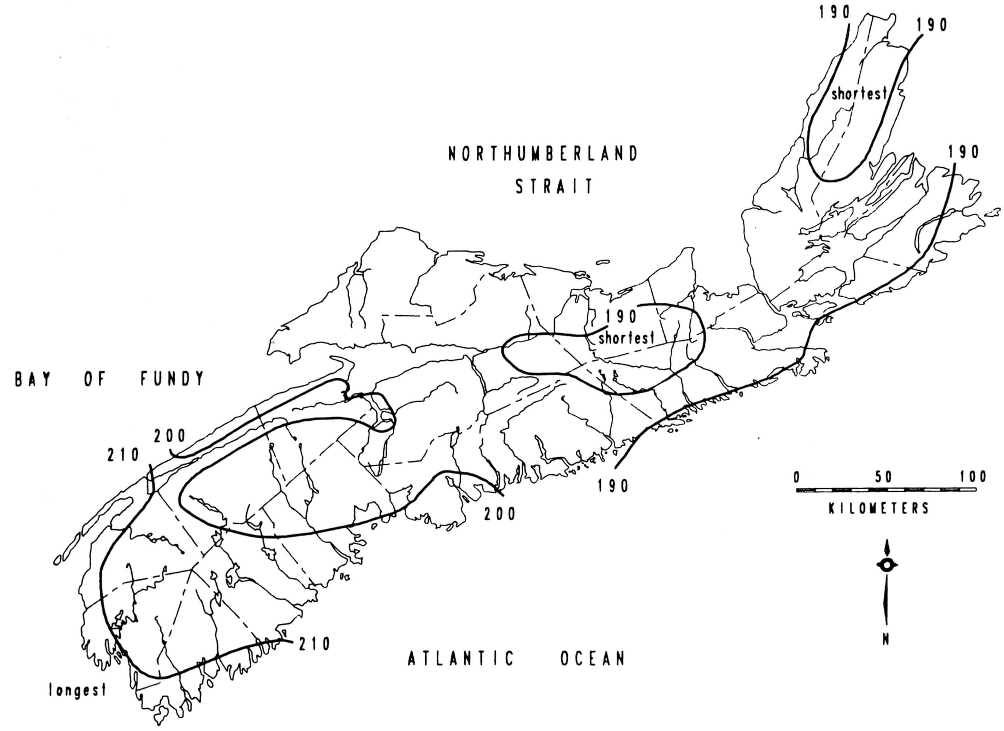


Figure A.5: Duration of Growing Season

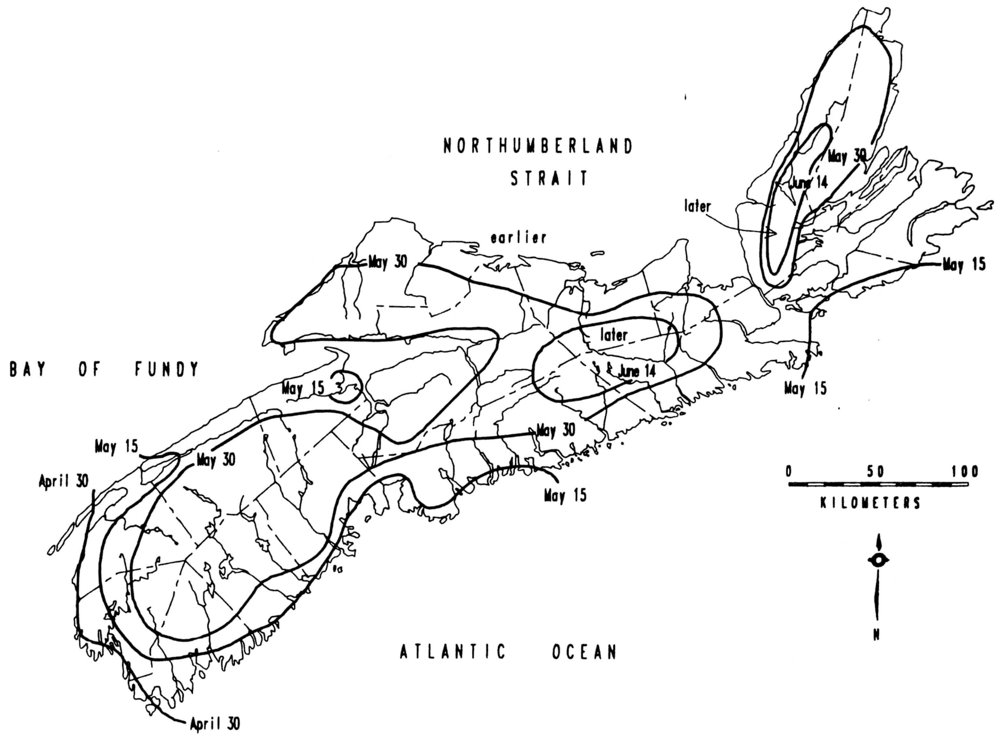


