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CRANBERRY INDUSTRY IN WISCONSIN

By
HENRY F. BAIN

WISCONSIN DEPARTMENT OF AGRICULTURE

STATE CAPITOL, MADISON, WISCONSIN

WALTER A. DUFFY, Commissioner

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FOREWORD

The cranberry industry is one of increasing importance to Wisconsin. In the last decade it has steadily grown until today Wisconsin is the third state of the nation in cranberry production, next to Massachusetts and New Jersey. Of a total of 29,000 acres devoted to this crop in the United States, Wisconsin has nearly 2500 acres.

Wisconsin, with large areas of marsh especially adapted to cranberry culture, is particularly suitable for the expansion of this industry whenever the time is opportune for such expansion, and bids fair to lead the nation in cranberry production. In 1928 the value of the Wisconsin cranberry crop was slightly less than \$1,000,000.

The cranberry industry is making its contribution toward providing proper land utilization in our state. In large acreages included in the bogs, in the flowage necessary to maintain the water supply, and in protecting lands surrounding, considerable areas are being put to definite use which otherwise would be waste.

The cranberry industry, similar to all other agricultural industries, has to combat plant and insect diseases constantly. It is with the specific purpose of aiding in disease problems and also to further the industry generally that the Wisconsin Department of Agriculture is cooperating with the industry and employs experts to devote their entire time to assist the growers in control work.

Clever devices and improvements in the machinery of production, wise marketing plans under which one large cooperative handles the sales of practically the entire crop of America, control in expansion of production, and plans to increase consumption so that the cranberry may take its proper place throughout the year on the American table instead of only at Thanksgiving and Christmas time. All

are factors which lend stability and cheerfulness to the prospects for this industry. The intelligence, aggressiveness, and energy of the cranberry growers of Wisconsin, have done and can do much in advancing this most promising branch of our agricultural industry.

Walter A. Duffy

Commissioner of Agriculture.

THE CRANBERRY INDUSTRY IN WISCONSIN

By HENRY F. BAIN
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INTRODUCTION

Wisconsin ranks third among the cranberry producing states in the United States. Information concerning the cranberry industry in the two leading states is readily available through several recent publications.¹ The present work has been undertaken for the purpose of supplying the distinct need for a description of the cranberry industry in Wisconsin. The data on which the paper is based were collected by the Cranberry Office of the Wisconsin Department of Agriculture in connection with its program of inspections of commercial cranberry marshes in the state.

STATISTICS

Acreage and Production

Cranberry production in Wisconsin is in a transition stage between the former practice of harvesting wild cranberries and the modern highly specialized cultivation of this crop. Many acres of wild vines still exist from which fair-sized crops are harvested in favorable years. Other wild marshes are ditched and supplied with limited flowage protection. From this point there are many gradations in degree of cultivation. These conditions make it practically impossible to estimate the acreage of producing vines. The difficulty is enhanced by the presence of abandoned, formerly cultivated marshes which occasionally produce crops, several of which, indeed, are now being brought back to a state of cultivation. It has been thought

¹Barber, C. W.: Cranberry Acreage and Production in Massachusetts. New England Crop Reporting Service and Mass. Dept. of Agr. Boston, Mass., July, 1925.

Beckwith, C. S. and Weiss, H. B.: A Survey of the Cranberry Industry of New Jersey. N. J. Dept. of Agr. Circular No. 45:1-13. 1922.

Franklin, H. J.: Cranberry Growing in Massachusetts. Mass. Agr. Exp. Sta. Extension Leaflet No. 72:1-14. 1923.

Beckwith, C. S.: Cranberry Growing in New Jersey. N. J. Agr. Exp. Sta. Circular 144: 1-39. 1922.

best in compiling the present acreage values to include only those marshes which are given a degree of attention calculated to insure commercial crops every year. Even here several border-line cases are included which might well have been classified as semi-cultivated or abandoned.

The total acreage of marshes in the state figured on the above basis is 2120, distributed among 12 counties as shown in Table I and Figure 1. Table II shows separate acreage values for young vines and for those in full production in 1928. Since the average Wisconsin planting reaches full production in 4 or 5 years, Table II indicates that the acreage has increased 20% within the past five years. This is not wholly true because a certain proportion of the increase represents replanted acreage, while some inferior acreage has been abandoned during that time. There has been, nevertheless, a rapid expansion of the industry, largely along the lines of the most approved recent methods of culture.

