Wisconsin State Cranberry Growers' Association. Forty-fourth annual meeting, Wisconsin Rapids, Wisconsin, January 2, 1931. Forty-fourth annual meeting, pavilion, near Nekoosa, Wisconsin, August 12, 19...

Wisconsin State Cranberry Growers Association
[s.l.]: [s.n.], 1930/1931

https://digital.library.wisc.edu/1711.dl/B33ULKSJAR53Q9B

Wisconsin State

Cranberry Growers' Association

FORTY-FOURTH ANNUAL MEETING

Wisconsin Rapids, Wisconsin

January 2, 1931

FORTY-FOURTH ANNUAL MEETING

Pavilion, Near Nekoosa, Wisconsin

August 12, 1930

Wisconsin State

Cranberry Growers' Association

FORTY-FOURTH ANNUAL MEETING

Wisconsin Rapids, Wisconsin

January 2, 1931

FORTY-FOURTH ANNUAL MEETING

Pavilion, Near Nekoosa, Wisconsin

August 12, 1930

W. D. HOARD & SONS COMPANY
FORT ATKINSON, WIS.

LETTER OF TRANSMITTAL

To The Honorable Philip F. La Follette,
Governor of Wisconsin

Sir: I have the honor to submit herewith in requirement of law, the Forty-fourth Annual Report of the Wisconsin State Cranberry Growers' Association, containing papers read, discussions thereon, together with a financial statement for the year 1930.

Respectfully yours,

Clare S. Smith,
Secretary.

Wisconsin Rapids, January 2, 1931.

MINUTES OF THE FORTY-FOURTH ANNUAL SUMMER MEETING

Moccasin Creek Pavilion, Near Nekoosa, Wis.,
August 12, 1930.

Meeting called to order by President A. B. Scott at 10:30 A. M. Minutes of the forty-third winter meeting read and approved.

Speakers on the program were A. U. Chaney, C. M. Chaney, H. B. Scammell, E. L. Chambers, E. E. Browne, L. M. Rogers, Miss Maude Swett and W. J. Blatchley. Their papers will follow the minutes. County agents H. R. Lathrope of Wood and L. J. Kuenning of Monroe gave short talks and offered their assistance to the cranberry growers.

Moved and seconded that a vote of thanks be extended to the Wood Co. Bank for the fine noon luncheon, to the St. Ry. Company for the use of the pavilion, and to Mr. H. B. Scammell of Toms River, N. J., for coming and addressing the meeting, also to Mr. L. P. Daniels for the candy and cigars.

Moved and seconded that the winter meeting be held the first Wednesday in December, with a banquet following.

Motion made and seconded that the chair appoint committee of three to work with the Conservation Commission to draft new regulations in regard to fire permits. A. E. Bennett, Herman Gebhardt and Guy Potter were appointed.

Motion made and seconded that the Association put on a creditable exhibit at the State Fair.

Motion made and seconded that President appoint a committee to take care of the county fair exhibit. President appointed the secretary to take charge of both exhibits and get help if necessary.

Guy Potter, S. N. Whittlesey and Guy Nash were appointed to draft resolutions of regret on the passing of Robert Rezin, Sr.

Meeting adjourned.

CLARE S. SMITH, *Secretary.*

CROP ESTIMATES

By Mr. A. U. Chaney

If the Wisconsin crop carries through according to the present guess, the estimate has been placed at 45,000 to 50,000 barrels. There have been no complete reports, only statements from individual growers in different parts of the three states. Based on a rather personal canvass of Mr. Benson and Mr. McGrew, and letters from different parts of Massachusetts, we are now placing the Massachusetts estimate at 360,000 barrels, or 40,000 barrels less than last year. These figures may be changed when we get in the complete estimate. Certain sections on Cape Cod proper have been very dry, having had no rain from April until a short time ago and dry bogs are simply burned up. Bogs which produced very heavily last year have a very light crop this year. The crop is earlier around the Cape—apparently one week earlier than normal. From appearances, there will be more Early Blacks than last year in both Massachusetts and New Jersey, and less Late Howes. Most of the shortage on Cape Cod is on late varieties, particularly Late Howes. In New Jersey there are all sorts of guesses, but the estimate was based on the returns from the Philadelphia office of about half the members of the Sales Company. Based on their guesses, against what they shipped last year, it would indicate that the state would have 125,000 to 135,000 barrels, as against 90,000 last year. I am inclined to think it will be about 125,000. Based on that report, if it comes through, the crops of the country would be practically the same as last year. Oregon and Washington, according to a wire a month ago from the president of the association, are figuring on 12,000 barrels, as compared with 12,500 last year. This estimate may have been reduced or increased since then. Figuring New Jersey 125,000, Wisconsin 48,000, and Cape Cod 360,000, it would make 545,000 for the country, as against 544,000 last year.

As to the market prospects, that is very hard to estimate. You people sometimes say a crop is "spotted"; the same term might be used in regard to the market conditions. Farm crops are very bad in certain sections of the country. How this will affect matters is hard to tell. My brother really knows more about it today than I do. He is really the sales manager of all the eastern berries, and is in closer contact with the trade lately than I have been. What information I can give you, I have gotten mostly from him. When there is a surplus it is hard to get a price. There was a surplus of green corn and beans this year, and the prices were very poor. In regard to peaches, there was a very short crop throughout this part of the country, but California has a large crop, and is selling them very cheap. They are selling, delivered in car lots, at seventy-five cents per box. They are quoting them in California at fifty cents a box for Alberta peaches, which is very low. Based on the crop of last year, I expect the Early Blacks may open a little lower

than last year, because there are more. We cannot say definitely whether we will get last year's prices. We ought to get them. Conditions may change entirely. We will have to sell more berries in some places, and probably less in other places. It will mean very close handling.

Note: Report now indicates the Massachusetts crop was 385,000 bbls., New Jersey and Long Island 144,000 bbls., Wisconsin 40,000 bbls., Oregon and Washington 6,500 bbls.

MARKETING CONDITIONS

By C. M. CHANEY

I am a cranberry salesman—not a grower; therefore there is not much that I can say on the growing subject.

It seems as though the food business, especially fruit, as a result of the general depression, has not suffered as to volume as much as other lines. The people will eat. In some of the markets that I have visited recently the volume has been ahead of last year, although prices generally are on a much lower basis than a year ago. It seems that with a normal supply of any particular line of fruit or vegetables sales are liberal at reasonable prices, but with a little over normal supply there is trouble, and many commodities with an oversupply at the present time are selling at ridiculously low prices. At the present time there is an oversupply of California peaches, and they are selling at unreasonably low prices. I understood the other day, when in Milwaukee, there were standing on track in that market over 30 cars of California peaches that were still owned by the shippers, and they were trying to get offers on them. Of course this particular crop of California peaches came on the market all at once, and during abnormally warm weather.

It looked for a while as though we were going to have a surplus of cranberries, i. e., more than a normal crop, in which case I believe we too would be in trouble.

There seems to be no speculative feeling among the dealers, and I do not think there will be any this fall. It is the final consumer that we have to depend on for the sale of our cranberries, and it is up to your selling agencies to figure out what the consumer will pay for the entire crop. The season ended up well last year, and we usually have a good year following a good year, as a good ending of one season leaves a good feeling with the trade for the following season with reference to that particular commodity. That is one advantage we did not have last year. I am, however, somewhat dubious about getting last year's prices, for as you know they were fairly good.

What we need mostly is a general improvement of business conditions so that the people of the country get a more optimistic feeling. Everybody seems to be pessimistic. I hope in the fall, when our crop begins to move, they will get out of that attitude.

About two weeks ago I attended a National Co-operatives Convention in Columbus. One of the officials of the association was telling me about figures that he had from the telephone company, giving statistics of depressions since 1884, which showed that when there had been a depression running from six to eight months that conditions would begin to improve with the moving of the crops, usually in September. This is about the time that cranberries begin to move, and I hope that this year won't be the exception.

Conditions generally do not seem to be improved very much from what they were about eleven months ago, except that the fruit jobbers and brokers are doing a good business at the present time as to volume. One reason for this, I think, is that the large buyers and chain stores are not speculating; in other words, they are not buying in volume in advance, and consequently are buying more from the local jobbers and brokers.

CRANBERRY FALSE BLOSSOM FROM THE VIEWPOINT OF THE GROWER

By H. B. Scammell

It was indeed very kind of your president, Mr. Scott, to invite me to come to your meeting. I fear, however, that I am going to take away with me much more than I can bring to you. On my last visit here the title of doctor was accorded me and this time Miss Smith has addressed me as professor. I lay no claim to either of these titles. In fact I find distinction enough in being listed merely as a grower of cranberries and blueberries.

The story that I have to tell is not a pleasant one and it does not paint a glowing picture of cranberry growing in New Jersey. It is of a most discouraging nature and I am impelled to speak of it because it seems to me the time has come to cease mincing words about false blossom. Referring to the title of this paper, "Cranberry False Blossom from the Viewpoint of a Grower", it may seem somewhat ambiguous to you but, at any rate, it is not misleading because I can say without fear of contradiction that I am engaged in the growing of false blossom as well as in the growing of cranberries.

When I visited you in 1923 there was no opportunity, owing to the wintry weather, to examine your marshes so that my knowledge of false blossom in your state has been obtained from the reading of reports or from conversations with investigators who have made a study of your problems. It would be extremely unwise of me, therefore, to attempt any discussion of this disease except as I have seen it on my own stamping ground.

Stevens, Franklin and Bain have been the leaders in pointing out to all of the cranberry growers the dangerous nature of the false

blossom disease. At times there have been some who have made light of their predictions and of their efforts to acquaint the growers with the facts concerning the disease as they have found them. This is, of course, a quite natural trend of affairs but I am glad to have the opportunity to say that I believe, most thoroughly, their work has been well and conscientiously done. I find that too much emphasis has not been placed upon the seriousness of the disease. Some of our growers who, as recently as two years ago, clung to the opinion that conditions were being exaggerated have swung around to the view that false blossom is truly rocking the cranberry industry. Speaking for New Jersey, in my opinion, the boat has not only been rocked but has shipped a lot of water.

False blossom has spread rapidly in New Jersey from the time of its discovery there in 1915. The following year I made an effort to determine if aphids were carriers of the disease but was unsuccessful in proving a case against them. Three or four years later we found a small but very severe infection of false blossom on a section of native Jerseys in what is known as the New Guinea bog. Just over the dam lies the Sweetwater bog containing eight acres of Howes, planted in 1917. The infection of the Jerseys was complicated with a bad case of girdlers and to complete the picture rot was so prevalent that little crop was harvested. This area was turfed and replanted, the variety chosen being Howes. Not at all did we suspect the enormity of our mistake. Howes were doing well for us and we wanted all we could put in. The Sweetwater bog gave promise in its early days of being an excellent producer. However, infected vines must have been planted there when the cuttings were taken from our main Howes bog, the vines of which were obtained from Massachusetts in 1910. The Sweetwater infection spread rapidly and has now reached the point where it is no longer profitable to continue cropping it.

The winter flowage of 1927 was allowed to remain on this bog until the following tenth of July to control the inroads of the girdler and to determine what effect the so-called water cure would have on the false blossom infection. Diseased vines were marked before flooding and an examination at the end of July showed only ten per cent had died. This bog appeals to me as a typical case of what may be expected of a new planting of Howes when exposed to false blossom infection with improper facilities for reflowing. The crop record of that bog is an interesting one and quite enlightening although very discouraging. The yields are as follows:

1921	5 crates	1926	728
1922	85	1927	water cured
1923	133	1928	662
1924	441	1929	386
1925	731	1930	250 estimated*

*Actual yield 197.

Judging from the appearance of the bog this season the time has arrived to eliminate this planting of Howes and to substitute a resistant variety. But what variety shall we plant? McFarlins are obtainable in the state but are not looked upon at present with favor. Champions, which seem to be popular with quite a number of growers, have been suggested. A thorough inspection of a Champion bog, made in company with Messrs. Stevens, Wilcox and Beckwith, a few weeks ago, revealed an advanced case of false blossom, so I have definitely scratched that variety from the list. In the native Jerseys lies a possibility of securing a resistant variety by selection and testing, a work in which Miss Elizabeth White is energetically engaged. However, that is a piece of work that will require much time and all the while there are bogs that need replanting. The Centennial variety produces marvelous fruit but is fully as susceptible of the disease as the Howes. The varieties known as Woolmans and Richards I have found this summer to be seriously infected. We come finally to that old standby of the Cape, the Early Black. This variety is standing up well in New Jersey and growers who have replanted in recent years or who are contemplating replanting are turning to the early black. While it is true that the Blacks are showing little infection for the most part, examples have been found that show considerable infection. The berries are liked by the canners and are good croppers.

As an instance of what annual reflowing has done for a bog of Howes I should like to cite the case of a well known bog in our territory. This area was planted in 1910 with Howes and Blacks sent down from Massachusetts. There is little doubt but that our false blossom troubles arrived with that purchase. Up to date the bog has been by far our most profitable one. It can be reflowed from a large, live stream that rambles through it and in recent years we have added a reservoir above it that gives an ample supply of water. If the reservoir is emptied into the bog at night for frost flooding, the stream entering it unfailingly fills it the next day for use the following night. The bog has been reflowed regularly each year for insects and frequently for frosts. Sweeping with a net this past June I had difficulty in finding a single leaf hopper. The average of the Howes crops obtained here in the past ten years amounts to 4154 storage crates while the estimated crop for this year is 4000 storage crates. While new plantings of Howes cut from this bog have come and waned this bog is still highly productive. Nevertheless, in spite of all the reflowing that has been given it false blossom is on the increase and these Howes seem to be doomed.

