Wisconsin there is a great deal of fruit bud injury and frequently there is a considerable amount of leaf fall. Both types are evidently caused during the winter submergence. It is distinctly noticeable that these injuries are greater in deeper flooded portions of the marsh and are most severe where the vines themselves are not frozen in.

ADDRESS

By Professor F. L. Musbach

I am glad your chairman said you would not expect much from my talk, so that now perhaps you will not be disappointed. I could not help but be interested in the problems you cranberry growers have. You are in the same class as any other crop raisers—you have all kinds of problems. I do not know why you invited more trouble by asking us to work on fertilizers. You have yourselves to blame now if you encounter more trouble in this connection.

As your chairman says, we haven't much to report so far as results are concerned. We started last spring, through the cooperation of growers in the different parts of the state. We have one set-up of fertilizer plots on the Lewis marsh in Beaver brook, one on the Biron marsh, and another on the Potter marsh at Warrens. In all cases, fertilizer was applied on bearing bogs. You might be interested in seeing just what we are doing. I have a little chart here on which I have put down the mixtures we are using.

I might say in this connection that we are starting out on the basis that we do not know much about cranberry fertilization. We have studied the literature by Franklin at Cape Cod and Beckwith at New Jersey, and the results they got are quite conflicting, and I am not sure whether their results have very much application under Wisconsin conditions. The New Jersey work is on what are called Savannah marshes—hard bottoms—far different climatic and soil conditions than we have. We have read their reports carefully, and in a measure based our treatments on some of their findings. For example, the Eastern investigators seem to be agreed that rock phosphate is a better carrier of phosphorous than superphosphate; so in our plots we have used largely rock phosphate, but we are also including 20 per cent superphosphate. There is quite a little disagreement as to whether nitrogen shall be used, and if so, how much, because we do not want to stimulate vine growth too much; it is the berries we are after. In this first series we are using rock phosphate as a source of phosphorous. There are seven plots on which we used rock phosphate at the rate of 600 pounds to the acre with varying amounts of nitrogen and potash applied broadcast this spring after the last reflow.

When we came to nitrogen we were confronted with the problem of what carriers to use, because we know some forms will go into solution very rapidly. In the set-up we have here, we depend on nitrate of soda as the soluble carrier. Then we use a by-product of the city sewage plant at Milwaukee, called Milorganite, which carries 5 per cent nitrogen, which is slow acting, and a very small amount of phos-

phorous. We use half of each of these materials as the nitrogen carriers; 50 per cent from Milorganite and 50 per cent from nitrate of soda. You will note that nitrogen is omitted on one set of plots, another received 2%, and another 4%.

Practically any crop grown on peat marsh will require potash in liberal amounts. Potatoes require it especially, but we do not know very much about cranberries. We are using potash in varying amounts—6%, 12%, and 24%. On some plots there is a very heavy amount of potash used.

The Eastern growers recommend the use of sulphate of potash. Mr. Scott made the statement at one time that muriate of potash should be used. We are using sulphate of potash in all cases, but in order to compare both forms of potash, we put in one plot using muriate of potash. This will give us another lead on which to base our work in the future. There is a difference of about $5.00 per ton in the price of the two forms of potash. The muriate is the cheaper form, and if we can save a little money by using the cheaper form and get results, we want to know it.

Now we start with three other treatments that are somewhat different. In the series of plots discussed thus far, we have used 600 pounds of rock phosphate per acre. Cranberry soils are invariably acid, at least in the northern section. Organic acids will react with insoluble phosphates and make them more available for plant use. In this second series, we use 20 per cent superphosphate as a source of phosphorous. The three mixtures employed are 0-20-12, 2-10-12, and 2-20-12. Blank or unfertilized plots are spaced adjacent to each treatment and give us opportunity to study soil variations.