TABLE I
ACREAGE OF CRANBERRIES IN WISCONSIN IN 1928

County	Acreage	Number of Marshes
Barron	48	2
Burnett	82	2
Jackson	337	14
Juneau	201	9
Marquette	5	1
Monroe	296	14
Price	95	1
Rusk	33	1
Washburn	111	3
Waupaca	30	1
Waushara	20	1
Wood	862	22
Total	2120	71

TABLE II
ACREAGE OF CRANBERRY VARIETIES IN WISCONSIN IN 1928

Variety	Acres in full bearing	Acres young vines	Total Acreage
Bennett Jumbo	175		175
Berlin (Bell and Bugle)	50		50
Centennial	3		3
Early Black	1		1
Early Ohio	2		2
Gebhardt Beauty	15	2	17
Howes	7	83	90
Juneau	9		9
McFarlin	317	57	374
Mammoth	6		6
Mathews	1		1
Metallic Bell	36	4	40
Natives	913	23	936
Palmeter	4		4
Pointed Howes	2		2
Potter's Favorite	3		3
Prolific	25	5	30
Searls Jumbo	188	183	371
Seymour Beauty	2	1	3
Smalley Howes	3		3
Total	1761	358	2120

Wood County, with 862 acres of vines, has the largest acreage of vines in the state. The majority of the Wood County plantings are grouped on an extensive marshland in the town of Cranmoor. Others are located near Biron and in the towns of Remington and Saratoga.

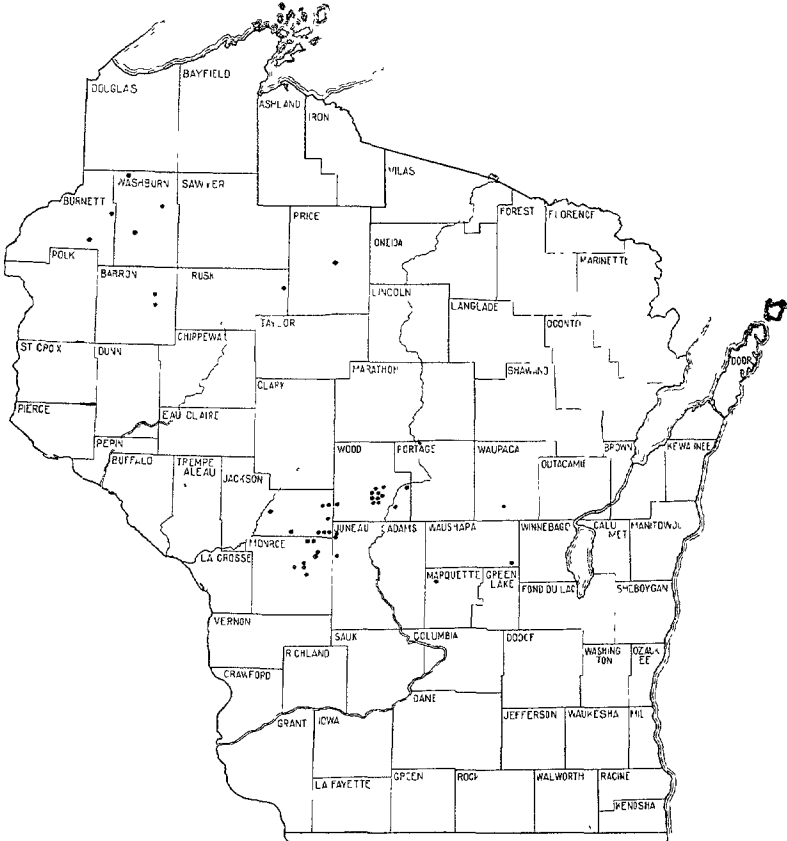


Fig. 1.—Location of Cultivated Cranberry Marshes in Wisconsin.

The Jackson County marshes are more scattered. There are marshes near City Point, Black River Falls, and Millston, while the largest single group is located in the Mather-Warrens district. The Monroe County marshes are located near Tomah, Valley Junction, Tunnel City, and Mather-Warrens. Juneau County marshes are all in the vicinity of Mather.