During the past summer, I have had the opportunity to see many bogs in New Jersey and have paid particular attention to the amount of false blossom to be found upon them. Everywhere I have found the disease and I regret to say that I know not a single bog that is free of it. To a number of New Jersey properties it has proved almost ruinous and the end is not in sight. I want to con-

vey to you as strongly as possible, that we believe we are up against the most damaging invader that ever has overtaken our industry. The fight has been waged only five years in New Jersey because we were not roused to the importance of it until Dr. Stevens came into our midst and made startling discoveries of the extent to which the disease has spread and traced infections back to their original sources. It was Stevens who laid all his information on the table at the Boyce Thompson Institute for Plant Research which resulted in the securing of the services of Miss Dobroscky for the assignment to determine what insect, if any, was responsible for the transmission of the disease from plant to plant. That she succeeded in fixing the guilt upon the blunt nosed leaf hopper is now a matter of record later corroborated by other workers.

In this connection it is somewhat disheartening to hear the assertion made by certain growers that false blossom is brought about entirely by scooping or, in other words, that it is a mechanical injury.

Various methods of bog management designed to stop the spread of the disease or to kill the infected vines have been tried. The experiment of water curing two years in succession was given a trial and found wanting. It will not be repeated, at least by that particular grower. Water curing for one season is practiced frequently with us and is to be recommended for insect control. It is my experience that vines which have been injured by the cranberry girdler are likely to die under the water cure and I believe that some growers have counted such dead vines as killed false blossom vines.

Where flooding is not practicable my belief is that spraying of new plantings to reduce leafhopper infestations may be money well spent if the work is very thoroughly done, but on old false blossom infected bogs spraying has not been shown to be a profitable practice. Most of us would like to continue growing cranberries but to make a success of the business my conclusion is that we must seek new and false blossom resistance varieties to replace those that are falling into the discard.

DISCUSSION

QUESTION: How do you apply the flood?

MR. SCAMMELL: We hold the winter flood on the bogs until the 10th of May, and reflow about the 12th of June. That is about as late as we dare reflow without injuring the crop. It takes just a short reflow at that time.

QUESTION: What do you mean by a short reflow?

MR. SCAMMELL: Get a full flood on the bog and then start to take it off. One bog that we reflow contains about fifty acres in all. We reflow it all with one dam. We can fill that bog over

night, and when it reaches the full head leave it a few hours longer and then start to draw it. On small sections, such as you have in Wisconsin, it is best to maintain the full head for twelve hours.

QUESTION: How do you treat the dams?

MR. SCAMMELL: If the leaf hoppers are very abundant, they should be treated with a kerosene spray. Perhaps Pyrethrum spray would do as well, but we haven't tried that.

QUESTION: Do you ever spread the kerosene on the water and let it down to the dams in that way?

MR. SCAMMELL: No. I have heard that recommended, but haven't tried it.

QUESTION: How long a submergence does it take to drown the leaf hopper? Does it require three or four hours?

MR. SCAMMELL: We think so. At that time they are in the immature stages, with very few adults, and a short wetting is all that is required.

QUESTION: What would be the corresponding dates in Wisconsin?

MR. SCAMMELL: I don't know. Perhaps Mr. Rogers could tell you. The point is to do your reflowing after all the leaf hopper eggs are hatched.

QUESTION: It does not depend upon a condition of the advancement of the plant at all?

MR. SCAMMELL: That figures in it, but of course you want to get all the eggs hatched, and in order to do that you must wait about as late as you dare without risking injury to the vines. With us it happens to be about June 12.

QUESTION: How about the temperature of the water? Do you have high or low temperatures?

MR. SCAMMELL: In our particular bog we have a flowing stream, and I think the water is cooler than where it is drawn entirely from a reservoir. As to the actual temperature, I cannot say.

QUESTION: How long is the hatching period?

MR. SCAMMELL: I do not know exactly when it begins, but it continues until about the 10th of June. From the time the water is drained off on the 10th of May, I believe hatching goes on for about a month.

QUESTION: Where are the eggs laid?

MR. SCAMMELL: The eggs are laid on the uprights, under the bark.

QUESTION: On the under side of the leaf?

MR. SCAMMELL: No. There is a species of leaf hopper that lays its eggs in the leaf, but I believe Mr. Beckwith and Mr. Hutton found that these eggs are laid under the bark of the uprights.

QUESTION: Do you consider that the leaf hopper is responsible for the false bossom, or that it carries the disease?

MR. SCAMMELL: That it carries the disease, and is the main factor in the spreading of the disease.

QUESTION: What stage of growth are they in at that time? Are they in the hook stage, or starting to hook?

MR. SCAMMELL: Hardly in the hook stage. Just before that, when there are plenty of very tender uprights formed.

QUESTION: What is the difference between the flowing for fireworm that we have in Wisconsin and the flood you describe? Would it be on a similar date?

MR. SCAMMELL: We have to flow a little earlier for fireworms than for leaf hoppers. Our practice is to flow on or about the 28th of May for the blackhead fireworm.

COMMENT: I think the fireworm hatches a little later here than in New Jersey.

MR. SCAMMELL: In New Jersey it begins to transform into the chrysallis about the 28th of May, and if one reflows after it is in the chrysallis stage it is too late. It takes at least three days under water to kill the chrysallis.

QUESTION: When do you have full bloom?

MR. SCAMMELL: Approximately the 4th of July.

QUESTION: Would you be in danger of getting false blossom if you had no false blossom on your bog, but had leaf hoppers?

MR. SCAMMELL: You wouldn't be likely to get it if you had no nearby source of infection.

QUESTION: A mile away?

MR. SCAMMELL: A mile away would be fairly safe.

QUESTION: Isn't there some other host of the insect besides the cranberry?

MR. SCAMMELL: It is said to attack the blueberry. Whether it has been found in recent years on blueberry and huckleberry, I do not know. I imagine Mr. Rogers or Mr. Goldsworthy could tell you more about this than I.

MR. GOLDSWORTHY: So far in Wisconsin I do not believe they have discovered any other host.

MR. SCAMMELL: It is said to be found on huckleberries. I do not think they are finding it there now, however.

MR. F. R. BARBER: What method would you recommend for destroying a bad section so it wouldn't be a menace to the other bogs?

MR. SCAMMELL: What we plan to do in our Sweetwater bog is to put it under water and keep it there until we get ready to replant it. If it is not convenient to do that, I saw a case in Wisconsin where a section had been burned off and disk harrowed frequently. It looked very hopeful that they would kill the vines on that section.

QUESTION: Where does it increase most rapidly, on a poorly drained or well drained bog?

MR. SCAMMELL: I can see no difference. It increases more rapidly on a young bog than on an old bog, however.

SOLVING CRANBERRY TROUBLES

By E. L. CHAMBERS

Mr. Scammell in his talk on cranberry false blossom brought out the fact that there still is need for a lot of research and investigation before we can make any definite progress in its control. One thing we apparently are all agreed upon now is that false blossom is every bit as serious as some of our disease specialists have been claiming it to be, which is an indication of making some progress since only a few years ago we used to hear some of our growers belittle its importance and dismiss it with the statement that if that was the worst problem the grower had to contend with they would have no need for concern. Now when this subject is mentioned at a meeting there is a very apparent silence and every ear is turned in hopes that something has been found that will offer means of immediate relief and insure the future of the industry and put it on a profitable basis.

Although without any doubt virus diseases of this degenerative type have been existing for ages past, they have been clearly recognized and studied only in recent years. Some of them as you know rank among the most destructive of the plant diseases we now have. There are at least two good reasons for these diseases becoming a subject of investigation at the present time, one being that we now have trained specialists to do the work and the other reason being that in our attempt to get size, color and other characteristics of the fruits of various crops, we have been sacrificing vitality of the plant and making them more subject to all kinds of maladies. To date our specialists have been unable to find any parasite in the diseased tissues of the plants infected with these troubles, but in view of the ability of the infective "principle" to multiply and spread within the host they are often supposed to be caused by organisms which they speak of as being ultra microscopic in size. Practically every one of the troubles appear to be spread by insects which, after feeding upon diseased portions, are apparently able to transmit the disease to other plants previously healthy. In contrast we know, of course, that the organisms causing malaria and yellow fever are carried by certain species of mosquitoes and by eliminating these specific mosquitoes it is possible to bring an epidemic of these diseases completely under control. In the case of these human diseases we have a definite organism which spends a part of its life cycle within the body of the insects in question before they can cause new infections.

Apparently one of the best methods science is finding to reduce losses from these troubles, where the insect Vector is known, is to reduce the population of the particular insect in question either by screening, as in the case of aster yellows to keep the aster leaf hopper from having access to the plants, or by spraying to reduce the insects on the plants, as in case of the cucumber beetle and the

various aphids known to be carriers of this virus from one plant to another.

The most satisfactory method of procedure in event a crop is isolated a considerable distance from other crops of the same plant that may be infected, is to secure stock reasonably free from the malady in question and with this idea in mind we have restrictions on the certification of cranberry vines both as to inter and intra state shipments. On the other hand, where the disease cannot be avoided, the next best thing to do is to plant only the most resistant varieties of cranberries, raspberries or whatever crop it may be and thus escape as much loss as possible.

The development of resistant varieties is coming to be recognized as the best solution of a problem of this nature. England and certain other countries of Europe are a step ahead of us in this work and they have already developed potatoes immune to early and late blight so that they need no longer spray for these. We have been hearing much of late about the new red raspberry developed by the Minnesota Experiment station called the Chief, which its originators make great claims for in behalf of its apparent resistance to the raspberry mosaic and other diseases so disastrous to the raspberry growing industry. Just how much immunity this new variety has remains to be seen and we have some of them under observation growing in our own garden. This variety has been developed from many careful selections and the same method will have to be followed in developing varieties or strains of cranberries exhibiting immunity to false blossom. Plants will have to be selected from bogs where they have been growing exposed to the trouble without apparently taking it and then these plants will have to be crossed and bred up to develop a fruit having the size, color and quality suitable for the market. This sounds easy, and it is easy, but it cannot be done in a few years, it may take a couple of decades but it will have to be done. Growing naturally in the wild state, many plants appear to suffer relatively little from insect attack as compared with their cultivated relatives. They apparently have acquired, through many thousands of generations a degree of tolerance to such interference, where as cultivated varieties of these same plants suffer severely from repeated infestation. This difference in plant response appears attributable to the fact that larger quantities of one plant growing together rather than a variety of plants encourages a greater insect population and affords a more stable food supply and in developing certain desirable characteristics others were sacrificed. Absolutely resistant plant varieties are of course of great rarity, and by resistance we mean that there is a low degree of susceptibility due, probably to no one factor but to many. Among these factors the more common ones include, thickness of cuticle, presence or absence of hairiness, acidity or alkilinity of the cell sap, date of maturity, general lack of vigor, etc.

The livestock breeders likewise find that through years of intensive breeding to maintain shape and color they too have sacrificed vigor and it has been recommended time and again that scrub blood should be introduced into these herds to restore some vitality.

In our field work we are trying to determine the insect populations on your various bogs throughout the state which will give us some clew as to some possible Vectors for false blossom in addition to the blunt nosed leaf hopper *(Euscelis striatulus)*, which species of leaf hopper has already been pretty well proven to be one species capable of spreading false blossom. To this end Mr. Goldsworthy has been setting light traps with automatic "shut offs" operated by alarm clocks and has collected thousands of species of leaf hoppers including more than a score of different species several of which are suspected as possible Vectors of this disease and a few, including the aster leaf hopper that are already known to be Vectors of other virus troubles.'

Usually when such an important disease is discovered, for the first time on a crop the owner exclaims that there ought to be a law protecting the public from having such troubles spread around. There is such a law in the state nursery inspection statute which requires that all nursery stock which includes cranberry vines must be inspected and certified as being free from dangerous insect pests and plant diseases. In addition we have special raspberry mosaic and cranberry false blossom regulations limiting the movement of such stock from other states where these viruses are present. Plant quarantines are established for the purpose of checking the spread of insect pests and plant diseases but none are complete in themselves but require public support without which they are no more effective than laws against selling liquor, committing murder and other crimes.

The work being done in the field at the present time includes the study of the life cycle of the blunt nosed leaf hopper and other serious pests to the cranberry industry in Wisconsin with the idea of working out their life history and thus determining in what stage the insects winter, when they become active, when the eggs are laid and hatch, etc., in order to determine the best time to make an attack for best results.

In handling any pest there are four things the growers must keep in mind: first, know your pest, how it feeds, when and where. Second, know your poison, whether it is soluble in water, a stomach or a contact poison, etc. Third, know your plant and its weaknesses. Fourth, follow directions. Just because twice the dose sounds quicker don't double it without knowing what effect this may have on the cranberry vines. It has recently been discovered that Bordeaux sprays, besides acting as repellents to leaf hoppers, also leaves a copper coating on the foliage which acts as a stomach poison when fed upon by these pests.

CRANBERRY CULTURE IN WISCONSIN

By Mr. Lawrence Rogers

I will take this opportunity to present for your consideration some ideas concerning cranberry culture in Wisconsin.

One thing that seems very important is close observation. Many things which when viewed casually seem of no consequence, lead directly or indirectly to much benefit or injury. There are many things happening on the marshes that cannot be discovered by walking along the dykes. We must get down among the vines to really know what is happening there.

