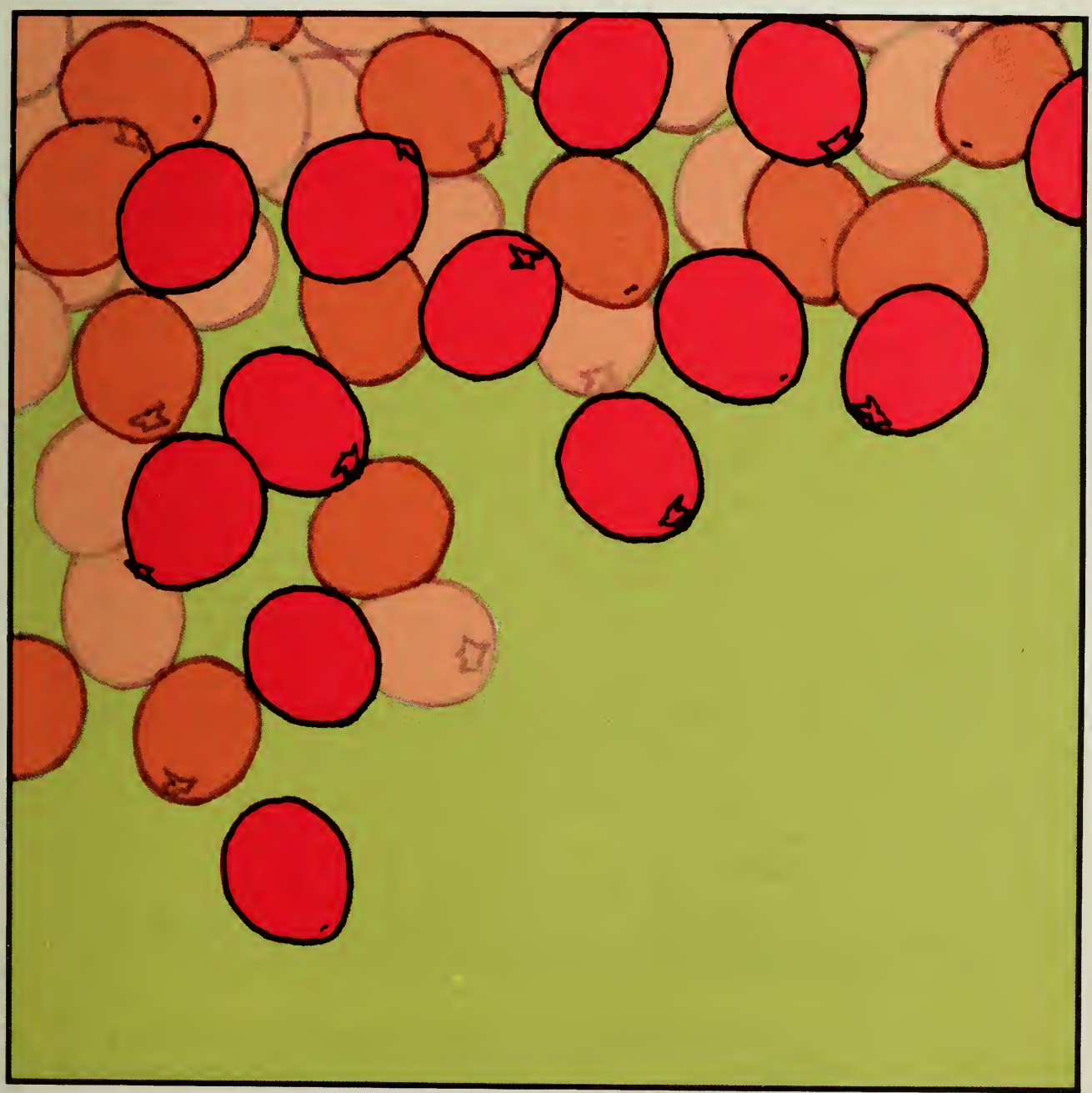
Growing cranberries

Agriculture
Canada

Publication 1282/E



Canada

PUBLICATION 1282, available from
Communications Branch, Agriculture Canada,
Ottawa, K1A 0C7

Cat. No. A53–1282/1981E ISBN: 0-662-11783-2
Revised 1981 **6M-12/81**

Également disponible en français

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CONTENTS

Cranberries grow best in acid bogs. For a successful cranberry operation you need:

- A large capital investment.
- Managerial ability.
- Professional engineering services to lay out the cranberry development and its irrigation system.
- To plant clean, healthy stock of a variety recommended for the region.
- To follow a sound program of fertilization, and disease and insect control.
- To harvest the fruit carefully and store it under proper conditions so that the fruit will be of high quality and will command optimum prices.

CULTURE

Cranberry growing is a highly specialized form of small-fruit production, limited, for the most part, to Canada and the United States. On arriving in the New World, the Pilgrims found this fruit growing profusely in the Cape Cod area of Massachusetts. They learned from the Indians that cranberries were the source of a brilliant red dye for their clothes, and that the berries could also be made into a delightful sauce. In the late 1800s, farmers in Massachusetts began to cultivate the berries and to devise methods of protecting the crops against adverse elements of the environment. From this beginning, cranberry culture moved west to Wisconsin and on to the Pacific Northwest. It also moved north to Nova Scotia. In the report of the Nova Scotia Fruit Growers Association for 1874 it is recorded that a shipment of berries was sent to Boston that year and that it arrived in excellent condition.

