Potato Varieties Suitable for Organic Production
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This afternoon we're going to look at organic production. We also need to understand that organic production will evolve in the Maritimes at the same time as conventional production will continue. That might mean that we might have some conflict, but I think that's an issue that we need to discuss here, and I would like to bring that up a little bit later during the presentation.

Having said that, what I would like to talk about today are two trials–one that was conducted by McCain Foods in Maine and another trial that we conducted at the research farm in New Brunswick. I'm trying to get some statistics on organic potato production in Canada and I could not really find them. Knowing what I know of the Canadian potato market, I kind of figured out that it's probably less than 1% of the Canadian potato market. I believe that the majority of production right now is designed for the table market. However, and some of you might be surprised by this, some processors have expressed interest in accessing organic potatoes for processing. A couple of years ago there was one full circle of potatoes grown in Alberta for processing for Maple Leaf Foods, and a lot of the growers in the area are quite keen to look at how this trial went throughout the season. I'm not quite sure how well it went in the end, but it was done only for one season for Maple Leaf. I suspect that as time goes by Cavendish might be interested or we might be interested. The level of interest is likely to grow in the future depending on how the market evolves.

There are countries where organic potato production is more established. In Denmark, for instance, I was able to get some statistics. There were about 17,000 tonnes of organic potatoes that were grown on 747 hectares. It still makes only a small portion, but nonetheless when you start growing about 1500 acres you start to be substantial for a country like Denmark. What they found is that the yield of organic potatoes was on average 23.6 tonnes/hectare, and that compared with an average of about 35.8 for conventional ware potatoes. So, on average, in Denmark the organic potato yield is about 3% to 4% lower than conventionally grown potatoes.

We heard this morning that the Netherlands is quite an innovative country in terms of trying new methods. There are also quite a bit of organic potatoes being grown in the Netherlands. Two years ago there were 24,000 tonnes of organic potatoes produced. Again, it's a small fraction of what they produce. The Netherlands produce about 7.4 million tonnes, but this is still a sizeable amount of potatoes. What they found in their situation is that the yield of organic potatoes was about half of what the conventional potato production system allows them to do. Perhaps one reason for that is because the Dutch, as we learned this morning, have a law that whenever there is blight coming in the field at above a 5% level, they must topkill. The reason they do that is to make sure that the neighbouring growers who are conventional growers can have fewer problems with late blight. So that is perhaps one of the reasons why they have a slightly lower yield than Denmark.

What are the major limitations to organic potato production? From my point of view, I think that there are really three. One is disease resistance, mostly late blight. Late blight is a disease that can really have a large impact on the crop, and it's very important that we are able to develop disease-resistant potato types, as Carlos was saying this morning. I believe also, as Bernie was mentioning, that fertility requirements, especially nitrogen (N), could be a large limiting factor. Potato is a crop that yields high levels of protein and carbohydrate per acre, but to be able to do that you need to properly fertilise it. Of course, the N requirement will basically increase the yield

potential of the varieties, and long-season varieties will basically tend to require more N. Bernie also touched base on total yield and tuber size. With regard to tuber size, N is very important to be able to get the size that the market is looking for. Obviously there is always the question of acceptable genotypes. Are there genotypes out there that would do better in an organic production system compared to other genotypes? In my mind that is also a major limitation.

When we talk about variety, really, what we are trying to do here is match a variety that you are growing with what the market wants, what we will be able to sell. In conventional potato production systems, varieties are grown based on market requirement. As a processor we're asking for certain varieties, and to a large extent in the table market it's the same thing. The packers want a certain variety to sell. My thought at this point in time is that in the organic production system right now you probably don't have as many requirements from the market as we do in conventional production systems. So I think you've got an opportunity to look at what we call your specialty or gourmet varieties that might have a greater appeal to the consumer. By being able to grow these different varieties, you might be able to establish yourself a very good niche market. I'm talking about fingerling-type varieties or exotic skin/flesh combinations. So you could have varieties with a combination of red skin and yellow flesh, or pink skin and yellow flesh, or even all blues. From your point of view, if you can find that there is a market for those kinds of varieties, I think it would be wise for you, as organic growers, to be able to tap into that market, because this is not something that conventional growers do very well. However, specialty and gourmet varieties is obviously a very limited market and will likely saturate rapidly unless efforts are made in the promotion. Having said that, there was a very good article written by Joyce Coffin in the January edition of *Fruit & Vegetable* magazine where she was basically putting forth ideas on how to market new varieties. That article is really worth reading.