I have often been asked, "Would you plant on sand?" That question can hardly be answered yes or no. It is generally agreed that at the time a marsh comes into bearing, say five years old, it should have a considerable quantity of sand over the peat. Yet I would say no, unless you have two or three feet of quick drainage and very coarse free sand nearby. At least 75 per cent of the Wisconsin marshes do not have such environment. On these, I would be very careful in preparing the bottom not to grade in any bad weed roots and then would plant vines on the mud by the present "stamping" method, using vines freely and taking great care in distributing them. A bad feature of this culture is that the water must be kept near the surface the first season, making weed seed germination certain. The first year, and for that matter every year, I would go over the marsh often taking out the most vicious weeds, leaving the annuals and all others that can be controlled later by drainage or mowing. The second season I would take the water down to induce the roots to go after it. The third and fourth seasons I would lower the water to the bottom of the ditches, raising it only in time of extreme drouth. The amount of sand to use will be controlled by the vine growth, but as much as possible should be put on during the third and fourth winters, care being taken not to cover the uprights. New shoots will come from the runners through from one-half to two inches, according to whether the sand is packed or remains loose.

If planting on sand, use the same care in getting out all bad weed roots and cover the peat with a layer of sand two to three inches deep. Plant with a dibble, pushing the vines well down through the sand into the peat. It is important to spread the vines apart in the hill and press the sand firmly and closely about the plants. In this method of planting it should not be necessary to raise the water except possibly in extremely dry weather and few weeds should appear the first season.

The second season the vines may need to be protected from frost and weed trouble will be likely to follow. Soon after planting, about 200 lbs. of Nitrate of Soda per acre, carefully applied, near but not on the hills, would be a help. If a slow growing bottom, 250 lbs. is not too much. In fact, I think 250 lbs. not too much on most if not all Wisconsin marshes. If at the end of the second season the vines

have not made sufficient growth, the same amount may be applied broadcast the following June or July. A light coat of sand should be put on at least once before the vines reach bearing age. Some heaving the first winter may be expected, but if the lifted vines are heeled in as soon as the water is removed and the vines have been fertilized and have a good root system, they should not be very much retarded.

Another thing I wish to express an opinion on is frost flooding. It is pretty generally conceded that an excessive number of floodings causes an abnormal vine growth at the expense of the fruit. To prevent this, growers should strive to have their water nearby and have gates large enough to flow each section quickly. Under these conditions, flooding can be delayed until the mercury gets well down towards freezing and many times clouds, wind or fog may appear on the end of the high and may be passing, and the temperature will not drop lower than freezing, making it unnecessary to use water. A few floodings saved in this manner during a season may mean the difference between a heavy and a light crop. To learn when to flood and when not to, growers should begin to watch the drop at dark and note the fall every half hour through the night until the daylight. Continue this for many nights, carefully noting weather conditions, weather map, barometer, and the kind of warning received. After keeping notes in this manner for a number of seasons and studying them carefully, you will be able to tell within a very few degrees how long your thermometer will go and determine whether to flood or not. When a season is getting near the end of the probable frost period and you have not flooded often, there would not be the need to take as much risk in holding off the flood as you might take if you thought you had used all the water the vines could safely stand. In making observations, I would always use the same location but would check by thermometers placed in other permanent locations, carefully noting wind direction and condition of bog, (whether recently sanded and amount of vine growth).

It is a good policy to have a thermometer for a check in some nearby lowland where it will not be affected by the flooding water, as sometimes while you are flooding the temperature will moderate and otherwise you will be unable to detect it, thereby using water unnecessarily. I do not think it wise to work from the very coldest place on the marsh; it would be better to lose a few small areas each year than to flood the whole marsh to save them.

Another thing that should receive a great deal of study is, how early in the spring to protect the bud. For example, some night about the middle of May you estimate the temperature will drop to 25 degrees. The question before you is will your buds stand that amount of cold at their present stage of growth? If you don't know anything about it, you will have to flood. If you feel from having studied the matter that your marsh will stand the estimated temperature without injury, you may save the flooding. Buds that have

started quickly from having excessively warm weather just before a cold night will stand less frost than buds arriving at the same stage of development by a slower process.

The "water cure" is practiced by quite a number of growers. Generally a few acres are treated each year. As a weed killer, I think its success is doubtful. Wide leaf, bluejoint and a few others may be controlled, but many kinds are likely to seed in; some that were not there before. As a method of renewing the vines, it seems excellent, many uprights appearing near the root system and good crops following for several years. Very old marshes that have not been sanded, especially if filled with wide leaf or infested with blackhead, would be very much benefited by the water cure. I do not know very much about this method, but conclude from what observations I have been able to make that one should proceed about as follows: Let the winter flood off at the usual time, giving the sun a chance to kill the algae grown during the winter submergence. Then flood bebefore the vines have made any growth. Hold the water until about the 10th of July. Rolling is considered a part of the water cure, but I have not come to any conclusion as to when it should be done or how much of it.

During the past few years there has been considerable effort among the cranberry growers to obtain some weed killer that would help them in the fight for cleaner marshes. So far, I fear little progress has been made. In 1929 we experimented with some of the recommended chemicals, condemning most of them for the reason that the vine was killed as early as the weed. We found the cranberry vine more or less resistant to sulphate of iron, sulphate of copper, and kerosene. We found that sulphate of iron, sugar form, applied dry at the roots, killed Buck Bean, Sensitive Fern, and Feather Fern, but would need to be repeated as all of the plants would not receive the required amount at the first application. We tried the Sulphate of Iron on many other vicious weeds, but with only partial success. As a spray, Sulphate of Iron will kill the tops of many weeds without greatly harming the vines, but does not seem to sufficiently injure the weed roots. We sprayed with Sulphate of Iron, one quart to four quarts of water, on Star-grass June 25, 1929. This turned the tops black, but later new shoots appeared. On July 9 we repeated, and again on July 30. Examination about the middle of August showed both top and root apparently dead, but in June, 1930, some shoots appeared. We estimated this experiment to be about 85 per cent successful. This summer we are continuing the Sulphate of Iron trials, both spray and dry, and are also working with Copper Sulphate, which we hope may prove of more value than the iron. Many of the growers are using kerosene, and will probably soon arrive at some definite conclusions as to its value. I have observed the results of many applications and conclude that good work can be done with it under favorable conditions. These conditions seem to

be hot weather and dry soil. With so many working at this, some definite method of application should soon be established.

Budding was very light in 1929. This was somewhat due to the July frost and the late working of the tip worm, but more to some unknown reason. Budding in various fields ran from 30 to about 60 per cent. Vines of medium thickness carrying 45 to 50 per cent of well formed fruit buds would be able to produce a large crop. It is doubtful if more than a 70 per cent budding on thick vines would be desirable. This season the marshes are showing a very good budding, even at this date, which is quite unusual. If they do not start growing again they should be well hardened to stand the winter.

Wisconsin growers resanded about 300 acres of marsh last winter. This is a very good record, but one I hope they may surpass the coming winter.

This season was very favorable for the control of the blackhead fireworm. The warm days the first two weeks in May hatched many of the eggs earlier than usual and the heavy flooding necessary for frost protection about the middle of the month and again toward the end gave a considerable degree of control, making a special flooding unnecessary. A few growers did make a special flood with more than usual success.

I wish to congratulate the Wisconsin cranberry growers on the close estimate they made on last year's crop, and hope the crop this season will also come well up to the estimate.

CHILD LABOR LAWS AS APPLIED TO THE CRANBERRY INDUSTRY

By Miss Maude Swett

I am glad to be here this afternoon to speak to you about the Child Labor Law, because I think there is some misunderstanding on your part as to how the Child Labor Law applies to your industry.

All labor legislation is an outgrowth of the recognition that there are certain evils possible in our highly complicated industrial system; that it is to the interest of all that these evils be remedied, and that the problems of industry, therefore, have become social problems. One of the evils is that of child labor. Child labor has been defined as the working of a child under such conditions that it interferes with his physical development, his education, and his chance for a certain amount of recreation which all children need if they are going to develop into normal men and women. If it means that, the purposes of a good Child Labor Law are twofold: First, that every child shall have a chance to become a strong man or a strong woman, and second, that they shall also have their educational chance—a chance for at least a common school education. That is not a lot to ask for any child. To attain these purposes, there must be some restrictions set around the employment of children. We may not all

agree as to what those restrictions should be—but, as our guide, we must take into consideration the welfare of the child and not the needs of the industry or the needs of the family of the child.

We must have, then, certain restrictions as to the minimum age at which children may go to work, the hours they may work, and restrictions as to how much education they shall have before they may start to work. The Wisconsin law provides and sets those standards for industries other than agriculture. In the beginning, our law, as the laws of all states, exempted agricultural pursuits on the theory that working at agricultural pursuits meant doing chores around the home farm, etc., and therefore it is not necessary to have it included in the Child Labor Laws. But there has come about a change in some kinds of agricultural pursuits, so we now have what is spoken of as "industrialized agriculture" and children work under foremen, in gangs, etc., under much the same conditions as in factories or stores, except that they are out of doors. Sometimes they are exploited in some of these kinds of industrialized agriculture. The Legislature felt it should bring under the provisions of the Child Labor Law certain types of agricultural employment of children in the state, but it didn't feel that it was wise to set up the same restrictions that it had for other employment because of the administrative difficulty, for one thing, of enforcing the law. The Legislature says that children under 12 shall not work at all except in agricultural pursuits. Children under 14 and over 12 years of age may work during vacations at certain limited occupations but to work during the school term, a child must be fourteen years of age, and must have finished the eighth grade or attended school for nine years if he has not finished the eighth grade.

In 1923, the Legislature gave the Industrial Commission power to establish regulations to protect the welfare of children who are working in industrialized agriculture such as in gardens controlled by canners, in cherry orchards, market gardens, cranberry marshes, and sugar beet fields. The Commission to date has only made regulations for one of these industries, and that is the sugar beet fields. We felt that there the children were actually being exploited. In this section, you do not have sugar beet fields and probably do not know of the situation. The children are brought in from all sections of the United States, from Texas, and as far north as Canada; there are a great many from Nebraska and Colorado. They are brought here sometimes following some other harvest, or taken out of school in April and brought to Wisconsin with their families long before they are needed so some other state won't get them for their beet fields. They do not attend school here because school will soon be out. The community says, "What is the use? They aren't going to be here long." In the fall they say, "What is the use of starting in September?" They will have to be kept out in October to harvest the beets. So they don't get back to school until way into November, if at all. It was found in a survey that over 65 per cent of those

harvesting beets were minors, and over 60 per cent were under twelve years of age, many under ten, and quite a number were eight and nine. Even though our compulsory school law said children under fourteen should be at school at least six months of the year in the rural districts, these children were not there. The regulations provide that children under fourteen years of age shall not work in the sugar beet fields while school is in session, and shall not work over eight hours per day or forty-eight hours per week. Eight hours a day for a youngster under fourteen we felt was enough. Finally, through working with the county superintendents and school teachers, the situation as to school attendance is improving.

We also have kept watch over the employment of children in the cherry orchards. We are finding this a different proposition. This is a vacation proposition. Hundreds of the children are brought together to live in camps. The problems there are housing, sanitation, supervision, and recreation. This year we had a very serious problem with the lack of supervision in one of the girls' camps. We have not made any regulations in this regard; the cherry growers made the regulations themselves, but we had to say to that camp, "We will give you one more chance. If you do not see that these girls under sixteen are properly supervised, we may have to make the ruling that we won't let girls under sixteen work for you." These regulations would probably have to apply to the whole industry. We do not make regulations unless we have to and so long as the industry establishes proper conditions of employment for the children, we shall not need to.

When we made our survvey in the cranberry marshes, we found that on account of the change in your methods of harvesting you were not using children to the extent that you used to, and found that you were not keeping them out of school. They were local children, largely, or from nearby localities, and were back in school in September. Our force and money is very limited, and we haven't felt the need so pressing with children in the cranberry marshes as with children in the beet fields, where they actually were being sadly exploited. So we spent our time and energy there.

We will never make rules and regulations in regard to employment of child labor on the marshes without the help and advice of you growers. Preliminary to making regulations, we want to know what the situation is. We haven't visited you of late, because we have been so busy taking care of these other matters. We should know to what extent children under sixteen are employed by the growers; whether they are local children so they can go home at night, or whether they are brought there to live; if so, whether they are there without their parents; how they are housed; what supervision they have, etc. At the time we made the survey, we didn't feel the situation was such that we needed to make regulations. They were telling me today that a child was injured while working with his father, and the insurance company, which is used to dealing

with other employers in factories, stores, etc., who may employ children illegally, and who are subject to the double and treble liability provisions of the compensation law may have made you feel that you are liable to the same double and treble compensation provisions of the workmen's compensation law. If we should adopt an order which said that you must have a permit to employ a child, you would then be liable under that law if you employed the child without a permit. The factory owner must have a permit to employ a child under seventeen. If he has said he is over seventeen, the responsibility rests with the employer to know that he is telling the truth. If a child is employed in that case without a permit, the employer would be liable for double compensation and if employed with a permit but at a prohibited job such as running an elevator, that would call for a triple compensation, and if the child were seriously injured, it could amount to a lot of money. That has helped to make employers realize their responsibility. That provision was put into the law at the request of the employers as they felt that they would rather have some limit fixed upon the amount of damages that the child could get under a law suit. The regulations are no stricter as to responsibility for illegal employment than before the employer was brought under the workmen's compensation law and as the child labor law stands now, there are no regulations which apply to cranberry marshes, so double and treble liability do not apply. The question now is, do you feel that there is a need for a law or aren't you using children to any extent? If we visit you this year, it will be only to find out what the situation is, so that if someone makes the statement that we are not enforcing the law as we should, we can say that you did not need the regulations.