Another thing we wish to study is the effect of fertilizers on the keeping quality. Here again we have very conflicting reports if we refer to the Eastern work. Franklin of Cape Cod reports poor keeping quality of berries where fertilizer is used. Beckwith reports contrary results. We are trying to find out the effect on berries after they have been kept in storage. Dr. Bain and his associates agree to make this study.

We hope, also, this year to get some results of the effect of fertilizer on the size of berries by your standard measuring cup.

If you saw the crop on the Biron marsh now, you would not see any difference in the plots. The vines all look alike, with an excellent set of berries. At the Lewis marsh at Beaver Brook you would see a great difference in two of the plots—those receiving 2-10-12 and 2-20-12. These have a fresh, green, healthy color, and the line is very sharp between these and adjacent plots.

These three inaugurations are on three different bogs, all in bearing condition, planted from five to ten years ago. That is one important part of our work. At Beaver Brook we started with a fertilizer application on new plantings. It is quite important to get the vines in bearing condition as soon as possible. If we could by proper fertilization shorten the period between setting and bearing, we would have accomplished something that would be of service to cranberry growers of the state.

DISCUSSION

Question: How large are the plots?

PROF. F. L. MUSBACH: They are small—one-fortieth of an acre. This is for two reasons: In the first place, we are going to harvest them separately, and we do not want to incur too much of a burden on the growers. It means harvesting each one separately. We want to get weights on each plot. Also, in case we ran against a serious "snag", the smaller the damage the better. We do not expect that we are going to have much damage.

Question: What results have you had on weeds?

PROF. MUSBACH: Weeds will respond to fertilizer like cranberries do. We had an experience of this kind with another crop this year. Conditions were very favorable for weed growth, but very unfavorable for peas. The result was that the peas went down and the weeds came up, and we had a beautiful stand of weeds. Weeds are tremendously heavy feeders, and utilize soluble plant foods. I wouldn't be at all surprised that under certain conditions if you have weedy ground it will be a little more so after applying fertilizer.

Question: What results have you had with the vine growth on the new plantings?

PROF. MUSBACH: We have only one case where we are trying that, and that is on the Beaver Brook marsh. If we get into trouble anywhere, it will be up there. We started with a mixture containing 4 per cent of nitrogen, 9 of phosphate, and 10 of potash. The applications range from 300 to 1200 pounds per acre. Mr. Lewis says that there is a little injury because of burning with the application of 1200 pounds. That is getting pretty high. We have used four different rates—300, 600, 900 and 1200 pounds per acre. Those are small plots. It is possible that we could use more nitrogen on a new planting, and that is what I am especially interested in.

MISS LUCETTA CASE: I would like to ask if they have had heavy rains on Beaver Brook since they applied that fertilizer?

MR. C. L. LEWIS: Yes, we did. I think it was applied on June 17, and we had a good rain the next day after that. We had a great deal of rain up through the 22nd of June, and practically no rain from then until the first of August.

MISS LUCETTA CASE: I asked that question because one year we had heavy rains and had almost immediate success with fertilizer. You spoke about the vines looking so fine, and I think it is because it rained and forced the fertilizer into the soil. The second year it didn't rain, and we didn't see the immediate results that we did the first year.

MR. F. R. BARBER: Are they doing any weeding on the plot?

MR. C. L. LEWIS: We have weeded it once, but the fertilizer had nothing to do with that.

PROF. MUSBACH: If your ground is pretty weedy to start with, it makes them grow.

MR. F. R. BARBER: Weeds respond as much to fertilizer as the vines do, if not more so. There is a bigger area subject to weeds, especially where they are planted in rows. Ours were spudded in in rows, and the space between the two rows would grow up solid to weeds that never had troubled us before on that particular ground.

PROF. MUSBACH: Weeds are not very particular what they feed on. They are coarse feeders. It doesn't take much food to give them a good start. I wonder if there isn't more trouble where vines are thin. If you have a good stand of vines, won't they hold weeds back considerably?