In Canada today, cranberry growing is restricted to certain areas: the lower portions of the Fraser River valley of British Columbia; marshes or bogs in the Muskoka District of Ontario; an area near Drummondville, Quebec; and several parts of Nova Scotia (see Table). The cranberry plant thrives under the cool, moist conditions in these regions. Cranberry growing is largely restricted to acid soils along the edges of streams, on seashores, and in bogs of temperate North America.

Cranberries are in great demand in North America because they make a tasty sauce to go with meat and poultry, and can furnish a juice and cocktail.

Description of the plant

The cranberry plant is a low-growing vine with persistent leaves. The berries develop on shoots that arise from the main runners (Figure 1). In late summer, flower buds form near the ends of the shoots, and from these the flowers (Figure 2) and subsequent fruit develop the following year. The flowers appear in mid-July and are pollinated by insects. The fruit matures in late October, the exact date depending on the variety, season, and geographical area.

Varieties

Present-day varieties have been developed by crossing and recrossing selections of the large cranberry, *Vaccinium macrocarpon* Ait. Two closely related species are the small cranberry, *Vaccinium oxycoccos* L., and the lingenberry, *Vaccinium vitis-idaea* L. var. *minus* Lodd. Although the flavor of these two species is delightful, berry size limits the possibility of their commercial production.

FIGURE 1 Cranberries are borne on upright stems arising from the main vines.

FIGURE 2 Flower of the cranberry.

TABLE Production of cranberries in Nova Scotia and British Columbia, 1970–1980*
(All figures in thousands of kilograms)

Province	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nova Scotia	48	54	73	54	41	128	153	84	136	126	136
British Columbia	2625	4706	3476	5223	4170	5550	6311	6674	6683	7207	6810

*Received from Statistics Canada 1 October 1980

Today most growers plan their production for processing rather than for fresh fruit. Older varieties such as *Early Black* and *Howes* have fallen into disfavor because of low yields. A variety that produces high yields of a dark red fruit is essential. The following are some of the varieties currently being planted:

Ben Lear A large, dark-colored berry (Figure 3) of early maturity, which has yielded 370 barrels of fresh fruit (45.4 kg/barrel) per hectare. Because of its early maturity this variety helps to extend the picking season, and is suitable for high-quality cranberry juice and frozen-fresh fruit. The fruit breaks down rapidly if held for more than a week in common storage.

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Page 7: The photographs on this page should be reversed.

FIGURE 3 Fruit of the varieties *Stevens* (left) and *Ben Lear* (right).

Stevens A large berry of midseason maturity (Figure 3), which has produced 500-600 barrels of fresh fruit per hectare in Wisconsin. It is well adapted to water harvesting (*see* p. 13), the berries keep well under normal storage conditions, and the vines are strong and grow vigorously.

Bergman A midseason variety of medium color, introduced by the United States Department of Agriculture in 1961. It has given excellent yields on both the East and West coasts, and the fruit has been favorably received by the processing industry for both sauce and juice.

McFarlin An attractive, late-maturing variety, which has been productive in British Columbia. The berries are large and deep red, are round-oblong, and have a heavy, waxy bloom.

Crowley A medium to large, dark-colored berry that matures about 2 weeks earlier than *McFarlin*. It was introduced by the Washington Research and Extension Unit at Long Beach, WA, and was recommended on the basis of its productivity, early ripening, and high pigment content.

Developing the bog

Choosing a site

In developing a cranberry bog, plan for development well into the future (Figure 4). A recent cost analysis study in Nova Scotia

FIGURE 4 Water plays an important role in cranberry production. The pumphouse on the right contains electric pumps which force water through the irrigation system in dry or frosty weather. The gasoline pump on the left is a backup system in the event of a power failure. It is being used here to pump water onto the bog before harvest.

shows that it takes $20,000–$25,000/ha to develop a bog, and that annual maintenance and operating costs are $3,000–$4,000/ha.

Seek the services of a professional engineer who can help in laying out the bog, deciding on the location of the pumping station, choosing the size and capacity of the pumps and the irrigation system, determining the pressure needed at the sprinkler heads, and estimating the capacity of the reservoir, if one is needed.

Preparing the bed

The pattern originally developed in Wisconsin is used to prepare the newer plantations in Canada. This pattern calls for a series of planting beds, each about 1 ha, serviced by a single reservoir of water.

Remove all vegetation from the proposed site by scalping with a bulldozer. Push the old roots, sods, and other debris into a pile along the edge of the planting area, and level this material to provide a service road around the growing area (Figure 5). Ensure proper drainage by installing bulkheads at the end of each planting area (Figure 6). Around the edge of the growing area dig a ditch 1 m wide x 0.5 m deep. Make the growing area perfectly smooth, and grade it so that at the center it is less than 15 cm higher than at the margins.

FIGURE 5 The debris from the bog has been pushed into a dyke, the top of which serves as a service road. The ditch around the edge of the dyke drains water into the bulkhead.

FIGURE 6 The bulkhead was made by cutting an oil storage tank in two. The valve, turned from above, regulates the water level for harvesting.

Plant stock

Buy vines from a reputable dealer and be sure they are true to type and fairly free from weeds. If by chance the vines contain weed seeds or other sources of weed infestation, remove the unwanted matter by sorting or washing. When you receive the vines, put them in a cool, humid place. If they must be kept outdoors, place them in a cool, shady spot and cover them with evergreen boughs. If the vines seem dry, sprinkle them with a little water.