DISCUSSION

QUESTION: In the employment of children, would it make any difference if they were Indian children?

MISS SWETT: There is no distinction as to whether they are Indian, white, or Negro. We want to keep in mind the fact that we should not deprive the children of school.

COMMENT: In case of the Indian children, we don't employ them, but we give their fathers and mothers a job and they do the employing.

MISS SWETT: That might get you involved with the insurance company. An employee of an employee also becomes subject to the compensation law, but not the double compensation; what compensation there would be would be the regular compensation. You are not subject to the double or triple regulations. In the law it says the Commission may have the power to regulate the labor of these children under sixteen. It doesn't say that we must, but it says the Commission may adopt regulations. We have adopted them in the case of the sugar beet fields. You cannot violate any regulations now, because there are none to violate. I think I should say something about wages. Although you are not subject to any regulations under the Child Labor Law as yet, there is a wage law which

does apply. The Commission has the power to set a living wage for the children. It originally had the power to set a limit for minors and women. Then, when the District of Columbia law for women was declared unconstitutional insofar as it applied to adult women, our law was amended to provide that women should not be paid an oppressive wage. It was left to the Commission to decide what an oppressive wage was. The living wage has been determined, so the commission has taken the stand that if the adult women are paid at least as much as the employer must pay to minors as a living wage, the Commission will not raise the question of whether the wage paid is an oppressive wage. In your case, the rate would be twenty-two cents per hour for experienced women and minors. Your work is classified as a seasonal industry. It doesn't permit a learning period. In other industries, where there is a chance to use knowledge gained the year around, they do permit a learning period. When we checked, we found you people were paying the minimum. We have never set a minimum for children under fourteen, because there are so few things that they can do. In other industries, children of fourteen years of age may work for a year at sixteen cents, and then twenty cents; after they are seventeen and have had six months experience, they must be paid twenty-five cents. Where learning periods are permitted, women may work three months at sixteen cents, three months at twenty, and then twenty-two in towns of under 5,000 population, and twenty-five if over 5,000 population.

I think when Miss Hendrickson asked some time ago, most of you thought from two to three bushels was a fair average pick per day; they might pick more but wouldn't be apt to pick less than that.

It would run from twenty to twenty-five cents. That would include the inexperienced. Your sorters you pay by the hour, I believe.

The question of hours has been brought up. Where you are furnishing meals for some of the pickers, the women's hours which apply in mechanical establishments, hotels, and restaurants, do not apply to a boarding house or place like this, so the hours of the women are not regulated. When a law enumerates certain kinds of employment to which it applies, and then says "any other employment", the courts hold that it means just those named in the law. When a law enumerates like that, it is weakened because it applies only to the places enumerated and there are quite a lot of places not governed by law which should be, no doubt. For this reason, your boarding houses are not covered by this law.

USE AND ABUSE OF FIRE PERMITS

By Mr. J. W. Blatchley, *District Fire Warden*

I can assure you that I am not a cranberry grower, and know very little about the industry. I have come before you today to discuss this matter of burning permits. The present form of burning permit seems to be a hardship on some of the growers. I have talked to the Commission a number of times about some form of permit that would help the growers. I understand that you growers have to burn at certain times for various reasons. Perhaps in the morning conditions were so that you could burn, but by the time you could get a permit conditions changed so that you couldn't use it.

We have had various arguments about the matter, and finally they asked me to come to you and talk the matter over to see what

we could do. If we can get an insight into what is really needed, perhaps by your next meeting we can work out some plan that will be satisfactory.

The present form of burning permit is really issuable for five days only. You must have a permit, even though you burn only a fork full of refuse, in order to comply with the law. I have this season issued permits to a few of the growers that would carry up to the first of July, and that seems to have helped them and we have had no trouble from it. That doesn't exactly fit in with the present fire law, but if we try it out and it looks favorable we can make a change in the present law. What I would propose would be that if a grower wanted those permits he would make application, and we would supply him with a blank form to fill out which would give us some idea of how he was located and what he wanted to do. I will show you an example. I have here a township map. For instance, if you owned four sections you could outline it, and also outline your bog in those sections, the inlet and outlet of your water supply, and possibly the type of land adjoining yours. Then we would know practically all the conditions, and when it turned dry we could be in readiness for some trouble in your vicinity. In some instances we might see fit to refuse a permit. We are all liable to misjudge conditions and go a little too far on chances. If a man owns all the land surrounding his bog, I cannot see any reason why he cannot burn it if he wants to, regardless of whether it is timber land or not. If he wants to destroy his own timber that is all right. Of course, we want to know when he is doing it, and why. The trouble has been in the past that too many parties were careless and let the fire get onto other people's property. We are trying to prevent that now.

I think some agreeable arrangement can be worked out. I would like to have all of you who are interested think the matter over, and at the next meeting we will try to devise some form that would be satisfactory. We hold that it is inconvenient for many of you to hunt up a warden and get a permit and often by the time you get the permit it is out of date. It is easy to tire of that and say, "They won't know anything about it." Then we come down and say you are careless and a lawbreaker. I feel confident that we can get a form of burning permit that will take care of things very nicely and be of very little inconvenience.

DISCUSSION

QUESTION: If I burn without a permit, what responsibility am I assuming?

MR. BLATCHLEY: You are responsible for the damage you do. If you burned your neighbor's property and he took it to court he could collect for twice the amount of the damage. If the amount of damage was assessed at $1,000 he could collect $2,000. Then you would also be liable for a fine of $200.00. If no damage is done you are only subject to the latter fine.

IN MEMORIAM

WHEREAS, Divine Providence has seen fit to remove from our midst a fine neighbor, friend and member of this Association, Mr. Robert Rezin, Sr., be it therefore

Resolved, That this Association tender to his family our sympathy in their bereavement and hereby express our deep sense of loss to us all, be it further

Resolved, That this resolution be inscribed in the minutes of this meeting and a copy be sent to the surviving family.

GUY N. POTTER,
S. N. WHITTLESEY,
GUY NASH.

MINUTES OF THE FORTY-FOURTH ANNUAL MEETING

Meeting called to order at 11:20 a. m., Dec. 3, 1930, at the Realty Hall at Wisconsin Rapids, Wis.

C. J. Timbers of the Wis. Inspection Bureau spoke on warehouse insurance rates.

Following luncheon President A. B. Scott addressed the meeting.

Minutes of the previous meeting were read and approved.

The financial report was read and approved. Oscar Potter, Guy Nash and A. Hedler were appointed as auditing committee. They reported the books correct.

Phil Bennett, Ermon Bennett and Joe Bissig were appointed as nominating committee.

Dr. H. F. Bergman, E. L. Chambers, F. L. Musback and J. I. Marquard were the principal speakers on the afternoon program.

Motion made and seconded that the chair appoint a committee to assist Dr. Bergman in getting around to the marshes. He expected to spend a month here.

Motion made and seconded that the fertilizer experiment referred to by Mr. Musback be left in the hands of the county agents to work out as they see fit.

A report on the state fair exhibit was given by E. L. Chambers and the secretary. A vote of thanks was given to Mr. Chambers for his assistance, also to the secretary. Moved and seconded that five dollars per day be allowed the secretary and Mrs. Rogers for their services in connection with fair work.

Moved and seconded that a vote of thanks be extended to Mr. A. E. Bennett for securing an appropriation for this association from the Wood Co. Board.

Moved and seconded that secretary remit for subscriptions to Wis. Horticultural Society for all paid-up members.

Moved and seconded that secretary cast a unanimous ballot for reelection of the same officers for the ensuing year.

Motion carried to adjourn.

Covers were laid for one hundred and twelve growers and business friends at the 6:30 banquet at the Witter Hotel Wednesday evening, December 3, with Guy O. Babcock acting as toastmaster. Toasts were responded to by Mayor Geo. Mead, E. L. Chambers, H. J. Rahmlow and Theo. Brazeau. The remainder of the evening was spent in dancing.

C. S. SMITH, *Secretary.*

ADDRESS

By A. B. SCOTT, *President*

This meeting marks the end of another year of cranberry activity for the Cranberry Growers. In most respects, it has been an unusual year and has carried with it experiences and events that were new to all but a few of our oldest growers.

There is ever a struggle between the constructive and destructive forces of nature and at times, and with regard to certain things, it seems that the destructive forces are about to win the fray. With the early spring frosts and late cold weather, along with lack of moisture in the early spring, the hail storms and excessively hot weather during July and the extremely dry weather during August, September and October, it would seem that the constructive forces would have to take the count; but apparently it was not to be. From the State crop report we find that Wisconsin produced 40,000 barrels of cranberries this year and that a total of 569,500 barrels was produced in the United States, which is 23,000 more than last year. All of which goes to show that with what feeble assistance man can contribute it must indeed be under very unfavorable conditions for the builders that the destructive forces of nature would prevail to such an extent that there would be no rewards for the efforts put forth.

I am of the opinion, however, that the constructive forces of nature will have to work overtime for a period if we are to have a sufficient supply of water to give the required amount of flooding to protect the vines on cranberry bogs in Central Wisconsin this winter and spring.

With the good crop we had for the kind of a year we experienced, has come a highly satisfactory monetary return despite the financial depression that now exists. I think it is in order here to call the attention of our cranberry growers that we are probably only one of a large group of growers of agricultural products that has experienced such a slight decline in the selling price of our product. Our cooperative marketing plan is the most important of

the various factors that enter into the selling of our product and it is chiefly that factor that is responsible for the satisfactory returns for our cranberries this fall. True, we have had some complaints from consumers of berries this year, probably more than last year, but it was not unexpected, when the weather conditions that prevailed during the harvesting period are taken into consideration.

Those destructive forces of nature enlist services of a host of assistants and one of these which is making great inroads on Wisconsin Cranberry Bogs is the False Blossom. We are on the eve of an era in which there will be a great struggle to overcome the ravages of this destructive force. I believe that False Blossom is one of the chief causes of our low production. In the crop report just mentioned, we are credited with an average production of 13.3 barrels of cranberries per acre for the State. No definite plan has as yet been formulated to combat this force other than that used by some growers, which is the removing of the infected vines and replanting to some of the more resistant varieties. This unwelcome intruder will continue on its way until man has solved its baffling mysteries and prescribed the much wanted remedies to aid the constructive forces.

Knowledge and information about one's enemies enable one to wage a more intelligent battle with those enemies. The weak spots must be found and study and exchange of ideas contribute to that fund of information that is required to accomplish that result. That is the purpose of our association meetings. It looks like a long jump to double that production, but by continued aid to constructive forces the various obstacles can be overcome and a habit of production can be grown into our large acreage of vines, that will not fall far short of the mark we shall strive to reach.

It is to this end that these programs have been arranged, and we are fortunate in having with us today men who have had a large amount of experience in their lines and who I feel sure will have something of particular interest for all of us.

ELIMINATING CRANBERRY LOSSES

By E. L. Chambers

Some time ago a conference with some of our cranberry growers revealed the fact that there existed in our bogs troubles which were at times almost as serious as false blossom and resulted in greater losses than caused by certain of our more serious cranberry insect pests. This trouble we refer to is the one that takes place after the winter flood has been admitted, which has in several sections resulted in taking a heavy toll of the vines. In an attempt to get at this cause with the idea of correcting the trouble we had Mr. Rogers come into Madison and consult some of our nationally known biochemists connected with the University of Wisconsin, the city of Mad-

ison and the State Biological Survey. It did not take us long to discover that considerable was known about the lack of oxygen in the water in the presence of decaying organic matter and that a lot of technique had been developed to measure this oxygen content but that only a chemist could ever hope to master the technique.

We learned that Dr. Bergman was again being employed by the federal government on cranberry investigations and we decided to see if we could enlist his help, and our commissioners of Agriculture and Markets began to correspond with the federal department assisted by your president and we were advised almost immediately that they had decided to send Mr. Bergman to make a survey of our bogs during December and present the two papers you have just heard.

While there are a lot more pleasant things that Dr. Bergman could do than come out here and do field work in December, he felt that you had a problem and he might be able to help, and if he could he wouldn't let a little thing like Wisconsin winter weather interfere and in a few days he will have a lot of equipment reach him which is being consigned to him for the purpose of carrying on this work, and he will very likely have some valuable information ready for you when you attend your next summer's meeting. If anyone can solve this problem we believe Dr. Bergman can do it and we have confidence that he will be able to advise you how to avoid this trouble in the future.

In talking to some of our cranberry growers we find that they feel sometimes that they are connected with an industry that has troubles galore while many other industries are more fortunate. We know of no industry that does not have existing about it like a flock of vultures flying over head, a host of pests and diseases which are a potential menace to the crop and unless a constant watch is maintained severe losses may result without any warning whatsoever. Our entomological statisticians figure that under the best control we have, the average loss over the entire country caused by insect pests alone can comparatively be figured at 10 per cent of the value of the crop. In some instance with little or no attempt at control this percentage may approach 100 per cent as compared with almost complete control where every effort is made to prevent losses.

Insect control is becoming more and more complicated each year with more pests changing their food habits from wild hosts to our cultivated crops being grown in greater abundance and with the introduction of new pests through various avenues of commerce. If we increase the number of sprays very much more in the case of certain of our crops we will almost have to install overhead irrigation systems to make it possible to get the work done promptly enough and then we have always before us that danger of getting too much spray residue to suit the Board of Health.