MR. F. R. BARBER: Yes. This was where they had been spudded in. The weeds got so bad we abandoned the whole field. The vines had been old and hadn't been doing well. We applied the fertilizer, and we found that even though we tried to confine the fertilizer to the hill, it seemed to spread out and enhance the growth of weeds between the rows. It formed a solid mass of cut grass.

PRES. A. B. SCOTT: I think there is one thing we ought to bear in mind in using fertilizer. Most weeds complete their growth in a year, and are annual weeds, that show up so prominently on fertilizer. Cranberry vines take three or four years to reach maturity. Those things must be taken into consideration.

MR. H. R. LATHROPE: While we are discussing weeds, it just occurred to me that if people using sodium chlorate used it without any regard to the amount per acre, they will probably get some damage on the crop following. If it is used at the rate of one pound to one gallon of water applied to a square rod, there probably will not be much damage to the soil. Bogs are different than uplands, but a moderate application will not hurt the soil. However, if you would use three or four gallons per square rod, I am afraid you would get a bad killing of the soil for a few years after application. The water used in flooding probably absorbs the toxic effect of the chemical so that it will not have harmful results for as long a time.

MR. L. G. KUENNING: I would like to make a little report on the Potter marsh. It looks as though we are getting results there, especially in vine growth. It looks as though we may have a little difference in the quality and size of the berries. Of course, that is more or less speculative. We will not know definitely until we harvest them. Each plot will be harvested separately and weighed separately. If we get any results, they will be sent to your secretary, so that they will either be sent out to you, or given at the January meeting.

I know many of you growers have used fertilizer. Some say it is worthless, and some recommend this, and some that. I remember Miss Case said 3-10-4 was the best mixture she has used. Probably that is a good recommendation. Our object is to find out what are the best carriers, and how much of each should be used. So often it is the case that the person using the fertilizer does not make a systematic check-up on results, and consequently we have a lot of opinions not necessarily facts. The particular set-up we have at this time we consider very simple and elementary, and probably from this we will have to go on to a bigger experimental field. We at least are going to get definite facts from experiments of this kind. We will try not to jump to any conclusions, and we hope you will not. The results obtained this year may not mean a thing. We may have to go into it another year, and from there may have to go into a more extensive field of fertilization. I am hopeful of the results that may be obtained.

MR. H. R. LATHROPE: Whatever is done this year or next, it should be done with the idea in mind of making it a long time period—three or five, or even more years, because we might get amazing results on one bog one year, and another year the results might be vastly different.

It is a long time program to really get information that will be valuable. Mr. Beckwith has been working on fertilizers for ten years in New Jersey, and his results are certainly very interesting.

MR. L. M. ROGERS: I would like to ask if there is much loss of fertilizer when applied when we have no rain.

PROF. F. L. MUSBACH: If there is no rain, there will not be much loss. If you had a drenching rain five minutes after applying, in the case of nitrogen, the soluble nitrogen no doubt would go down, but neither the phosphate nor potash would be affected by rain. Both are fixed in the soil so there would be no appreciable loss except in the case of nitrogen. Lack of rain would make very little difference, but I am not sure just how to answer that. Some of the bogs are sanded, and some are not. Where you have two or three inches of sand over your bog and the roots at some depth, I question very much the beneficial effect of fertilizer under those conditions. I wonder if it isn't true that you have the ground water at a pretty high level early in the spring, so that the ground isn't dried out completely. If there is a layer of moisture, the nitrogen especially will go down. Your phosphate and potash will not move as rapidly—they do not move far in any case—but in dry seasons you will not get the effects.

Question: Would it be advisable to fertilize after the fall crop was off, and then turn your flood on slowly?

PROF. F. L. MUSBACH: I question that practice of putting fertilizer on in the fall and then flooding. Your vines are going into a dormant stage. I think it would be much more desirable, basing my opinion again on the Eastern work, to apply in the spring after the last reflow.