Planting

Cut the vines into lengths of 7–10 cm, using a forage harvester or corn chopper. Broadcast the cut vines over the surface of the bog at the rate of 1700–2200 kg/ha. Push the vines into the surface of the bog with a planter (Figure 7), or set of disks. Sprinkle each planted area right away, and water the entire plantation freely for the next few days. Plant as early in the spring as possible.

FIGURE 7 Vines are pushed into the surface of the bog with a planter. Insert shows density of vines and depth of planting.

Fertilizing newly set vines

Although heavy applications of fertilizer stimulate weed growth, this competition can be removed with a selective herbicide.

Because of the high cost of developing the cranberry bog, you should promote vigorous growth and bring the plants into bearing as quickly as possible. Make two applications of a 5-20-20 fertilizer: apply 225 kg/ha about mid-June and a further 112 kg shortly after July 1. Then apply 45 kg of ammonium nitrate per hectare about mid-July and a further 65 kg at the end of July.

Maintaining the bog

Sanding

The main purpose of sanding is to provide a suitable medium for the roots of the cranberry plants, but because some weeds do not grow well in sand this practice also affords a fair amount of weed control.

How frequently and how much sand should be applied depend on how well the cranberry vines grow and on the amount of weed cover present. If growth is fair, apply 1 cm of sand every 3–4 years. Each application requires 120–130 m^3 of sand per hectare. Apply sand in the fall after harvest. If there are many weeds and vine growth is poor, apply the sand in late winter. When the bog is frozen, you can drive a loaded dump truck on the ice, but do not spread a layer of sand thicker than 1 cm.

Flooding

Cranberry vines are overwintered in or under a protective layer of ice. If the bog is not flooded, the plants will dry out in late winter. Flood the bog in the autumn as soon as the sand is frozen firm. Allow the water to barely cover the vines. Too much water reduces the amount of light penetrating through the ice to the plants. In winter the plants still need some oxygen, which they get by photosynthesis, although at a much reduced rate. Keep drains clear during the winter so that when a thaw occurs ice will not rise and pull out the vines. Drain the water from the bog when danger of severe frost is over.

Fertilizing

Base your fertilizer program on the present condition of the vines and the previous year's yield of marketable berries. Shortly after the floodwater has been drained from the bog and again about 2 weeks later, apply ammonium nitrate at the rate of 35–100 kg/ha. Do not apply more than this amount, because too much nitrogen will result in poor berry color, low fruit set, and excessive vine growth. Later in the season apply a complete fertilizer. An application of a 5-20-20 fertilizer at the rate of 112–336 kg/ha has given the most consistent increases in yield, depending on soil conditions and vigor of the vines. Research workers in Wisconsin have esti-

mated that a yield of 100 barrels will remove 26 kg of nitrogen, 11 kg of phosphorus, and 21 kg of potassium per hectare.

Frost protection

If there is a threat of frost to blossoms or fruit, irrigate until the danger is past (Figure 8). With adequate water and properly functioning equipment, you can protect your crop at all times. Flooding a bog for frost protection is no longer recommended because of the water and time requirement, and the danger of spreading diseases at flowering time.

FIGURE 8 Irrigating a cranberry bog to provide moisture for the growing berries. The same system will protect the crop from frost injury during the growing season.

Controlling weeds

Plants that become weeds of cranberry bogs are the native vegetation of poorly drained swamps, ponds, and bogs. They are mainly species of sedges and grasses, and are difficult to identify. For identification of weeds and recommendations for their control, consult a weed specialist in your area.

Listed here are a few herbicides, and the concentrations recommended to kill specific weeds.

Herbicidal oil Apply up to mid-May at the rate of 5600 L/ha (0.5 L/m^2) for control of rushes, asters, and goldenrod.

Iron sulfate ($FeSO_4 \cdot 7H_2O$) Apply up to late July at the rate of 1 kg/m^2 for control of sensitive fern, marsh St. John's-wort, cinquefoil, and asters.

Iron sulfate and salt Mix 9:1 by weight. Apply a small amount to each royal plant and cinnamon fern plant.

Water white kerosene Apply up to mid-May at the rate of 7000 L/ha (0.6 L/m^2) for control of poverty grass, sedges, woolgrass, and spike-rush.

New chemicals Because new materials are constantly under evaluation, contact your local agricultural authority for the latest information.

Pollination

The size of a berry is related to the number of seeds it contains. Adequate pollination is therefore essential. For each bearing hectare, supply 2–4 strong colonies of honey bees during the bloom period. Do not bring hives to the bog while there is still a danger from an insecticide, and avoid applying harmful material while the bees are working the cranberry flowers.

Harvesting

The aim in harvesting is to gather the berries as economically as possible with minimum loss or injury to the fruit. Because of high labor costs and the short harvesting season, operators now use mechanical harvesters. There are many types of mechanical harvesters; some harvest the berries wet, some operate under dry conditions. In water harvesting (Figure 9), the bog is flooded to a depth of 15–20 cm. The harvester then rakes, or beats, the berries from the

FIGURE 9 Cranberries used to be dry-harvested but are now usually water-harvested. The berries are raked, or beaten, from the vines and any that escape the harvester are corralled by a boom.