As these pests increase, we are compelled to study their life cycles closely and work out combination sprays which will serve several purposes at the same time. We must be sure we are using the right type of attack on each pest as we can not expect to kill an insect which derives its food from the sap by covering the outside of the leaf with an arsenical. Nor can we hope to kill a bug with a "tough hide" with a weak contact spray which may be very effective against plant lice and the younger stages of leaf hoppers. Then again there is a limit to the amount and kind of spray material a given plant can stand without injury.

We never like to bring up a discussion of the various Virus diseases which are becoming so popular just now as outstanding maladies since our investigators have not yet been able to isolate any organism and without an organism it is hard to find a method of attack unless there is only one species of insect known to act as its Vector or carrier and then, of course, it is only a matter of finding some way of reducing this particular species. The aster leaf hopper is an example of one pest which has been definitely proven as a potential carrier of the Virus causing aster yellows and in isolating it from aster plants by screening, the disease can be avoided. We cannot very well screen a cranberry bog but maybe we can find a period in its life cycle when we can apply some form of bog treatment to reduce its numbers to a minimum. We are very fortunate, it appears from last summer's observations, in not having very many of the blunt nosed *(Euscelis striatulus)* leaf hoppers present on our bogs in comparison with other species and in comparison with the cranberry growing areas of the East. It is for this reason that we feel certain that another species is also a Vector of false blossom since we apparently have considerable spreading of the trouble in spite of the scarcity of the species proven by experimental work to be a Vector. The aster leaf hopper, *(Cicadula sexnotata)* and the potato leaf hopper *(Empoasca fabae)* were the three most abundant species found on your bogs last summer and cage experiments are in progress to determine whether one of these may possibly be Vectors also.

If we become impatient at times because of the delay in finding out all of the facts concerning a Virus disease we need only to think of our medical profession who, although they have spent hundreds of years trying to solve the mystery, have not found the causal organism for such maladies as simple colds and mumps.

Practically all of our insect pests occur in epidemic form for a year or two and then gradually disappear again for a short period of a few years only to return with apparently more furiousness. This appearance and disappearance of pests in more or less regular cycles is due to the fact that they have certain natural parasites usually as small wasp-like insects attacking the egg or larval stage which, being very small are rarely observed. When they have so completely routed their host as to find themselves out of food, they

gradually die out and the host insect in turn begins to reappear in large numbers until its parasites again become established. As an example of a pest of this kind, we had a severe outbreak last summer of a scale insect on jack pine known as the Scotch pine scale. It had rarely been noticed in the forests until last summer when it suddenly appeared in epidemic numbers killing out many jack pine throughout the state, and by the end of the summer a small black beetle about the size of a ladybird beetle appeared and destroyed large numbers of these scale insects and it may survive the winter and completely repel this scale insect which threatens to destroy our jack pine by coating the trees with their bodies and excreting large quantities of honey dew which smothers the trees. So here we have the jack pine considered free from pests almost wiped out in some sections in one year by a pest never before thought to be particularly serious because its natural parasites kept it under control.

We must also remember that experimental work to be of any value must be repeated several years and compared with a satisfactory check before any conclusions can be safely drawn. For instance, we have a pest in Wisconsin known as the pine bark louse which appears annually on white pine almost everywhere and whether anything is done in the way of control or not it just naturally disappears by migration to other host plants during mid-summer and then reappears late in the fall. Because of this habit many have concluded that some treatment they have used on the trees infested with this pest had been successful whereas a tree left along side without any treatment if checked would have shown the same results.

Several years ago we were preparing to spread poison bran for the control of grasshoppers in some of our northern counties and just as we were ready to issue the word to the farmers that they were about all hatched out of the egg beds and were ready to migrate, a storm was threatening and so it was thought advisable to wait until after the storm, and two days later, after a heavy storm had subsided, there were not enough of these hoppers left to warrant the spreading of the bran. In another county adjoining they decided to apply a new bait being tried out and the farmers there still believe that the enormous reduction in numbers of these insects was due to the treatment whereas, had they waited they would very likely have found it unnecessary to apply the poison at all. We are prone to jump at conclusions and when we try to repeat the trick it fails and too often we discover our mistake too late.

QUESTION: Does this leaf hopper have more than one generation?

MR. CHAMBERS: The blunt nosed and sharp nosed have one generation, and the yellow leaf hopper has two. All occur early, and the yellow again in September.

QUESTION: Aren't they killed during the flood?

MR. CHAMBERS: They hibernate in the adult stage and survive. It is only the younger stages that are easily killed by flooding.

QUESTION: Do you know the result of the incubation experiments for fungus which were carried on this summer? The expectation was that the keeping quality was going to be very good, and it wasn't as good as was expected.

MR. CHAMBERS: I supposed those reports had been turned in to you people. Those experiments were carried on by Mr. Bain. Mr. Rogers didn't have the reports on any work that was done for the federal government. If they haven't been turned over to you we do not know about them.

THE OXYGEN CONTENT OF WATER IN WINTER-FLOODED BOGS UNDER ICE

By H. F. BERGMAN

The first studies on the oxygen content of flooding water of cranberry bogs were made some ten or twelve years ago. These studies were begun in an endeavor to discover the cause of severe injury to cranberry vines which had occurred during the flooding of bogs for the control of certain insects. It was shown by the investigations then made that the presence of large amounts of organic matter such as occurs in many reservoirs is apt to reduce the oxygen content of the water to a very low level or even to exhaust it completely. It was also shown that cranberry plants, under conditions prevailing at the time of spring flooding, may be seriously injured by a lack of oxygen in the water.

During the past winter we have been engaged in a study of the oxygen content of the water on cranberry bogs under ice. This work was also undertaken in an endeavor to determine the cause of serious injury to cranberry vines which became evident soon after the winter flowage was removed.

Last spring a severe defoliation of vines on several bogs in Wisconsin was observed. On the bog on which injury was most severe, there was a total loss of the crop over a considerable part of the bog. Not only were the fruit buds killed, and complete defoliation brought about, but the terminal buds also over most of this area were killed. Other bogs showed more or less defoliation, dead terminal buds and probably reduced yield. In other cases there was a certain amount of defoliation without any other apparent injury. An examination of these bogs led to the conclusion that the injury might be due to lack of oxygen in the water during the winter.

The oxygen requirement of cranberry vines under winter flood is undoubtedly very low yet metabolic processes which require oxygen take place to some extent. The continued demand for oxygen by working parts of the plant at times when the oxygen supply is insufficient to meet the demand leads to injury and often to the death of the plant. Naturally, the injury is apt to be more severe and to take place more quickly at higher temperatures than at near freezing but the possibility of injury to vines by oxygen de-

privation under winter conditions is to be recognized. Dr. Franklin, more than ten years ago, called my attention to the fact that a considerable amount of dropping of leaves occurred on some bogs that had been under ice during the winter. This suggested injury as a result of oxygen deprivation raised the question as to the oxygen content of water of winter-flooded bogs and the effect of winter flooding on yield of fruit.

The amount of injury during the period of winter flooding varies not only on different bogs but also on the same bog from year to year. Except in those cases where the injury is sufficiently severe to cause defoliation, death of fruit buds or of terminal buds, we have at present, no way of determining whether or not injury by oxygen deprivation has occurred. It is possible that injuries of less serious nature from this cause are occurring more or less commonly without being recognized as such. These injuries may, nevertheless, be causing a reduction in yield of some bogs.

As already noted, a study of the whole problem of injury to cranberry vines during the period of winter flooding was begun last winter. The course of the oxygen content of the water in two winter-flooded bogs under ice has been determined. One of the bogs is located at South Chelmsford, the other near Wilmington. The first series of determinations of oxygen content were made late in December. Others were made periodically up to the last week in February, at which time the ice melted during a week of exceptionally warm weather.

The water supply for the South Chelmsford bog comes from a natural pond of considerable size about one and one-half mile from the bog. The water flows through a small stream down to the bog. About one-half mile above the bog the stream has been dammed to form an upper reservoir. Another reservoir, the lower, has been made just above the bog, adjoining it. To bring the relation of the bog to its water supply clearly before you a map has been prepared.

The water supply for the Wilmington bog comes from a reservoir which lies nearly one-half mile above the bog. The reservoir has been formed by damming a small stream. The relation of the reservoir and bog at Wilmington is shown by another map. Water samples, for the determination of oxygen, were taken from the pond and reservoirs as well as from various parts of each of the bogs. The trend of oxygen content of the water in the reservoirs and bogs as compared with that of the pond is shown in the accompanying tables.

Oxygen Content in Winter Flooding Water Under Ice

Source of Sample	Depth	Temp. Cent.	Oxygen in cc. per Liter on Various Dates			
			Dec. 19–20	Jan. 6–7	Jan. 28–29	Feb. 24–25
Baptist Pond	6 in.	0	9.61			
Baptist Pond	6 in.	0	9.78			
Baptist Pond	2 ft.	0	9.30			
Baptist Pond	2 ft.	0	9.11			
Baptist Pond near outlet	1 ft.	3		10.21		
Baptist Pond near outlet	1 ft.	3		9.91		No samples taken ice melting much open water
Baptist Pond near outlet	3 ft.	4		6.08		
Baptist Pond near outlet	3 ft.	4		6.16		
Baptist Pond near outlet	1 ft.	3		9.40		
Baptist Pond near outlet	1 ft.	3		9.34		
Baptist Pond near outlet	3 ft.	4		6.21		
Baptist Pond near outlet	3 ft.	4		6.14		
Baptist Pond	1 ft.	1			7.92	
Baptist Pond	1 ft.	1			8.15	
Baptist Pond	3 ft.	1			5.84	
Baptist Pond	3 ft.	1			5.83	
Baptist Pond	5 ft.	0.5			5.14	
Baptist Pond	5 ft.	0.5			5.24	
Baptist Pond	1 ft.	0.5			8.29	
Baptist Pond	1 ft.	0.5			8.12	
Baptist Pond	3 ft.	1.5			5.90	
Baptist Pond	3 ft.	1.5			5.85	
Baptist Pond	5 ft.	3			6.34	
Baptist Pond	5 ft.	3			5.62	
Lower Reservoir South Chelmsford.						
edge of ice near outlet	1 ft.	2.5				3.71
edge of ice near outlet	1 ft.	2.5				3.72
edge of ice near outlet	2 ft.	2.5				2.82
edge of ice near outlet	2 ft.	2.5				2.65
50 yds. from outlet	1 ft.	2.5				2.46
50 yds. from outlet	1 ft.	2.5				2.38
50 yds. from outlet	2 ft.	3				2.41
50 yds. from outlet	2 ft.	3				2.44

Oxygen Content in Winter Flooding Water Under Ice On Bog at South Chelmsford

Source of Sample	Depth	Temp. Cent.	Oxygen in cc. per Liter on Various Dates			
			Dec. 19–20	Jan. 6–7	Jan. 28–29	Feb. 24–25
50 yds. from gate	6 in. incl. ice	1	7.82			
50 yds. from gate	6 in. incl. ice	1	7.79			
50 yds. from gate	6 in. incl. ice	1	7.92			
Bog W. end near gate	6 in.	1	3.13			
Bog W. end near gate	6 in.	1	3.47			
Bog W. end near gate	18 in.	1	2.65			
Bog W. end near gate	18 in.	1	2.69			
Bog W. end near gate	18 in.	1	2.74			
Bog W. end near gate	18 in.	1	3.08			
Bog. E. side opp. pines 50 yds. out	2 ft.	4				0.0
Bog So. end East of ditch	18 in.	3.5				0.0
Bog So. end East of ditch	18 in.	3.5				0.0
Bog So. end East of ditch	18 in.	3.5				0.41
Bog So. end East of ditch	18 in.	3.5				0.41
Bog So. end West of ditch	1 ft.	3				0.88
Bog So. end West of ditch	1 ft.	3				0.68
Bog No. side N. of house 75 yds. from shore	1 ft.	3				3.93
Bog No. side N. of house 75 yds. from shore	1 ft.	3				3.68
Bog N. of house on E.-W. line res. to pines	2 ft.	3.8				1.33
Bog N. of house on E.-W. line res. to pines	2 ft.	3.8				1.36

Oxygen Content in Winter Flooding Water Under Ice Reservoir—Wilmington

Source of Sample	Depth	Temp. Cent.	Oxygen in cc. per Liter on Various Dates			
			Dec. 19–20	Jan. 6–7	Jan. 28–29	Feb. 24–25
Reservoir E. end near outlet	1 ft.	0.5		5.85		
Reservoir, E. end near outlet	1 ft.	0.5		5.87		
Reservoir, E. end near outlet	2 ft.	1		5.73		
Reservoir, E. end near outlet	2 ft.	1		5.87		
Reservoir, center	1.5 ft.	1		5.53		
Reservoir, center	1.5 ft.	1		5.60		
Reservoir, West end center	1.5 ft.	0.8		5.75		
Reservoir, West end center	1.5 ft.	0.8				
Reservoir, near outlet	1.5 ft.	0.2			5.10	
Reservoir, near outlet	1.5 ft.	0.2			5.11	
Reservoir, near center E. to W.	1 ft.	0.2			5.58	
Reservoir, near center E. to W.	1 ft.	0.2			5.58	
Reservoir, 50 yds. from gate	1 ft.	0				6.62
Reservoir, 50 yds. from gate	1 ft.	0				6.61
Reservoir, 50 yds. from gate	2 ft.	0				6.88
Reservoir, 50 yds. from gate	2 ft.	0				6.82
Reservoir, 100 yds. from end	1 ft.	0				6.83
Reservoir, 100 yds. from end	1 ft.	0				6.80
Reservoir, 100 yds. from end	2 ft.	0				6.82
Reservoir, 100 yds. from end	2 ft.	0				6.81