The remaining marshes are isolated from the others. Those in Barron County are situated near Rice Lake and Cameron respectively; in Burnett County, near Ferron Park and Hertel; in Marquette County, near Westfield; in Price County, Near Phillips; in Rusk Coun-

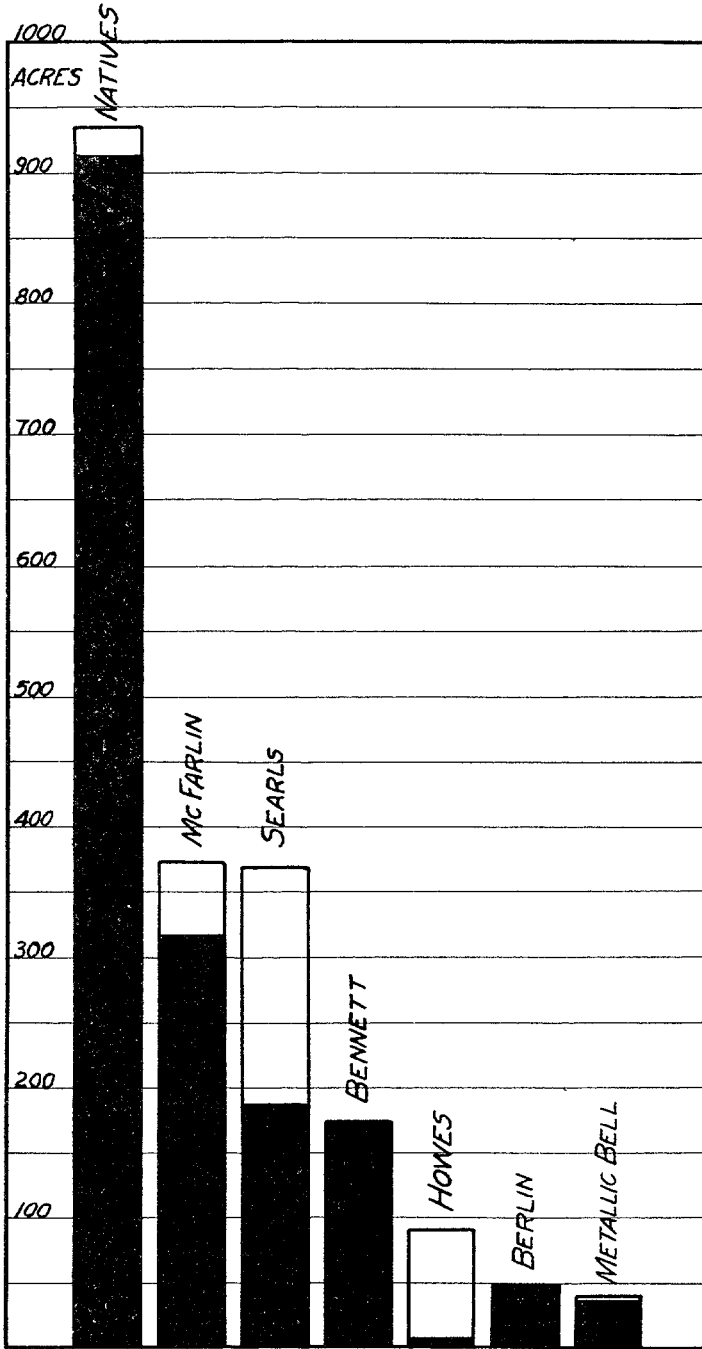


Fig. 2 —Comparative Acreages of the Leading Cranberry Varieties in Wisconsin. Solid portion of the graphs represents acreage in full production, and the open portion acreage of young vines.

ty, near Hawkins; in Washburn County, near Beaver Brook, Spring Brook, and Minong, respectively; in Waupaca County, near Waupaca; and in Waushara County, near Berlin.

This distribution gives rise to several distinct centers of the cranberry industry. Wisconsin Rapids, the center of the Wood County district, is general headquarters of the cranberry growers' organizations. The Mather-Warrens district forms a compact unit including all Juneau County marshes and part of those in Jackson and Monroe Counties. The several marshes in the northwestern part of the state form a natural group in many respects.

Varieties

Table II gives the acreage of different varieties grown in the state. Nearly 50% of the vines are of unselected native varieties. Selected vines of Wisconsin origin, in the order of importance, are Searls Jumbo, Bennett Jumbo, Berlin (probably not a pure selection), Metallic Bell, and Gebhardt Beauty. McFarlin, which ranks second, and Howes, fifth, in point of acreage, are of Massachusetts origin. Prolific is a Michigan variety. The remaining minor varieties are mostly of Massachusetts and Wisconsin origin. Comparative acreages of the leading varieties are shown graphically in Figure 2.