FIGURE 10 Boats containing cranberries are transferred from the bog to the wagon by a forklift and then the berries are transported to a packing plant. A drain at the bottom of the wagon allows excess water trapped in harvesting to be released.

vines. The berries that are knocked off float to the surface and are gathered (Figure 10). Water-harvested fruit is dried before it is stored (Figure 11), or frozen for processing as soon as it has been cleaned. The dry-harvesting method is losing favor because up to 30% of the crop is lost through berries dropping to the surface of the bog. Soft berries and foreign matter are removed during the final inspection (Figure 12).

LEAF COMPOSITION

On bearing cranberries of the *Ben Lear* variety, the maximum value for leaf nitrogen (N) is 1.0% and the maximum value for phosphorous (P) is 0.1%. The range for potassium (K) is 0.34-0.4%; for calcium (Ca) 0.6-0.7%; for magnesium (Mg) 0.27-0.31%; for iron (Fe) less than 50 parts per million (ppm); and for manganese (Mn) less than 150 ppm. On a new bog with the same variety an application of 17 kg of nitrogen per hectare per year provides sufficient growth and a leaf N value of 0.88%. Differences exist between varieties, and the following leaf nutrient ranges for bearing *McFarlin* cranberries on a British Columbia bog are presented for a 2-year period. The range for leaf N is 0.73-0.95%; for P 0.096-0.099%; for K 0.25-0.40%; for Ca 0.26-0.3%; for Mg 0.3-0.38%; for Fe 74-93 ppm; and for Mn 521-736 ppm. In the state of Washington, an application of agricultural lime ($CaCO_3$) in January at a rate of 1000 kg/ha gave highest yields and best keeping quality with the

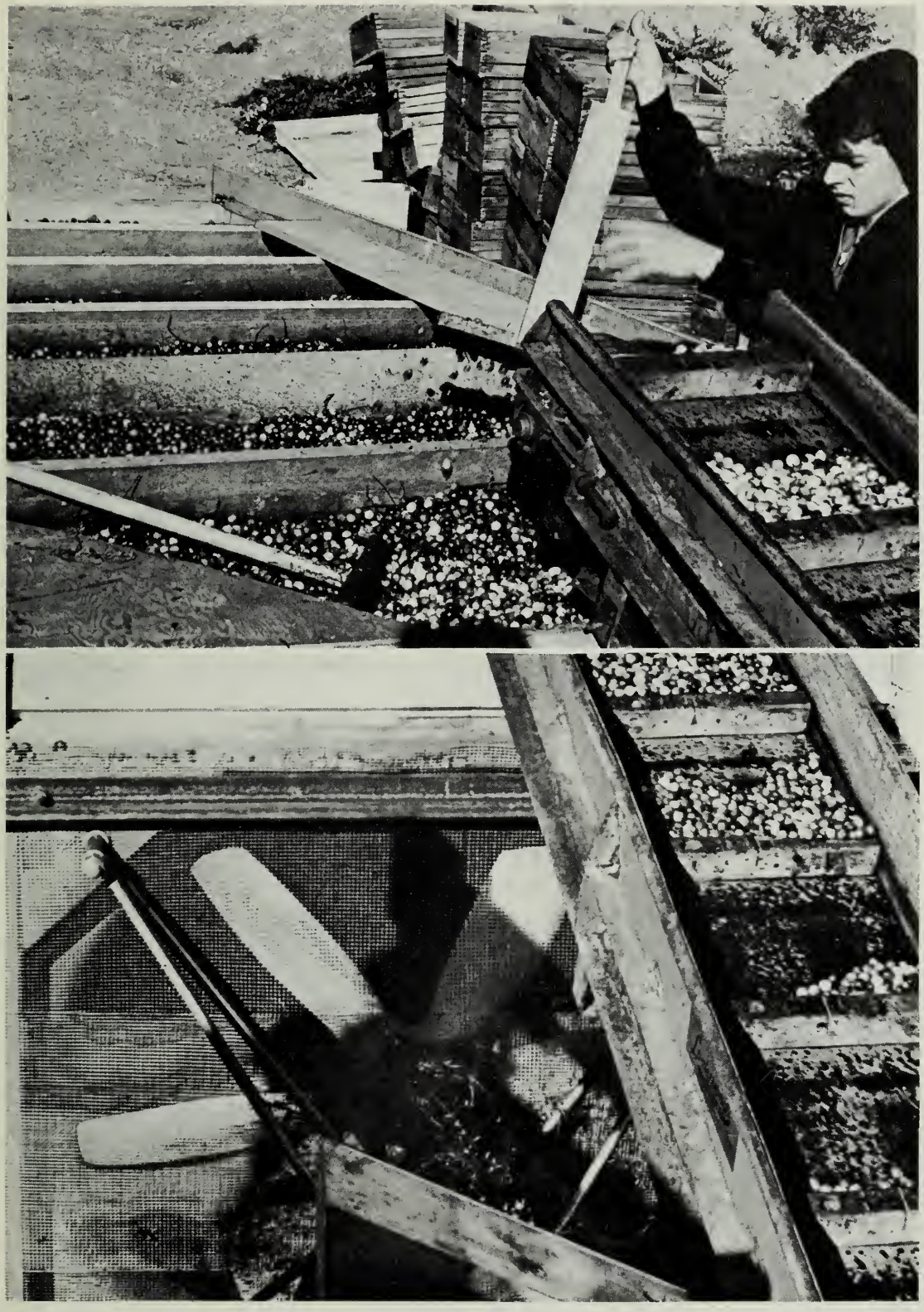

FIGURE 11 A conveyor belt carries cranberries to the top of a dryer following water harvesting. The fan below forces dry air up and around the berries.