Oxygen Content in Winter Flooding Water Under Ice On Bog at Wilmington

Source of Sample	Depth	Temp. Cent.	Oxygen in cc. per Liter on Various Dates			
			Dec. 19–20	Jan. 6–7	Jan. 28–29	Feb. 24–25
45 yds. fr. E. bank 60 yds. fr. N.	1 ft.	1		6.40		
45 yds. fr. E. bank 60 yds. fr. N.	1 ft.	1		6.34		
30 yds. fr E. bank 20 yds. fr. N.	1 ft.	1		8.75		
30 yds. fr. E. bank 20 yds. fr. N.	1 ft.	1		8.78		
30 yds. fr. E. bank 20 yds. fr. N.	2 ft.	1.5		6.29		
30 yds. fr. E. bank 20 yds. fr. N.	2 ft.	1.5		6.30		
15 yds. above outlet	1 ft.	1		4.95		
15 yds. above outlet	1 ft.	1		4.89		
15 yds. above outlet	3 ft.	0		4.83		
15 yds. above outlet	3 ft.	0		4.77		
25 yds. N. W. of preceding	1 ft.	1		6.03		
25 yds. N. W. of preceding	1 ft.	1		5.91		
N. of house near cent. bog	1 ft.	0.5		5.54		
N. of house near cent. bog	1 ft.	0.5		5.45		
West end N. of cent. 75 yds. fr. No. bank	1 ft.	0.5		5.46		
West end N. of cent. 75 yds. fr. No. bank	1 ft.	0.5		5.47		
West end S. of cent. 75 yds. fr. No. bank	1 ft.	0.5		5.43		
West end S. of cent. 75 yds, fr. No. bank	1 ft.	0.5				
West end S. of cent. 75 yds. fr. No. bank	2.5 ft.	1		3.94		
West end S. of cent. 75 yds. fr. No. bank	2.5 ft.	1		3.79		
S. E. corner 20 yds. fr. So. bank	1.5 ft.	0.5			3.85	
S. E. corner 20 yds. fr. So. bank	1.5 ft.	0.5			3.73	
So. side 50 yds. E. of ditch	1.5 ft.	0.5			2.58	
So. side 50 yds. E. of ditch	1.5 ft.	0.5			2.84	
Ditch 20 yds. from gate	2 ft.	0.5			4.04	
Ditch 20 yds. from gate	2 ft.	0.5			3.99	
Ditch 20 yds. from gate	3 ft.	1			4.00	
Ditch 20 yds. from gate	3 ft.	1				
Center N. of house No. of ditch	1 ft.	0.5			2.71	
Center N. of house No. of ditch	1 ft.	0.5			3.06	
Ditch 75 yds. from West end	2 ft.	0.5			2.26	
Ditch 75 yds. from West end	2 ft.	0.5			2.28	
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.65
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.71
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.63
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.58
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.50
N. W. corner 10 yds. fr. N. W. near pines	1.5 ft.	0.5				6.64
N. W. corner 10 yds. fr. N. W. 25 yards fr. preceding	1.5 ft.	0				7.09
N. W. corner 10 yds. fr. N. W. 25 yards fr. preceding	1.5 ft.	0				7.04
N. W. corner 10 yds. fr. N. W. 25 yards fr. preceding	1.5 ft.	0				7.02
N. W. corner 10 yds. fr. N. W. 25 yards from preceding	1.5 ft.	0				7.09
Outlet gate (4 ft.)	2 ft.	0				7.40
Outlet gate (4 ft.)	2 ft.	0				7.41
Outlet gate (4 ft.)	4 ft.	0				7.35
Outlet gate (4 ft.)	4 ft.	0				7.39

Pure water at 32 degrees F. and under normal atmospheric pressure is capable of absorbing from the air 9.7 cc. of oxygen. The amount dissolved decreases slightly with each degree rise in temperature. The waters examined during the winter varied from 32-40 degrees F. At the latter temperature water absorbs 8.7 cc. of oxygen under the conditions stated. Using these figures as a standard for comparison it is evident at once that a great difference exists in the quantity of oxygen in the water from the various sources. The water of Baptist Pond was well supplied with oxygen although the amount decreased considerably at lower levels as winter advanced. The oxygen content of the water of the reservoir and bog at South Chelmsford was, from the very first, in nearly all instances, much below saturation and diminished rapidly until, within 4-6 weeks after the bog had been flooded, it was nearly or quite exhausted. The oxygen content of the water of the bog at Wilmington was greatly diminished during the winter but never to the point of depletion.

Factors Affecting the Oxygen Content of Water

The oxygen content of water is determined by two groups of factors, one physical, the other biological. Physical factors tend to keep the gases in solution in the water in equilibrium with those of the atmosphere. Biological factors disturb the equilibrium. They cause fluctuations the extent and direction of which depends upon the nature and number of organisms present in the water and upon external factors which affect the physiological activity of these organisms. Physical and biological factors may operate at the same time but usually not at the same rate. The oxygen content at any given time is the resultant of the number of factors acting and the rate of their operation.

Physical Factors

Physical factors are those which affect the solubility or distribution of a gas. The solubility of a gas in water depends upon the pressure exerted by the gas and upon the temperature of the water. As the pressure under the conditions here considered was essentially uniform we need be concerned only with the effect of temperature. The solubility of a gas in water decreased with rise of temperature. Water at 32 degrees F. can absorb 9.7 cc. of oxygen; at 40 degrees, 8.7 cc.; and at 50 degrees, 7.8 cc. The oxygen content of nearly all samples taken during the winter was much below the absorption capacity of the water from which it is evident that the temperature of the water, in these cases, was not the limiting factor in determining the amount of oxygen present. Conditions may exist which cause more oxygen to go into solution than could be absorbed directly from the air, but such conditions were not encountered during the past winter.

The distribution of gases in water is accomplished by the mixing of the water through wave action, flowing streams, by convection currents, or in the absence of these by diffusion. When Ice forms over the surface of the water direct contact with the air is cut off. This prevents any mixing by wave action which is the most effective method. A stream flowing through a reservoir or bog may keep the oxygen content at a higher level than would be maintained in its absence. This may account, in part, for the generally higher oxygen content of the water of the Wilmington bog as compared with that of the bog at South Chelmsford. A small stream flows through each of these bogs. The Wilmington bog is much the smaller of the two and the amount of water flowing through the bog, at least in proportion to the area, is much greater at Wilmington so that the effect in maintaining the oxygen content of the water is much greater than at South Chelmsford. The ineffectiveness of convection currents and of diffusion as agencies in the distribution of oxygen in water is shown by the fact that the oxygen content of the water, from any of the sources from which samples were taken, was found to diminish materially as the depth increased. The clearest illustration of the ineffectiveness is shown by determination of oxygen in water of the South Chelmsford bog and reservoir at depths of 2-3 feet. At this depth, an oxygen content of less than 1 cc. per liter of water was found, in many locations, even as early as three weeks after the bog had been flooded.

Biological Factors

Biological factors operate through processes which produce or consume oxygen. They do not affect the capacity of water to absorb gases or control their distribution. The processes which may operate are photosynthesis, respiration and oxidation of organic matter. As the gases consumed or produced by these processes are obtained from or given off into the water, the presence of organic matter or of submerged organisms is an important consideration with reference to the oxygen content.

Photosynthesis consumes carbon dioxide and liberates oxygen. The process can take place only in light of sufficient intensity and under suitable temperature conditions. Plants vary greatly, however, with respect to the light and temperature requirements for photosynthesis. Certain kinds of algae present in nearly all ponds and streams, some mosses which grow on marshy land and hence often found in reservoirs, and other mosses which are found growing on the ground under cranberry vines are all plants which are able to carry on photosynthesis at near freezing temperatures and in very feeble light. Even after ice forms over the surface of the water, sufficient light penetrates, at least on clear days, to cause an increase in the oxygen content of the water by photosynthetic activity of green plants present in it. A noticeable increase in the oxygen

content of water under ice on ponds and lakes has been observed by investigators in Europe and in Wisconsin. Investigators in both places have found, however, that a covering of snow over the ice or even cloudy weather prevents the formation of oxygen so that under these conditions a reduction in oxygen content occurs.

The processes in which oxygen is consumed are respiration and oxidation of organic matter. Respiration does not depend upon light but is influenced by temperature. In most flowering plants, such as the cranberry itself, respiration is nearly at a standstill at 32 degrees F. In the algae commonly occurring in reservoirs and on bogs, in mosses and in bacteria present in bog water, respiration goes on more rapidly even at near freezing temperatures than it does in flowering plants. As the oxygen consumed in respiration is taken from the water a continuation of this process even at a very slow rate would reduce the oxygen content of the water.

The decay of organic matter also uses up oxygen which is withdrawn from the water. The oxidation of organic matter is brought about by the action of bacteria. Complete oxidation of organic matter can be effected only in the presence of oxygen but to a certain extent it may occur also in the absence of oxygen. Decomposition of organic matter in the absence of oxygen results in the formation of substances such as hydrogen sulphide and methane and others which are not so readily detected. Hydrogen sulphide may be recognized by its offensive odor. Water containing it is very foul smelling. It was formed quite abundantly in the water of the reservoir and bog at South Chelmsford. Its presence was confirmed by chemical tests. Methane is formed by the decomposition of the peaty material on the bottom of reservoirs and in the soil of the bog. It is a colorless, odorless gas but large bubbles of gas which may be seen rising from the bottom of reservoirs or bogs are indications of its presence. Most of the reduction in the oxygen content of the water of the bogs and reservoirs examined during the past winter was probably due to the oxidation of organic matter although oxygen consumption by respiration was possibly a contributing factor.

Effect on Vines Deprived of Oxygen During Winter Flooding

The effect of continued oxygen deprivation during a considerable part of the period of winter flooding on growth and fruit production of the ensuing season cannot be stated with any certainty at this time. Certain possibilities, however, will be pointed out. It was mentioned earlier that on certain bogs in Wisconsin more or less complete defoliation, sometimes accompanied by death of all fruit buds and of the terminal buds, was observed in the spring. There seems to be no other explanation of this than that the injury was due to oxygen deprivation during the winter. This was a case of extreme injury. More or less defoliation after withdrawal of the winter flood has been observed both in Wisconsin and in Massa-

chusetts but without other apparent injury. It is nevertheless possible that many of the fruit buds are injured and fail to develop fruit although they may blossom and appear to be quite normal. This point needs to be studied.

It is well known that certain substances formed in living cells by respiration in the absence of oxygen are poisonous to the cells and result in their death with the subsequent break down of tissues. These substances are mainly alcohols and aldehydes formed by incomplete oxidation of sugars or other carbohydrates. All living cells require oxygen and suffer if deprived of it for more than a very short period of time. The demand of more active parts of the cranberry plant, such as flower buds and terminal buds, is certainly very slight at temperatures prevailing during the period of winter flooding but this demand if continued for some time, as seems to be true in some instances, might result in the formation of a sufficient quantity of alcohols and aldehydes to cause the death of tissues in the buds.

The results here presented show that oxygen deficiency may exist in the water of a flooded bog during a considrable part of the winter flooding period. This merely confirms the existence of a condition which had been suspected. The more important work of determining the extent to which cranberry vines are injured by oxygen deprivation during the winter flooding period remains. It is planned to continue investigation along this line again next winter and a further report may be possible thereafter.

INDICATOR METHODS FOR THE DETERMINATION OF THE OXYGEN CONTENT OF WATER

By H. F. Bergman

The danger of injuring cranberry vines and of losing part or all of a crop by flooding a bog during the spring, either for frost or insect control, is well known to cranberry growers. Injury from such flooding is due to a deficiency of oxygen in the water. The effect of weather conditions on the oxygen content of water and on the activity of various parts of the cranberry plant and the relation of the source of the water supply to the oxygen content of water have been studied extensively and the results presented to you on several previous occasions. From these studies it has been possible to formulate some general principles as to the handling of flooding water so that serious injury, at least, may be avoided. The need for further studies along this line has not yet ceased to exist. Further, more specific studies may extend the usefulness of flooding as a practice in bog management. One thing which is much needed, perhaps, the most needed, is a quick, easily applied and reliable method

for determining the approximate oxygen content of water at any time. The method must be one which can be used by any grower. It must be one which does not require any special skill or elaborate apparatus and must be one that can be made in a short interval of time. It is to such methods that I wish to direct your attention today.

Methods for the determination of the oxygen content of water may be classified in two groups: (1) biological, and (2) chemical. Biological methods are those which make use of some living organism which by alteration in behavior in response to changes in oxygen concentration indicate the relative amount of oxygen present. Three methods are applicable only with low concentrations of oxygen, i. e., at and below a concentration at which the organism begins to show signs of having insufficient oxygen to supply its needs. The usefulness of these methods depends upon the degree of tolerance of the organism used as the indicator for reduced concentrations of oxygen. Biological methods lack in sensitivity. They fail to show changes in oxygen content even though the change covers a considerable range of oxygen concentration. If any organism which begins to show signs of distress at the desired reduction in oxygen concentration is selected the method is simple and very useful. The principal difficulty lies in the selection of the proper organism to use as the indicator. Some are too sensitive to a reduction in oxygen content and others not sufficiently so.