Figure A.6: Average Last Spring Frost Date

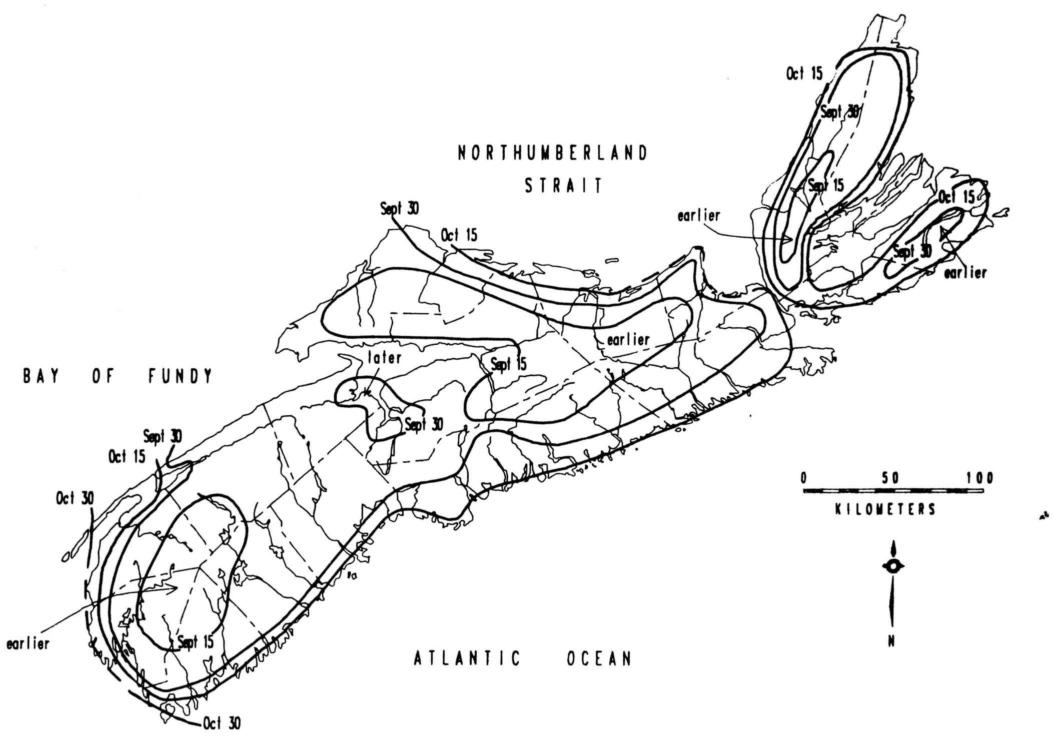