FIGURE 12 Soft berries and foreign matter are removed during the final inspection.

variety *McFarlin*. With increasing lime, the level of Ca in the fruit increases and the levels of K and Mg decrease.

In 1967 a composite leaf sample was taken from cranberry plants in each of four commercial bogs in the Kentville, N.S. area. Samples taken in mid-July consisted of fully matured leaves from the midstem section of the current season's growth. The ranges and average values are presented here for comparison purposes and indicate adequate levels of all nutrients determined. The range and average value for N are 1.39–1.81% and 1.60%; for P 0.12–0.15% and 0.13%; for K 0.54–0.58% and 0.56%; for Ca 0.45–0.61% and 0.5%; for Mg 0.15%–0.18% and 0.16%; for Mn 295–675 ppm and 449 ppm; and for Fe 89–267 ppm and 136 ppm.

DISEASES

Cranberry plants and fruit are subject to several diseases, mainly fungus diseases of the vines and storage rots of harvested cranberries.

Virus disease

False blossom

False blossom, caused by a virus, has been of great concern in the past, but is no longer considered a serious disease due to control of the vector, the bluntnosed cranberry leafhopper. In the early stages of the disease, the flowers stand erect (Figure 13) instead of drooping normally, and the petals tend to be more brightly colored than healthy ones. In the advanced stages, the flowers develop stunted petals or have none at all. The plants themselves suffer from a condition known as witches'-broom, an abnormal tufted growth of lateral branches and small leaves growing close to the stems. Diseased plants do not produce a marketable crop. The disease is most easily recognized when the plants are in blossom or during the latter part of August, when witches'-broom is most prominent. Misshapen fruit is sometimes associated with false blossom.

False blossom is carried from bog to bog and from district to district in affected vines used for new plantings. Within a bog and between neighboring bogs, it is spread only by the bluntnosed cranberry leafhopper (p. 27).

Control of this disease requires careful attention. When planting a new bog take great care to obtain vines from a disease-free source in order to reduce the possibility of false blossom, because this disease is known to spread more rapidly in a newly planted bog than in an established bog. If the disease is established at a number of points in a bog, prevent its spread to new shoots by controlling the bluntnosed cranberry leafhopper.

FIGURE 13 False blossom, showing diseased flowers standing erect.

The variety *Howes* is quite susceptible to the disease and *Early Black* is one of the most resistant.

Fungus Diseases of the Vines

Several fungus diseases cause damage in cranberry bogs, but none have proved destructive over large areas. Such diseases, usually limited to one bog or to a certain area in a bog, become severe due to buildup of disease during wet weather, or the disease may have spread from nearby infected areas.

Tip blight or mummyberry

Tip blight is both a vine disease and a fruit rot. It starts as a typical blight, killing the tips of the vines. The growth of the fungus at certain points within the bark causes the tips to turn brown and become misshapen. Grayish powdery masses of spores develop in these areas; the spores infect the developing berries at blossoming time. The disease is readily noticed when the berries start to ripen in the fall. They do not color naturally but become yellowish and remain hard. If an unripe infected berry is cut open, a white cottony fungus growth will be found around the seeds. The berries shrivel, become mummified, and drop to the ground, where they overwinter. In the spring apothecia grow out of the mummified fruit. These cup-shaped bodies produce spores which infect the young tips during wet weather. This disease has been found only in New Brunswick and on the Pacific Coast where it is called cottonball.

Removal and destruction of infected fruit during harvest help prevent a buildup of the disease. Fungicides are available for control of tip blight.

The variety *Bergman* is very susceptible to these diseases.

Red leaf spot and rose bloom

Red leaf spot and rose bloom immediately attract attention because of the bright colors they induce in the diseased parts of the plants.

In plants infected with red leaf spot, the bright red color of the spot is conspicuous on the upper surface of the leaves. The color is duller on the lower surface and the spots are covered with a bloom of spores. The red spots may also be found on the fruit.

The variety *Ben Lear* is very susceptible to red leaf spot.

Rose bloom first appears in the spring when infected dormant stem buds develop as twisted rose-colored shoots, resembling blooms. By midsummer the blooms dry up, shrivel, turn gray, and drop from the vine. After the dried blooms have dropped it is difficult to distinguish a diseased vine from a healthy one.

Cultural practices that reduce shading and allow for drainage of both air and water, lessen the likelihood of the disease becoming a problem.

Red gall

Red gall produces small, shotlike, red galls on the young buds, leaves, and shoots (Figure 14). It is erratic in its behavior, and although infected shoots do not bear fruit, the disease is not usually of great economic importance.

This disease occurs along the Atlantic seaboard, and in Canada has been found only in Nova Scotia. Control is obtained by early removal of water in the spring.

Fairy rings

Fairy rings in cranberry bogs resemble fairy rings in lawns and pastures and, like them, are caused by a species of mushroom. The cranberry roots are apparently smothered as the fungus grows in a widening circle from a center point. Under favorable conditions the vines will grow in previously affected areas. This disease is troublesome in Massachusetts and New Jersey, but it has not been recognized in Canada. Fungicides are available to control fairy rings.

Leaf spot and speckle

Leaf spot occurs in all cranberry bogs. The diseased plants form conspicuous black spots (Figure 15) on the underside of the leaves and a faint discoloration on the upper surface. This disease can be serious if severe, because leaf spot fungus is associated with speckle on fruit. Control of leaf spot has not been attempted, because speckle on fruit is controlled with fungicides applied when spraying for end rot.