To ascertain the suitability of the biological method for determining the oxygen content of water on flooded bogs a number of experiments have been performed. In these experiments pieces of cranberry sod have been dug up, placed in galvanized iron tubs, and the vines then submerged by filling the tubs with water which was taken from Spectacle Pond. This water is clear and is saturated with oxygen. For indicators fish were selected. Not all kinds of fish are suitable for this purpose. Only those which are able to endure considerable reduction in oxygen content can be used. Yellow perch and sunfish were used because of their availability and tolerance to rather rough treatment. One or more fish of either or both kinds as available were placed in each tub. The tubs were usually shaded to exclude light thereby preventing any supply of oxygen to the water by photosynthetic activity of the vines. Samples of water were taken at regular intervals and analyzed for oxygen. Observations on the condition of the fish were also made at each time of sampling in order to correlate their condition with known oxygen content of the water. The condition of the vines 24-48 hours after the conclusion of each experiment was also observed. The general results of these experiments may be presented in a brief summary.

A Summary of Results of Experiments Using Fish as Indicators of Oxygen Content of Water

Date	Hours of submergence		Condition of Fish	Condition of Vines
	Total	Oxygen below 1 ml. per liter		
1929				
June 22–26	57–60	28–32	Fish in tubs only last five hours. Soon showed much in breathing, some turned over on side.	Nearly all buds and flowers killed, also many growing tips.
July 1	8–9	2–3 at 25 deg.	Fish breathing with difficulty during last 3–4 hours. All alive at end of experiment.	Some bud and tip injury Temp. water 25 deg.
July 3	12	4–6	One fish dead, others nearly so, breathing with great difficulty.	Few buds injured; no tips. Temp. water below 20 deg.
July 5	6	1–1.5	Some fish dead, others living but breathing with great difficulty.	Some bud injury, no injury to flowers, young fruits or growing tips.
July 6	6	1–1.5	Same as July 5	Same as on July 5.
1930				
June 24	6	1½ in one tub only	Breathing with some difficulty.	No apparent injury to buds or growing tips.
June 28	7½	½–1	Breathing with some difficulty.	No apparent injury to buds or growing tips.

Submergence of cranberry vines for one to two hours in water at 23-25 degrees Cent. caused only slight injury to flower buds and none at all to flowers and growing tips even with an oxygen content of 1 ml. or less per liter. With the temperature of the water at 20 degrees or less, submergence of the vines for 4-6 hours at an oxygen content of 1 ml. per liter or less caused no more injury than 1-2 hours in water at 25 degrees and the same oxygen content.

Perch and sunfish begin to show difficulty in breathing by the time that the oxygen content of the water has been reduced to 2 mls. per liter although they may often survive even after having been kept 2-3 hours in water with an oxygen content as low as 0.5 ml. per liter. Either kind of fish shows difficulty in breathing before the oxygen content of the water is sufficiently low to cause injury to the flower buds of submerged vines. It is necessary, however, to take early manifestations of difficult breathing as an indication that the oxygen content of the water has been materially lowered and that a condition is being reached which if prolonged for a few hours more may cause considerable injury to flower buds and possibly also to growing tips. In bog management it would be necessary to re-

lease the water at this stage on account of the length of time required to lower the water level on most bogs. If one were to wait until the oxygen content of the water were reduced to such an extent as to cause the fish to rise to the surface and gulp for air there would be danger of causing considerable injury to flower buds, at least, and possibly also to growing tips since the fish are able to survive with an oxygen concentration well below that which causes injury to buds and growing tips. Although very tolerant to low concentration of oxygen the use of either of these two kinds of fish as indicators of the oxygen content of water can not be questioned if one takes early symptoms of difficult breathing as a signal for releasing the water.

There are three general types of chemical methods for determination of oxygen in water: (1) absorption, (2) titration, and (3) colorimetric. Determination by absorption or titration is the usual practice. Some titration method is most often used on account of the greater simplicity and rapidity of titration methods as compared with the absorption method. The absorption method, however, is the most reliable of all and must always be employed in case of any question as to the accuracy of other methods. Colorimetric methods depend upon the use of some chemical which becomes more or less highly colored in the presence of oxygen. This chemical is known as an "indicator". The intensity of color is proportional to the quantity of oxygen present. Hence it is possible to estimate the amount of oxygen present in a sample of water by adding the required chemicals and comparing with a standard equivalent to a known quantity of oxygen. In spite of the apparent simplicity of colorimetric methods they have never come into use, largely, no doubt due to the difficulty of preparing suitable standards. They might be useful for technical analysts but even then only in case many analyses are to be made daily.

Cranberry growers, however, need not be concerned with the measurement of the absolute quantity of oxygen in solution in water. All that it is necessary to know is whether or not the water contains enough oxygen to prevent injury to buds, flowers, young fruits or growing tips of vines. On the basis of experimental evidence it may be said that water may be used for flooding purposes without danger of injury if it contains one to one and one-half mls. of oxygen per liter of water. This statement is tentative as in the experiments performed it has not been possible to hold the oxygen concentration at a constant value. Assuming, however, that the figures given are correct, is there any method by which the oxygen content of water at any time may be quickly and easily determined? The method now to be described and demonstrated is such a one.

This method is a colorimetric one of amazing simplicity. It requires only a few small bottles, preferably glass stoppered, a pocket knife, a small vial or bottle of indicator and some sodium carbonate in order to make the test. No skill in manipulation is required.

Mix some of the indicator with 10 times its weight or volume of dry sodium carbonate. The indicator used is a phenolic compound which absorbs oxygen and becomes colored only in an alkaline medium. There are some three or four substances of this character which may be used. Then dip a small bottle in the water to be sampled and allow the bottle to fill nearly to the top. Add a small quantity of the carbonate-indicator mixture, such as may be held on the tip of the blade of a pocket knife, and drop it into the bottle of water and at once replace the stopper. With two of the indicators selected, the color begins to develop immediately but does not reach its maximum intensity for two or three minutes. With other indicators 15 to 20 minutes are required to develop color. If the water is well supplied with oxygen the color quickly becomes intense. If oxygen is absent there is no color production. In other words the color production is proportional to the amount of oxygen present; the less oxygen there is the less color. The color equivalent to a concentration of one to one and one-half mls. of oxygen per liter has not yet been determined. This is about the only part of this problem which has not been completed. The work is still in progress and that part of it will soon be finished.

In using these indicators it is necessary to use freshly prepared carbonate-indicator mixtures, as often they have been mixed and the absorption of water from the air causes oxidation of the indicator so that a fairly intense color may be produced even in a sample of water which contains no oxygen. With this precaution the method is dependable in the hands of anyone. With this method available to determine the oxygen content of water so that much of the guess work concerning the use of water is removed, the usefulness of flooding should be materially increased.

DISCUSSION

After some preliminary work, I selected from about one dozen or more chemical compounds, three as being suitable to work with. These indicators are very simple to use. All that is needed is a little bottle of about two ounces in capacity, about as big around as a quarter of a dollar or slightly larger, and another bottle of the chemical we use as the indicator, mixed with sodium carbonate. The bottle is filled with water, and just a small amount of the mixed indicator and carbonate is picked up on the point of a knife blade and quickly dropped in the bottle of water. It is shaken up and allowed to stand five to ten minutes. If oxygen is present, the water will become very intensely colored. The color will vary from a deep wine purple to a strong blue purple, or sometimes a very deep blue green. When oxygen is entirely absent, there is no coloration of the water at all. Slight amounts of oxygen give a greenish blue or reddish purple color to the water, depending on the indicator used. The test can be carried out within ten minutes by anybody right on the bog.

QUESTION: I would like to ask Dr. Bergman what effect he found on the plants on those bogs where he found no oxygen in the water.

DR. BERGMAN: We weren't able to come to any definite conclusion. They had been doing other things on the bog, so we weren't sure whether the injury observed was due to flooding injury or treat-

ment with iron sulphate and other things put on the bog during the summer preceding. I am carrying out the experiment again this winter there, and at the same time carrying on some real experiments with vines which can be kept under controlled conditions, so we have some hopes of being able to tell whether or not injury actually does occur from long continued deprivation of oxygen during the winter. If they do endure it without great injury, I am completely at a loss to account for some behaviors I have experienced in Massachusetts and Wisconsin.

QUESTION: How deep was the ice?

DR. BERGMAN: The maximum thickness of the ice was one foot. It doesn't get as cold in Massachusetts as it does here, so they do not have so much ice.

QUESTION: On most of our bogs the ice forms clear down to the bog, so the roots themselves are frozen. What effect would that have?

DR. BERGMAN: I would say that would be much better for the vines than to have one foot of water over the vines and ice above that. If the vines and ground would be actually frozen, it would keep them in better condition than if they were in water.

QUESTION: Isn't it a fact that if the plants are frozen in, they are entirely dormant and do not need any oxygen at all, analogous to a frog frozen up for the winter? If you were to put a frog in a small quantity of water, do you think that frog would survive during the winter?

DR. BERGMAN: I don't know. I do not believe it would, as its functions wouldn't be entirely dormant. If the plant were absolutely dormant it seems to me there wouldn't be a question of deprivation of oxygen, because our wild cranberry vines survive many times through the winter and raise crops in the spring, and they certainly do not get any oxygen when their functions are absolutely dormant, as they must be when frozen stiff.

COMMENT: That is the feature about having them in ice. It keeps them down to a temperature where no activity can take place. The temperature of the water is usually two or three degrees above freezing, and even at that temperature there is a minimum amount of activity taking place. If there is no oxygen present, it seems that injury is almost certain to occur.

COMMENT: The solution to this would be to freeze the bog to the ground; then you probably wouldn't have any leaf dropping.

DR. BERGMAN: Yes. After eight or ten inches of ice forms over the surface of the water, the rest of the water could be allowed to run off, letting the ice sink down on the vines. That would be another way to get away from the possibility of injury during winter flooding.

QUESTION: Does water passing over a bulkhead and dropping over a slight drop take on a large amount of oxygen?

DR. BERGMAN: I can't tell you how much it would take up. The greater the drop, the more oxygen it would take up. Agitating it in any way, or even exposing it to the air if it flows through a gate without any appreciable drop, will allow it to take up a certain amount of oxygen. Over a drop of six inches or more, the churning effect very greatly increases the oxygen content.

COMMENT: I have in mind, Dr. Bergman, that possibly the chief interest of this paper would come to those growers who use water on the vines more or less during the spring and summer. The most of the bogs, when the winter flood is put on, freeze pretty

close to the vines, if not clear down to the roots, with few exceptions. Some growers use water when they clip the grass, and some for insect floods, especially for fireworm. I think fireworm floods are possibly one of the chief causes of loss of crops because of lack of oxygen. Could you give us any additional information in regard to this?

DR. BERGMAN: In summer flooding, a great deal depends upon weather conditions at the time of flooding. I have found from studies made chiefly in Massachusetts, prolonged flooding cannot be made in cloudy weather unless at the same time it is very much cooler than usual. Cloudy weather increases the danger of flooding for any length of time. A great deal depends upon the source of water supply. A reservoir that is built on a marsh or swampy land of any kind where there is lots of organic matter, is always a poor place to get water. When water comes onto the bog in this way, it is always very low in oxygen and if the flooding is done during cloudy weather the danger of injury is greatly increased. It is better to pick a clear period, if possible, because then at least the sun is shining down through the water on the vines and the algae and other organisms always cause the oxygen content to increase during the day, and even though it drops during the night it is not so apt to go down to a point where it will cause injury.

PRES. A. B. SCOTT: Have you done any experimental work with respect to injury to cranberries after they have begun to ripen in flooding for raking?

DR. BERGMAN: I made some investigation here in Wisconsin in 1918 or somewhere along there. Those results were published in the American Journal of Botany, and also in a bulletin put out by the U. S. Department of Agriculture. There was some evidence of injury to berries from water raking. The immature berries seemed to suffer more than fully colored ones. On the other hand, fully colored berries that were properly dried stood up in storage tests almost as well as the best dry raked berries.

DR. BERGMAN: If any growers here have bogs now under winter flood who are interested in the matter of examination of bogs under winter conditions, I would be glad to talk with any of you and try to arrange to visit your bogs at some time during my stay here. I would like to have as much of a range of bogs as possible, in order to widen our information on this point. I will have to admit that I cannot see clearly yet what the outcome of this investigation is going to be—whether there is such a thing as winter flooding injury, or whether it is something else—but until that point is settled, I don't see anything else to do but continue to work to get evidence which will show in one way or another what we have to expect in this matter of winter flooding. Since some of the worst injury has been observed in Wisconsin, which has been contributed to oxygen deficiency during the winter, I think it best to get as much evidence in Wisconsin as possible.

WAREHOUSE INSURANCE

MR. C. J. TIMBERS

No increase is being made in the fire insurance rates on cranberry warehouses. It has been the customary practice to permit insurance of the cranberry warehouses at the same rate as other farm property, if the warehouse is located with the other farm buildings and insured in the same policy. However, when the warehouses have been located away from the other farm property, we still rate them within the farm schedule, but there is an approximate 40 per cent differential between the rates that were applicable to the warehouses that would be away from the regular group of farm buildings and warehouses located with the other farm buildings. Probably the only question that arose regarding the question of rates is that in certain cases the agents have quoted incorrect rates and have written some warehouses at Table A rates that should have been written at Table B rates. I believe there has been only one case raised, and that was raised by the agency at Tomah, and from information furnished it would appear that that particular case should have been rated under Table B rates, which are approximately 40 cents higher. It was a case of where there was just some insurance on the warehouse, and not on a couple of so-called boarding houses. They were valued at $300 or $400 each, which indicated that the buildings were not so very desirable from an insurance standpoint to begin with, which would also influence our judgment.