Figure A.7: Average First Fall Frost Date

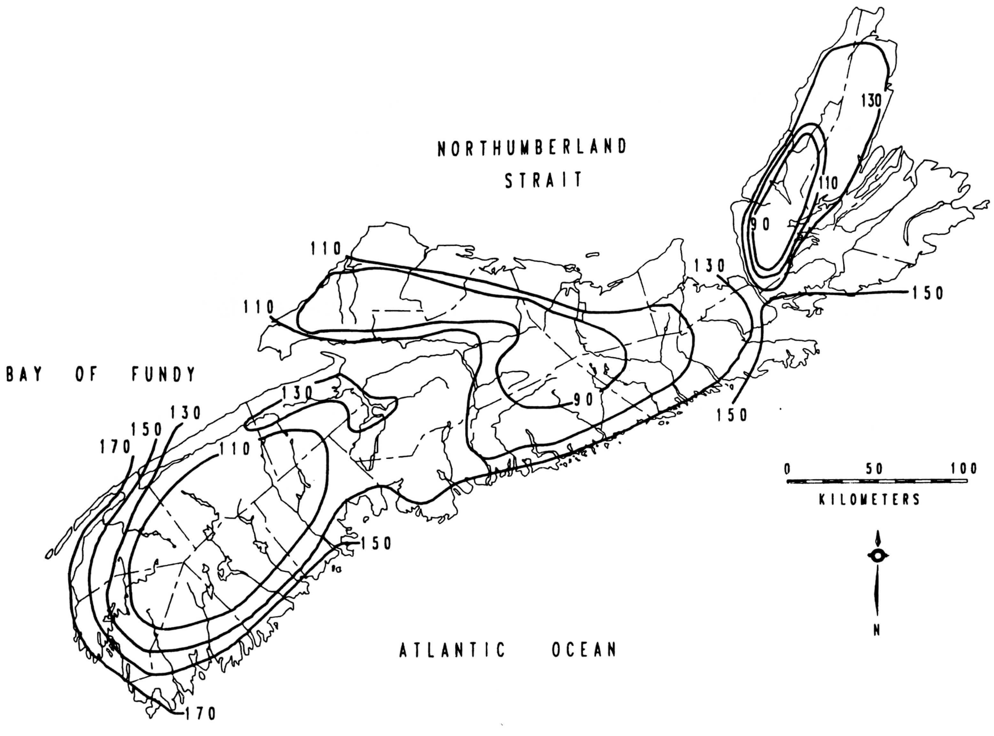


Figure A.8: Average Frost Free Period (days)