Leaf blight

Leaf blight occurs on some dry bogs in New Brunswick, causing the vines to weaken and die. To date control measures have not been necessary.

Storage Rots

Storage rots are responsible for an annual 25% loss of the cranberry crop of the United States and about the same amount in Canada. Extensive studies show that growing conditions are a pre-

FIGURE 14 Red gall on cranberry leaves.

FIGURE 15 Leaf spot of cranberry.

determining cause of damage by fungi. In affected berries where no organisms can be found the rot is called sterile breakdown.

In the early stages of development, the similarity of the different rots of cranberries makes laboratory identification necessary. The fungi responsible for the rots are widely distributed wherever cranberries grow. The mean temperature during the growing season largely determines the local importance of the fungi. Under the high summer temperatures in New Jersey the fruit may rot in the bogs before harvest, but in Nova Scotia rotting primarily occurs after the fruit is in storage.

Various rot-producing fungi have been found in the dried remains of the calyx of many sound berries. The infection takes place in the bog during the summer and the rot organisms lie dormant awaiting favorable conditions for growth. The presence of these fungi in the calyx explains the progressive rotting of the fruit after harvest and indicates the necessity of proper storage conditions.

The control of storage rots depends on a number of factors. Methods of control vary according to locality and condition of the fruit. In some years the firmness of the berries ensures good keeping quality without much trouble, whereas in other years the berries are so tender that only by careful handling and proper storage can the fruit reach the market in an attractive condition. Every effort should be made to prevent bruising during harvesting, cleaning, and packing. The berries should be dry when stored, or if they have been harvested wet, should be dried quickly. The fruit should be stored at

2°-5°C with good ventilation and at a relative humidity of 80-85%, or frozen immediately after harvesting and processing.

End rot

End rot is the most important storage rot in Nova Scotia. Losses from end rot may reach 30% or more. Rotting usually starts at one end of the berry (Figure 16), but it may also begin at the site of bruises or wounds. The decay is a soft, watery type. Decaying berries often become yellowish or brownish, and eventually collapse or shrivel like raisins (Figure 17). Infection occurs any time after bloom starts. Effective fungicides are available to control end rot.

Early rot or speckle

Early rot seldom decays cranberries in the field, but speckle (Figure 18) is important at harvest time. The first sign of early rot fungus is the appearance of minute, light-colored, watery spots on the surface of the berries. As the disease spreads, these spots are often marked with concentric, dark-colored rings. The disease may also appear as dark blotches or brownish zones known as speckle. Speckle is associated with leaf spot fungus as well as early rot fungus. Infected cranberries stored at a temperature of 15°C or above will decay. Early rot or speckle can be controlled with fungicides applied when spraying for end rot.

FIGURE 16 End rot in the early stage of development.

FIGURE 17 End rot, showing advanced stage of development.

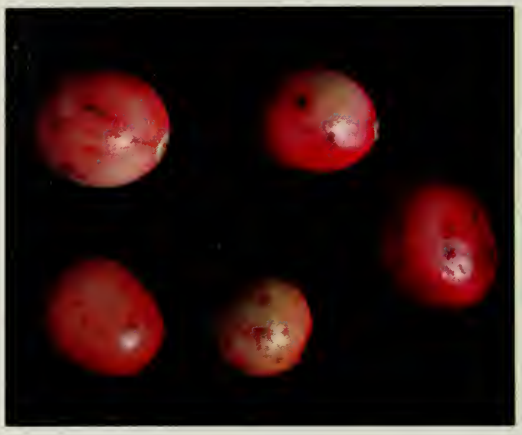

FIGURE 18 Speckle disease on the fruit.

FIGURE 19 Fruit rot of cranberry.

Fruit rot

Fruit rot can be serious. This disease is characterized by pale tan or mottled cranberries (Figure 19). It appears occasionally on cranberries at harvest time. Fruit rot can be controlled by fungicides applied when spraying for end rot.

Black rot

Black rot is of lesser importance. The dry-rotted berries are jet black and firm; they gradually shrink, and look like miniature prunes (Figure 20). Often tiny spore-producing pustules of the black rot fungus cover much of the berry surface. Black rot can be controlled with fungicides applied when spraying for end rot.

Minor storage rots

White, or ripe, rot (Figure 21) sometimes occurs, rotting the whole berry and giving it a whitish appearance. This disease may appear in the field in late-harvested berries.

Blotch rot also occurs occasionally. It produces a small, light-colored, soft spot on the berry similar to early rot or bitter rot. Blotch rot may destroy the whole fruit. In the later stages, dark-colored blotches appear on the inner surface of the skin.

The fungus of bitter rot causes a soft, light-colored rot similar to early rot or blotch rot. Fungal fruiting structures sometimes develop on the diseased berries.

FIGURE 20 Black rot of cranberry.

FIGURE 21 White rot of cranberry.

Sterile breakdown

Sterile breakdown is a term used to describe storage rots in which no organisms can be found. These rots cause the fruit to become soft and withered and may develop in cranberries held in storage for a month or longer. Losses of 30% or more have been experienced in some years. Cranberries are more susceptible to sterile breakdown when they are stored at temperatures above 10°C than when they are stored at 2°–5°C.

Low-temperature breakdown

Low-temperature breakdown develops on cranberries stored at -1.1–0°C. The berries are rubbery, their color is rather light, they lack the normal berry luster, and the pigmentation of the skin spreads into the pulp.