The second column of Table II shows the varieties which are being planted at the present time. Searls Jumbo easily leads the list. Howes ranks second, and it will be noted that most of the acreage listed for this variety has been planted within the past five years. The only other varieties which are being increased to any extent are McFarlin and natives. Ninety-three per cent of the vines planted in recent years have been of selected varieties, whereas 52% of the older marshes are of unselected native vines.

Production

The total production of cranberries in Wisconsin for each of the past five years is given below:

1924-----	42,000 barrels ¹	1927-----	23,000 barrels ²
1925-----	25,000 barrels ¹	1928-----	48,000 barrels ²
1926-----	80,000 barrels ¹		

The average annual production for this period has been about 43,500 barrels. The average yield per acre accordingly lies between 20 and 25 barrels, the exact value being subject to the same uncertainty that applies to total acreage. The yield of individual plantings varies between wide limits. A few marshes have averaged as high as 70 barrels during this period.

¹ Statistics on Cranberries. U. S. Dept. Agr. Yearbook of Agriculture 1926, p. 910.

² Estimate of Wisconsin Cranberry Sales Company, furnished through the courtesy of A. E. Bennett, President.

So many factors enter into the problem of yields that it is difficult to draw definite conclusions as to the comparative productivity of different varieties or to predict yields from new developments. The great fluctuation in total production from year to year (for example, from 80,000 barrels in 1926 to 23,000 in 1927) indicates clearly that the whole district is in large degree affected by prevailing favorable or unfavorable general conditions. Marshes developed along modern lines, however, almost invariably produce crops decidedly above the average for the year.

Under the best conditions of culture, it appears that Searls Jumbo is the most prolific variety grown in Wisconsin, probably followed by McFarlin. Many strains of natives, however, give consistently good yields, and under the frequent condition of excessive wetness and weediness they often bear better crops than selected varieties.

MARSH CONSTRUCTION AND MANAGEMENT

Types of Flooding Systems

The severe climate of Wisconsin has led to the development of a uniform plan of cranberry marsh construction dominated by the water-control system. There are no "dry bogs" in the sense that this term is used in other cranberry districts. In addition to being fully equipped for winter flowage, every cultivated marsh in the state is subdivided by dikes and cross-dams into comparatively small, level sections for more economical use of water during reflows. On many of the marshes inlet and outlet ditches are further arranged in a manner that permits independent flooding of individual sections.

Eight marshes obtain water directly from streams or natural lakes, six of them by gravity and two by means of pumps. The remainder are supplied by artificial reservoirs, many of which are fed by steady or intermittent streams. In the Mather and Cranmoor districts the same water is used repeatedly by growers at successively lower locations on the watershed. Many marshes are equipped for pumping flowage water back into reservoirs during periods of water shortage.

The size of reservoir required to protect an acre of vines of course depends upon many factors, chief among which are depth of water per unit area, and volume and regularity of feeding stream. An analysis of the water supply systems in the Cranmoor district showed that on the average there are seven acres of reservoir for each acre of vines. This district is situated on an extensive, nearly level plain, and all its marshes depend upon water impounded by dams. Some of the reservoirs are partly stream-fed while others have no source of water other than surface drainage and wastage from marshes located above them. The Cranmoor district ratio of reservoir to vine area is fairly typical of the state as a whole.

Soil Types

A wide range of soil types is utilized for growing cranberries in the state. Two marshes are located on comparatively pure sand. These naturally require the use of fertilizer. The remaining marshes are planted on various types of muck and peat. Each soil type requires its own particular method of management to obtain best results. Peat marshes are on the whole most easily managed.

General Management

Two general types of management are followed, which may be designated as the "wet" and "dry" methods of culture. The former, older method is distinct from the beginning. Mowed vines are broadcast on thoroughly soaked raw peat or muck and are then shallowly cut into the soft soil by tools devised for the purpose. The water table is held high for most of the first season to give the vines a chance to root. The shallow-rooted plants resulting are not adapted to deep drainage. In some cases light coatings of sand are applied after the ground becomes vined over, but often sand is never added. The chief advantage claimed for this method of culture is its low initial cost of construction.