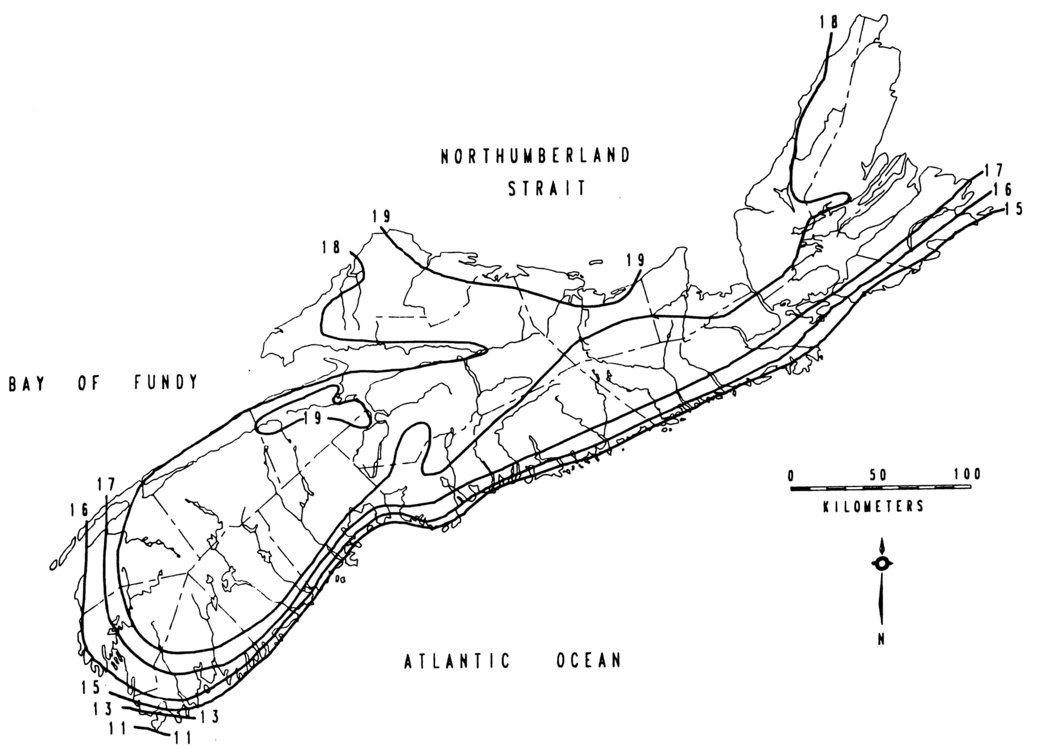


Figure A.9: Average July Temperature (^{0}C)

A.2 BLUEBERRY HARVEST DATES

Table A.1: Canada and U.S. Normal Blueberry Harvesting Dates by Area

Province/State	Begins	Most Active	Ends
Florida	April 15	May 1 – June 10	July 15
North Carolina	May 10	May 25 – July 1	July 10
Arkansas	June 1	June 10 – July 15	July 25
Georgia	June 1	June 8 – July 10	July 18
New Jersey	June 10	July 1 – Aug. 15	Aug. 30
Washington/Oregon	July 5	Aug. 5 – Sept. 5	Sept. 10
Michigan	July 10	July 25 – Sept. 10	Oct. 5
British Columbia	July 15	Aug. 1 – Aug. 25	Sept. 10
Maine	Aug. 1	Aug. 10 – Aug. 25	Sept. 5
New Brunswick	Aug. 10	Aug. 15 – Aug. 25	Sept. 10
Quebec	Aug. 10	Aug. 20 – Sept. 5	Sept. 15
Nova Scotia and Prince Edward Island	Aug. 15	Aug. 20 – Aug. 30	Sept. 10
Newfoundland	Sept. 5	Sept. 10 – Sept. 20	Sept. 25

Source: North American Blueberry Council (1985)

Appendix B

B.1 BLUEBERRY PRODUCTS IN CANADA

Table B.1: List of Blueberry Products Available in Canada — 1985

Retail	Foodservice	Bakery
Pies	Pies	Pies
Muffins	Muffins	Muffins
Waffles	Pancakes	Tarts
Tarts	Waffles	Turnovers
Turnovers	Pie Filling	Pie Filling
Jelly Roll	Topping	Donuts
Pie Filling	Donuts	Cheesecake
Topping	Syrup	Danish
Jam and Jelly	Yogurt	
Donuts	Sauces	
Syrup	Cheesecake	
Cheesecake	Crepes	
Yogurt	Sherbert	
Ice Cream	Jam and Jelly	
Pop Tarts	Parfait (Air Canada)	
Sherbert	Danish	
Danish	Parfait	
Baby Foods		
Aperitif Wines		
Wild Blueberry Cocktail		
Frozen Blueberry Beverage Base		

B.2 WILD BLUEBERRY FORMS AND PRODUCT LIST

Wild blueberries are available in the following forms:

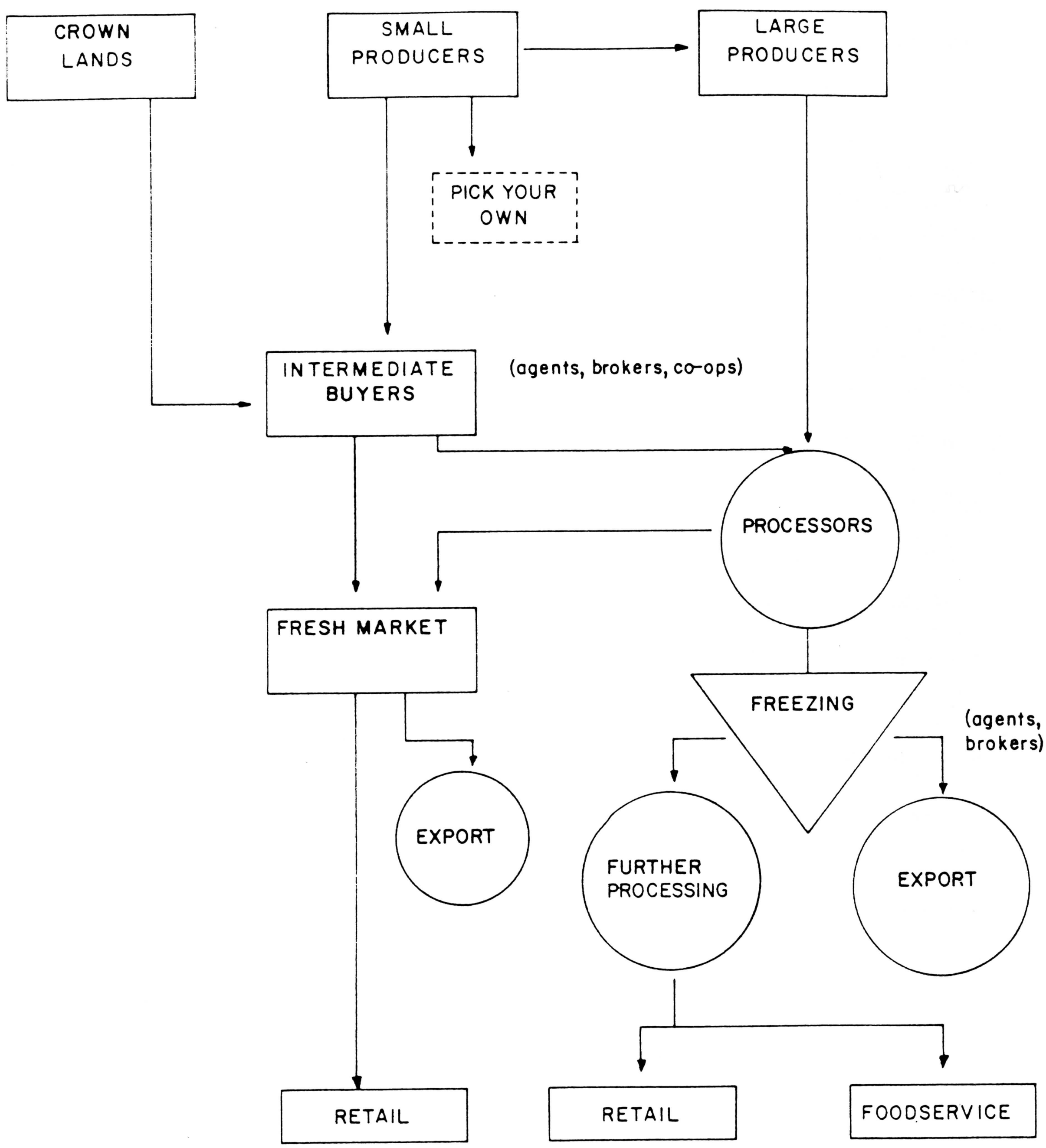
- fresh
- canned (in water, light or heavy syrup, or as filling)
- frozen, IQF
- concentrate
- extract
- pureé
- dehydrated

The increasingly popular wild blueberry is used in a wide range of products, including:

- muffin and cake mixes
- pies
- jams and jellies
- yogurt
- pancakes and waffles
- ice cream
- fruit juices
- syrup
- wine
- bagels

Source: Wild Blueberry Association of North America

B.3 BLUEBERRY MARKETING CHANNELS IN CANADA



Commodity Marketing, July 1985.

Index of Names

This document is prepared with co-operation with many people and organizations. The following had a part to play in the final preparation prior to printing: Dan Swim, Cartographer, Plant Industry Branch, NSDAM, Robb Gordon, Weather Resource Specialist, Plant Industry Branch, NSDAM and Jim Goit, Director, Plant Industry Branch, NSDAM.

DATE DUE	
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OCT 16 2010	
JAN 04 2011	

THE HISTORY OF THE LOWBUSH BLUEBERRY
INDUSTRY IN NOVA SCOTIA 1950-1990