In regard to this cranberry warehouse matter, our bureau does not specifically inspect all of these warehouses. In the ordinary risk in town we do specifically inspect all of these buildings before establishing a rate. In the case of farm properties, the expense of the inspection naturally would be considerable, which would also be reflected in the rate, and they are rated by what we call class rates. We have a farm schedule, and all farm property takes that rate, irresponsible of hazards. It is admitted that on some farms we have gasoline engines, and on others not. There are slight differences in hazards, but we have always felt the expense of inspection would so add to the cost that it would result in a raise for practically everybody. So we thought it safer to use class rates, and let individual companies use their judgment as to whether they wanted to take insurance under the rates. If a class becomes numerous or valuable enough so there is a sufficient amount of insurance, we will specifically inspect the buildings and establish individual rates based on fire hazards.

I was interested here to see if I could determine the approximate insurable values that would be considered in the companies that are members of the bureau that I work for. The companies that subscribe to our bureau are all stock insurance companies, and practically all mutual companies except the farm mutual companies. Not having

any farm mutual companies, we naturally would only be interested in companies that are members of our bureau. Approximately what is the valuation of your average warehouses?

(Answer:) I would think the average value would be $5,000.00.

How much insurance do you usually carry?

(Answer:) We carry heavier insurance while the berries are in the warehouse.

Is that the general practice, to insure berries while in the warehouse?

(Answer:) Yes it is, as a rule. Growers usually take out sixty or ninety day insurance on the berries and boxes and crates in the building.

What class of companies are you insuring with? We haven't had record of much insurance on the cranberry section. Since the matter has come up, I have been keeping track to get the volume of business involved so as to see whether or not we can afford to spend much money on inspection work.

The bureau I am with inspects and makes fire insurance rates for all the insurance companies. There are 400 companies doing business in the state, and if all the companies had to make their own rate the expense would be great, so we are using the co-operative plan. Each company supports our business according to the amount of business they do. We make rates for all of the companies.

DISCUSSION

QUESTION: What are the A and B rates?

ANSWER: The A rate is $1.40 for three years, and the B rate is $2.20 for three years. That would apply to contents, too. The one year rate is 70 cents on the A and $1.10 on the B schedule.

QUESTION: Would that include the cranberries in the warehouse?

MR. TIMBERS: We have a rate of $1.20 for the short term covering cranberries only, but for the general line of farm property on buildings and contents, the table A and table B rates would apply. There is a question of underwriting concerned. Where they don't have a spread, they have a little rate differential. The rates on northern property are a little higher. Rates vary according to districts. We have been encouraging, in rural districts, the agitation for having fire apparatus kept in the buildings available for fire fighting. We will have to give some rate benefit if that is done.

QUESTION: What is the rate per hundred per month on cranberries?

MR. TIMBERS: It would be 36 cents for sixty days. For thirty days it would be twenty per cent, or 24 cents. For ninety days it would be 48 cents.

QUESTION: If I had storage boxes or shipping boxes in my warehouse, would the same rate apply as on the building?

MR. TIMBERS: On the farm rate, there is no differential between the building and contents. The question raised was in regard to a gasoline engine. In this case, the conditions of the standard fire insurance policy prohibit the use or storage of gasoline or a gasoline engine. Therefore it is necessary to have a permit for that engine, and also a permit for the storage of gasoline. That, I think, is probably the most common thing violated in the usual

policy. I think in most farm mutual by-laws you will also see the prohibition of the storage of gasoline. If you store automobiles in a barn you must have a permit or they can deny liability. It does not cost any more on the farm policy, nor on any type of policy. The company merely wants that notice. Some companies will not insure property in which gasoline is used.

QUESTION: You assume you are storing gasoline when you have a gasoline engine?

MR. TIMBERS: While you are using it. The policy reads use and storage. It is well to go over the standard policy once in a while, and to go over the by-laws if you are in a mutual.

Another question raised is about the knowledge of agent. Wisconsin courts are very uniform in that respect, if the agent saw the engine and knowingly sold you the policy. In mutual companies they haven't gone that far. They have held that being members of the company you are bound by the by-laws. It is usually unsatisfactory to even have the agent's knowledge. It is better to have a permit.

ADDRESS

MR. F. L. MUSBACH

The only experience I have had with cranberries, either directly or indirectly, comes about twice a year; one time is Thanksgiving Day, and the other time is Christmas Day. However, that doesn't touch very vitally the question in which you are interested.

You are operating on a soil type with which we have had experience in growing crops of practically every description except cranberries.

Four or five years ago I was called in by a party growing cranberries in the Lake Nancy district. We put on various mixtures at that time based largely on what was done under similar soil conditions in the eastern states—New Jersey and Massachusetts. We put on the fertilizers, and the growers reported they got an excellent crop of weeds, but no cranberries. Whether the fertilizers were to blame or not we do not know but we got no results on the treatments we used. We used complete fertilizers, including nitrogen, phosphate, and potash, using in that case raw rock phosphate because it has been found one of the good carriers of phosphate by the eastern growers. Most of you in Wisconsin are operating on bogs that have in them a large amount of nitrogen and organic matter. I understand that some of you are operating on sandy bogs. Is that true? (Answer: There are a few on sandy soil.) There we have surer footing but when we operate on a true peat soil six to eight feet in depth we aren't so sure about our recommendations. The results obtained in Massachusetts and New Jersey may not apply to Wisconsin conditions.

Speaking of peat bogs we can give you some instances in Massachusetts and New Jersey where they have had some increases by the use of fertilizers ranging from one to three barrels per acre but what gains they make are more than offset by the bad factors.

One of these is that they find that rot comes in on berries grown on the fertilized peat soil much more extensively than in the case of the unfertilized soil. The second objection they find is that they have been able to produce a very fine growth of weeds which they didn't have otherwise. Third, they kept track of the time of picking those berries, and because of the rather excessive vine growth it took their pickers nearly fifty per cent longer to pick a bushel or barrel of berries. We must bear in mind that this work was done under conditions similar to those existing in Massachusetts. Whether similar results would be secured in Wisconsin remains to be seen. We have no evidence thus far.

My thought in coming before you today was to tell you about our interest in your work. The only way that I know of by which we can prove whether fertilizers can be used advantageously under your conditions in Wisconsin is to try them out.

We have had similar experiences in other lines of work, of which I might tell you because it represents somewhat parallel conditions. Five years ago we started to carry on some work with the use of commercial fertilizers on potatoes. We thought we could profit by the experience of growers in Pennsylvania, Maine, and New York states. After five years of work we found that the recommendations that apply to growers in the East did not apply to Wisconsin conditions at all. In other words, what our growers needed in practically every section proved just the contrary. Our people needed to use high amounts of potash and relatively small amounts of nitrogen. We couldn't depend on the results obtained by the eastern people where conditions are quite dissimilar.

I am not a prophet and cannot tell whether Eastern fertilizers practices apply to your conditions. They have secured and are securing some very fine results in increase in yield and quality on their sandy type cranberry fields by liberal fertilization. Complete fertilizers are used in which nitrate of soda or bloodmeal is the source of nitrogen ground raw rock phosphate for phosphorus, and ordinary muriate of potash for potassium. But sandy soils are quite different from deep peat lands.

I should be very glad to cooperate with this association and County Agents Kuenning and Lathrope who are very much interested in the problem, by trying out fertilizers on typical deep peat marshes. At least we want to concentrate on those because the bulk of the acreage is grown on this soil type. We would like to try out various combinations with the understanding that it is purely an experiment. We wish to work on typical marshes so what results secured, either favorable or otherwise, would apply to a large part of the cranberry section. We want to work with men who are willing to cooperate on a proposition of this kind. We will operate on rather small plots for various reasons. First of all, we don't want any grower to assume too much of a loss in case it happens

to be a loss. Experimental work means that sometimes. Our plan is to try out a number of fertilizer combinations, on typical cranberry bog land, the crop from which may be not only harvested separately but also graded and the quality scored. This will mean some extra work on the part of the grower but unless this can be done experimental work has little value.

TYPES OF PUMPS USED IN CRANBERRY FIELDS

MR. J. I. MARQUARD

I certainly appreciate this opportunity of talking to you about pumps and pumping equipment. The types of pump which you could use in cranberry raising would be three. We can take the water out of the ground by three different methods. You can put air in the ground, put pressure behind it, and it carries water with it. You can pump water as high as 200 feet. However, the air lift is not a very efficient means of pumping. If you have a fifteen horsepower gasoline engine, you can get only five horsepower of actual water deliverance by means of air. That system is gradually going out of use, except where we have certain water conditions which would destroy a pump in a short time. The next type which could be used would be the positive displacement pump. These pumps are of the type very similar to the old hand pumps, except that we can put them in the ground 300 or 500 feet. The disadvantage is that we can get a limited amount of water, because then every gallon of water pumped has to be displaced by the plunger, and if we wanted to pump 8,000 gallons per minute we would have to put in a big pump with a plunger bigger than that desk. The cost would be too great. On cranberry marshes where you require a large amount of water, the only method is by means of centrifugal force, or the centrifugal pump. If I wind this chain around this knife and release it, the knife will go into space, indicating there is some force throwing it out. That is centrifugal force. In the centrifugal pump, there is a shaft extended through the water and rotated.

I want to describe a few of the types of pumps which can be used or have been used by our corporation. You can classify the pump according to the drive. This type pump is one which Mr. Hedlar will recognize. We have furnished him with four at Cranberry Lake. The water comes in at the bottom, comes through the propellor, and goes out. Each pump delivers 8400 gallons across a head of about six feet. We have another pump which has an enclosed shaft all the way up. This one cannot freeze in the winter. The one with the water coming up might have a tendency to freeze. The third type is a belt pump. That is, I believe, what most of you

people would be interested in in the line of a pump. However, you are far from the source of power and cannot use a motor. It would be necessary to drive it by means of a motor and belt.

I might explain the reason for the thrust bearing. If I push on this desk with ten pounds force, the desk is pushing back at me with ten pounds force. To every action there is an equal and contrary reaction. When you pump water and the pump throws the water up, you must remember the water is trying to throw the pump back with the same force. Unless you put in a thrust bearing to take that force, you will have trouble. Our men discovered that the entrance through the pump is a very important part, especially in this type pump. The water enters through a hole at the bottom, which is flared or made in the form of a bell. I understand some of you men are manufacturing your own pumps, so do not have the entrance at the bottom in a straight line, because if you do you are making a bad mistake. If you flare it out you get much better efficiency. The less bend and the smoother the water entrance, the more efficient the pump will be.

FINANCIAL STATEMENT, WISCONSIN STATE CRANBERRY GROWERS ASSOCIATION CALENDAR YEAR 1930

		Receipts	Disbursements
Jan. 1	Balance on hand	$328.31	
Jan. 5	—No. 70—H. R. Ebsen—Rezin memo.		$ 8.75
Jan. 25	—No. 71—Erma Gaulke—stenographic work		2.00
Feb. 20	—No. 72—H. J. Rahmlow—Horticulture Soc. Subs.		20.80
Mar. 8	—No. 73—A. C. Rockwood—envelopes and stamps		1.38
Mar. 31	—No. 74—C. S. Smith-salary 7/7/29 to 1/1/30 and exp.		46.73
Apr. 14	—No. 75—A. C. Rockwood—100 wrappers, 200 stamps		3.00
July 7	—No. 76—C. S. Smith-salary to 7/1, 1930		40.00
July 28	—No. 77—A. L. Fontaine, p. m.—250 stamped envs.		5.49
Aug. 13	— Dues received	35.00	
Aug. 18	— Dues received	12.00	
Aug. 22	—No. 78—Wood Co. Bank—trav. cheques, State Fair exp.		120.30
Aug. 22	—No. 79—Anne Bamberg—expressing recipe fo. to Fair		6.00
Sept. 6	— State Fair premium (75) ref. onch. 78 (50)	125.00	
Sept. 6	—No. 80—H. B. Scammell—honorarium		118.00
Sept. 17	— Refund-ch. No. 78, above county fair exp.	13.82	
Oct. 7	—No. 81—Erma Gaulke—steno. services, Aug. meeting		15.00
Oct. 10	—No. 82—C. S. Smith-county fair expense		50.00
Nov. 19	—No. 83—A. L. Fontaine, p. m.—125 double cards		2.50
Dec. 3	— Dues received	13.00	
Dec. 4	— Dues received	14.00	
Dec. 4	—No. 84—L. P. Daniels		17.00
Dec. 4	—No. 85—Mrs. C. O. Burt		5.00
Dec. 4	—No. 86—Robert Beppler		5.00
Dec. 4	—No. 87—Arthur Gaetke		5.00
Dec. 4	—No. 88—L. P. Daniels		5.00
Dec. 5	— Dues received	2.00	
Dec. 18	— Wood County Board Appropriation	300.00	
Dec. 18	—No. 89—Mrs. Mary Rogers—State Fair Allowance		40.00
Dec. 26	—No. 90—C. S. Smith-State Fair allowance		40.00
Dec. 26	—No. 91—C. S. Smith-postage, envs., express		8.83
	Total receipts and disbursements	$843.15	$566.28
Jan. 1, 1931	Balance on hand	$276.85	