Only seven or eight marshes in the state are operated strictly on the "dry" basis. In this method, which is much more widely followed in cranberry regions outside of Wisconsin, cuttings are originally planted in a layer of sand three to six inches deep, and the soil is kept well drained at all times. Despite the higher initial cost of planting, this method of culture has many advantages in subsequent management, and leads to better average crops. The "dry" marshes in Wisconsin, located for the most part in the northern section of the state, contain about 10% of the acreage of bearing vines and produce more than 20% of the annual crop. The practices of resanding and better drainage are being gradually adopted on many of the wetter marshes in the central part of the state.

Harvesting

The harvest season generally extends from the first week in September to early October. The crop is harvested with the Wisconsin rake or scoop, which differs from the eastern scoop chiefly in having long handles which permit its use from the standing position. Hand-picking is done only on young or very thin vines.

About 50% of the crop is at present "water-raked" or raked on the flood. This method of harvesting appears to be growing in favor because of its unquestioned advantages in cheapness, clean picking, and slight injury to the vines with resulting higher average crops. A few of the larger growers have installed chaff-picking and drying machines to aid in more rapid drying of water-raked berries.

Selling and Shipping

Seventy per cent of the Wisconsin growers, controlling more than 75% of the acreage, market their crops through the cooperative Wisconsin Cranberry Sales Company, an organization affiliated with the American Cranberry Exchange.¹ Large-scale shipment of berries ordinarily begins about the middle of October and continues until Thanksgiving. Comparatively few growers have warehouses suitably built and located to store and ship berries during the winter months.

PROBLEMS ENCOUNTERED IN GROWING CRANBERRIES

Climatic Problems

The climate of Wisconsin presents a series of difficult problems for the cranberry grower. Vines must be adequately protected against winter and early spring killing throughout the long, severe cold season. The transition period from winter to summer condition of the marsh is attended by much uncertainty as to the best method of management. Frosts are likely to occur frequently from May, when vine growth usually starts, until late in June, when blossoming begins, occasionally in July and August, and with increasing frequency in September. Any one of them may cause partial to total crop failure. Nearly every summer some section of the state is visited by local hail storms or torrential rains which are responsible for a reduction in size of crop on affected marshes. Occasional summers are too cold for the berries to develop normal size.

The cranberry grower relies chiefly on the use of water to combat low temperatures, though sanding the marsh confers a certain degree of protection. To assist in the frost control program, the United States Weather Bureau provides special cranberry frost warnings which are sent to cooperating distributors in each section of the state and in addition are broadcast by a centrally located radio station. Frost control has been developed to a high degree of efficiency.

Insect Problems

It is customary to classify cranberry insects into foliage, bud, fruit, stem, and root attacking forms.² Wisconsin marshes are remarkably free from pests belonging to the latter two groups.

¹For a discussion of this organization see: Hobson, A. and Chaney, J. B.: Sales Methods and Policies of a Growers' National Marketing Agency. U. S. Dept. Agr. Bul. 1109: 1-39. 1923.

²Hardenberg, C. B.: The Cranberry Insects of Wisconsin. Wis Agr Exp. Sta. Bul. 159: 1-23. 1908.

Scammell, H. B.: Cranberry Insect Problems and Suggestions for Solving Them. U. S. Dept. Agr. Farmers' Bul 860: 1-45. 1917.

Franklin, H. J.: Cape Cod Cranberry Insects. Mass. Agr. Exp. Sta. Bul. 239: 1-67. 1928.

The cranberry fruit worm (*Mineola vaccinii* Riley) is the most damaging insect in the state. It is present on all marshes, though some appear to be extremely subject to injury while others enjoy comparative immunity. The total amount of damage varies from year to year. No completely effective control treatment for this pest is known, but certain water-handling methods are thought to give partial control.

The black-headed fireworm (*Rhopobota vacciniana* Pack.) ranks second in economic importance. This insect requires constant attention, as destructive outbreaks occur when it is left unmolested for any length of time. Some growers make an annual practice of holding an early June frost flood longer and higher than usual for the purpose of checking this insect. Both the yellow-headed fireworm (*Peronea minuta* Rob.) and spotted fireworm or oblique-banded leaf-roller (*Cacoecia parallela* Rob.) occurs in Wisconsin, but neither has done much damage in recent years.