INSECTS

The cranberry plant is an attractive host to a wide variety of insects, but fortunately only a few of them are considered economically important pests. Their status as pests will vary from one part of the country to another, and the level of damage may also fluctuate between years at the same location. Cranberry growers are ad-

vised to use a sweeping net to determine the presence of high numbers of insects and to regularly examine their bogs for evidence of damage. For advice on where to obtain insect sweeping nets and how to use them, and for recommendations relative to specific problems, consult your local agricultural specialist.

It cannot be overemphasized that insecticides are poisonous, and should only be used when there are high numbers of insect pests which are not adequately controlled by cultural practices such as flooding and sanding. In order to obtain maximum control, insecticides (Figure 22) must be applied at the proper time and with proper equipment. Set up heavy spraying equipment on the edge of the bog and make application by means of a long hose. Take care to hold the hose away from the vines during spraying. Where possible, many growers have their bogs sprayed by aircraft or through low-volume sprinkler systems. Regardless of material used, carefully follow the directions and heed the warnings printed on the container label.

FIGURE 22 The insecticide is mixed in the barrel shown here and applied through the irrigation system.

Cranberry fruitworm

The cranberry fruitworm is the most serious insect pest of the large cranberry in the Maritime Provinces and Quebec. It is native to Canada and infests both cultivated and native stands. However, the fruitworm has not been recorded from British Columbia.

The insect overwinters as a full-grown larva in a cocoon either on the surface of the soil or slightly below. The cocoon is usually formed of small grains of sand or particles of peat or trash, held together by strands of silk. In early spring the larva enters the pupal stage and emerges as a moth when the cranberry is in full bloom. Eggs are laid within the calyx cup under the lobes, and occasionally on the berry. The newly hatched larva enters the berry near the stem end, closing the entrance with a fine silken web. After feeding for some time on the pulp, the larva leaves the berry and enters a second one in the same way. If it enters any others, it does so through the side (Figure 23) and may destroy as many as six berries. By early fall when the larva is full-grown, it is greenish and about 13 mm long. It then builds the cocoon in which it hibernates.

Control. Cranberries growing wild by rivers that flood each spring are not usually infested with fruitworm. However, populations thrive on higher ground. Regularly flooding and holding water on the bog until near the end of May will provide good control on cultivated bogs. Where flooding is not practiced, treat the bog with insecticides.

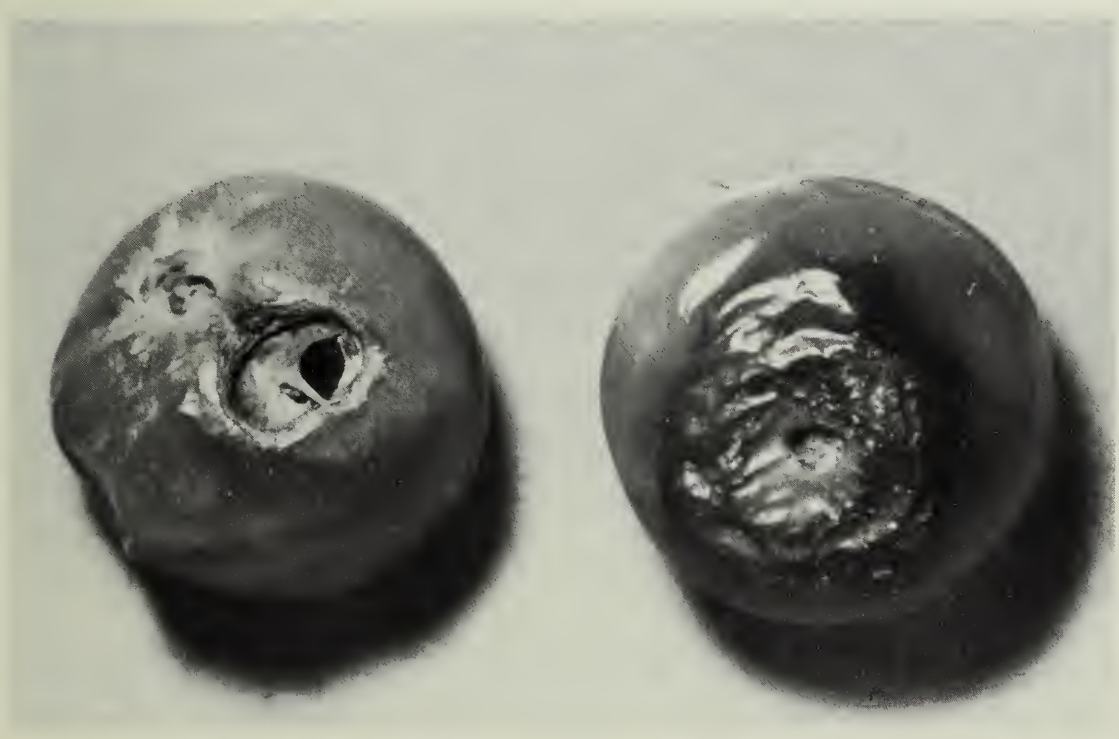

FIGURE 23 Injury caused by the cranberry fruitworm.

Blackheaded fireworm

Several species of fireworm may cause damage to cranberries but the blackheaded fireworm is by far the most common, and the only one that requires control treatments on a frequent basis.