The cranberry tipworm (*Dasyneura vaccinii* Smith) is prevalent throughout the state, and is often so abundant on the wetter marshes that practically all uprights are attacked. As a rule affected uprights recover sufficiently to produce normal fruit buds either on newly-developed lateral shoots or on the original uprights by direct development from lateral buds. It is impossible to estimate the amount of damage done by this insect. No direct efforts are made to control it.

Slight damage results from sporadic outbreaks of the chain-spotted geometer or span-worm (*Cingilia catenaria* Dru.), cranberry weevil (*Anthonomus musculus* Say), and an undetermined leaf miner.

Many injurious insects common to other cranberry regions are either entirely absent or are so rare that they do no material damage in Wisconsin. The fireworms appear to be the only insects capable of preventing crop production on neglected vines. Since they can be fairly successfully controlled with water, Wisconsin growers thus far have found other means of fighting insects unnecessary. Fruit worm control remains the outstanding unsolved insect problem in the state.

Weed Problems

Weed control is one of the most difficult problems encountered in growing cranberries in Wisconsin. The cultivated marshes are generally located on extensive swamp areas having a native vegetation rich in sedge, grass and other weed species which thrive under conditions most favorable to cranberries. The frequently-used flooding water has usually passed through miles of weedy swamps, collecting quantities of seed to deposit in the cultivated marshes. The wet bog floor necessary to a vine catch in the common method of planting furnishes an ideal seed bed for a great variety of weed pests, while the closely-placed, shallow-rooted cuttings are easily pulled out if hand-weeding is attempted. Even on the marshes which are sand-

ed before the vines are planted, the cost of keeping all foreign vegetation pulled out is prohibitive.

The growers have learned by experience that cranberry vines are unable to grow satisfactorily in competition with many varieties of weeds, while good crops may be produced despite the presence of other varieties among the vines. Weed control is largely concentrated on the former class, and the latter is merely given annual mowings. As a result of this system of weed management, Wisconsin marshes generally present a weedy and unkempt appearance.

The fight against pernicious weeds varies both with type of marsh and habit of the weeds. Hand-weeding, supplemented by frequent mowings, is the principal system used on sanded marshes. On unsanded marshes such chemicals as kerosene, iron sulphate, and lime are extensively employed, and greater dependence is placed on mowing. The "water cure", which consists of holding the winter flood over the vines until early July, is coming into more general use on extremely weedy marshes. Boat weed-clippers carrying motor-driven mowing-machine sickles below the water surface have been developed to increase the effectiveness of the water cure, and in some cases are substituted for hand-mowing of weeds among bearing vines.

Disease Problems

Storage rots.—Wisconsin berries are generally considered to be of good keeping quality, i. e., to be relatively free from storage and market rots. There is some evidence that this reputation is in part due to the fact that the crop is marketed early in the season. Comparative storage tests have indicated that the ordinary rots develop in about the same proportions as in berries grown elsewhere. Market rots sometimes cause trouble in seasons of big crops, when the berries move slowly.¹ More attention is being demanded in the directions of growing varieties having superior keeping qualities, and it is evident that greater precautions will be required during their harvesting, storage, sorting and shipping than heretofore.

Field diseases.—"Cotton ball" or hard rot, caused by *Sclerotinia oxycocci* Wor., is the only fungus disease of any consequence affecting plants or berries in the field. It persists in wet, mossy sections on a few marshes, but it is not of common occurrence elsewhere.

False blossom of cranberry, an infectious disease of the plant recently demonstrated to be carried by the blunt-nosed leafhopper (*Euscelis striatulus* Fall.)², is present on every marsh in the state, with one or two possible exceptions, and in many is a problem of

¹Stevens, N E and Bain, H. F.: Storage Rots of Cranberries in the 1926 Crop. *Phytopathology* 17:649-655. 1927.

Stevens, N E and Bain, H F. Storage Rots of Cranberries in the 1927 Crop. *Phytopathology* 18:809-814 1928

²Dobrosky, I B. Insect Studies in Relation to Cranberry False-Blossom Disease. *Proc. of the 53th Ann Meeting of the American Cranberry Growers' Assoc*, pp 6-11 1928

serious concern. Present evidence indicates that it is increasing steadily in adundance. Newly-planted sections of susceptible varieties when freely exposed to infection are sometimes ruined by the disease before they reach bearing age. The spread in older vines is usually slower and more variable than in younger plantings. Some of the best varieties are extremely susceptible to the disease. Reaction to false blossom has become a character of major importance in determining the value of a cranberry variety.