The insect overwinters as an egg on the underside of cranberry leaves. The eggs of the first of two broods hatch in May and the larvae usually burrow into the old leaves or expanding buds. Larvae are greenish or pale yellow, have a black head, and are about 8.5 mm long when full-grown. Pupation usually occurs in the sand and lasts 10–14 days. Activity is not easy to detect until new plant growth begins, but once new shoots appear damage to the plant is quite noticeable. At this time, the larvae web together three or four of the terminal leaves and feed on them from within the web. Within a few days the lower leaves are also webbed together.

The second brood appears in mid-July and remains active into August. These late-season larvae often web together several stems and may have nests that are larger than those of the first brood. Some of them, however, feed only on the berries. Plant damage, therefore, may reduce the current crop of berries, and also affect the crop potential for the following year by preventing normal fruit-bud development.

Control. Flooding in late May will help control blackheaded fireworm, but when this is not practical treatment with insecticides will be required.

Cranberry girdler

This insect is generally not a problem in Canada but may cause significant damage in some years, particularly in dry bogs.

There is one generation a year. The larvae pass the winter in cocoons fashioned from sand, leaves, or other trash, and pupate in late May or June. The pupal stage lasts about 3 weeks, and the moths, which are whitish with markings of yellow and silver, are active until August. Damage from larval feeding is evident in September or October, especially after the larvae have fed on the bark. Full-grown larvae are a dingy white, have a brown head, and are about 16 mm long.

Control. Infestations can generally be kept under control by regular sanding or fall flooding. Insecticide treatment for fireworm will also help prevent severe infestation.

Cranberry tipworm

This insect feeds on new growth from early spring until late summer. The adult is a small fly that lays her eggs near the base of terminal leaves. The hatched maggots feed on these leaves and this causes them to become cupped or bunched together. There may be

as many as four or five yellowish to orange-red maggots in an infested vine tip. Mature maggots are less than 2 mm in length. There are two generations; the first brood of maggots is active in early June, and the second brood appears at about the time the vines are in full bloom. The vines normally recover from damage caused by the first generation of maggots, but the second brood may reduce the number of flower buds for the following year.

Control. Resanding will help control this pest by preventing fly emergence.

Other insects

Other insects may cause some damage occasionally but they generally do not require special treatment. The black vine weevil is sometimes a problem in British Columbia. The legless white grubs with tan-colored heads feed on the roots. The adults are black beetles with long snouts, 8.5–10 mm long, and are present from May through July. Acceptable control may be obtained by flooding for 2 weeks or more during the dormant period.

The bluntnosed cranberry leafhopper may be a major pest in some cranberry bogs. It is responsible, through its feeding activities, for the spread of false blossom disease. The overwintering eggs of the bluntnosed cranberry leafhopper hatch in June and, after passing through a wingless and varied-colored nymphal stage, the adults appear early in July. They are light yellow to dark brown and about 4 mm long. Leafhopper populations are normally kept under control by insecticides that are used to control other pests in the bog.

SCIENTIFIC NAMES OF FUNGI, INSECTS, AND WEEDS

Fungus diseases of the cranberry and their causal organisms

Bitter rot	*Glomerella cingulata* (Stonem.) Spauld. & Schrenk
Black rot	*Ceuthospora lunata* Shear
Blotch rot	*Acanthorhynchus vaccinii* Shear
Early rot	*Guignardia vaccinii* Shear
End rot	*Godronia cassandrae* Pk. f. *vaccinii* Groves (*Fusicoccum putrefaciens* Shear)
Fairy rings	*Psilocybe agrariella* Atk. var. *vaccinii* Charles
Fruit rot	*Diaporthe vaccinii* Shear
Hard rot	*Monilinia vaccinii-corymbosi* (Reade) Honey
Leaf blight	*Naevia oxycocci* Dearn.
Leaf spot	*Gibbera compacta* (Pk.) Shear
Red gall	*Synchytrium vaccinii* Thomas
Red leaf spot	*Exobasidium vaccinii* (Fuckel) Wor.
Rose bloom	*Exobasidium vaccinii* (Fuckel) Wor.
Speckle	*Guignardia vaccinii* Shear
Tip blight	*Monilinia vaccinii-corymbosi* (Reade) Honey
White rot	*Sporonema oxycocci* Shear

Insects that attack the cranberry

Cranberry fruitworm	*Acrobasis vaccinii* Riley
Blackheaded fireworm	*Rhopobota naevana naevana* (Hübner)
Cranberry girdler	*Crysoteuchia topiaria* (Zeller)
Cranberry tipworm	*Dasyneura vaccinii* Smith
Black vine weevil	*Otiorhynchus sulcatus* (Fabricius)
Bluntnosed cranberry leafhopper	*Scleroracus vaccinii* (Van Duzee)

Some weeds of cranberry bogs

Asters	*Aster* spp.
Cinnamon fern	*Osmunda cinnamonea* L.
Cinquefoil	*Potentilla* spp.
Goldenrod	*Solidago* spp.
Marsh St. John's-wort	*Hypericum virginicum* L.
Poverty grass	*Danthonia spicata* (L.) Beauv.
Royal fern	*Osmunda regalis* L.
Rushes	*Juncus* spp.
Sedges	*Carex* spp.
Sensitive fern	*Onoclea sensibilis* L.
Spike-rush	*Eleocharis* spp.
Wool-grass	*Scirpus* spp.

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

Yield of cranberries is expressed in barrels per hectare. There are 45.4 kg/barrel.