These are potential varieties that organic growers can use to get themselves in the market, but if we really want to see organic production become mainstream, I think what we will need to do is really focus on varieties that the consumer at large in North America wants to eat. For most of it right now, what we are looking at is basically a round white or russet-type potato. I think that these varieties also probably have greater yield potentials. So we are looking at mid-season and long-season varieties, and to be able to do that, we need to overcome the limitations that we talked about earlier.

What we have tried to do is see if we could use some of the varieties that are either new varieties or commercial varieties that exist right now in North America or in Europe to grow under organic production here in North America. We did trial from 2000 to 2002. The trial was done in Maine, so we used the Maine Organic Farmers and Gardeners Association production guidelines. We aimed at developing a number of varieties, some of which you'll recognise from the presentation this morning. We had Agria, which is a Dutch variety. There is a variety called A90586-11 which is a North American variety, and it's probably the variety that has the most late blight resistance right now in the genotype we have in North America. It's a variety that we really wanted to try in this trial because it solves one of the problems that can be associated with organic production systems. We looked at two experimental varieties; we looked at Kennebec, an old standard of North America; at Santana, a Dutch variety; Sante; Shepody, a processing variety; Solide, also, I believe, a Dutch variety; Russet Burbank; and Umatilla russet.

What we basically did was planted our trial of potatoes following a green manure clover crop, and we believe that the green manure clover crop gave us about 50 lb/acre of N. We applied up to 25 tonnes/acre of manure. This was actually the highest level that the organic production

system in Maine will allow. This was applied in the spring, and it gave us about 62 lb N, 187 lb phosphorus (P), and 92 lb of potassium (K). We also added 2500 lb/acre of alfalfa meal, giving us quite a bit of N, and we also applied 600 lb/acre of blood meal. The total nutrient package of this production system was on average about 252 lb N, 187 lb P, and 149 K. These are the total potential nutrients that were present in our fertility package. However, probably not everything was available, especially the N. In the trial, the Colorado potato beetle (CPB) was controlled by Bt and *Beauveria*, which did a very good job. Timing was really good. Our fungal disease control was done using copper sulfate ($CuSO_4$), and the weeds were controlled using a Lely spring-tine harrow. I must say that in the three years of the trial we have never seen late blight, so this is something that was not present at that time so we cannot account for yield losses due to late blight.

To make it easier to look at the varieties, I took the average of the trial, which is the mean organic at the bottom, and I compared the varieties for each year based on whether they were higher or lower than the average of the trial. On the average over the three years we find that a number of varieties are actually doing better than the average of the trial. Late blight resistant variety A90586-11 did quite well at 197, Kennebec did very good as well as our experimental variety #2, and Sante did really well. Interestingly enough, Russet Burbank also did pretty well in terms of total yield.

When growing potatoes the total yield is important, but what's more important is what you can actually sell. What we have here is a little different picture actually. A lot of the varieties that did well in terms of total yield were not as good when we looked at the marketable yield. For instance, Russet Burbank went from 200 to 124. Again, we're below the mean of the entire trial. A variety like A90586-11 that was above average for yield is now lower than average. So basically what we're seeing here is that not all varieties can do very well in terms of total yield and also in terms of marketable yield. The greatest reason for that is tuber size. The varieties that tended to have a high proportion of small tubers–small tubers that are not sellable under the US #1 or Canada #1 system–are basically having lower marketable yield. So this data is really showing that the ability to deliver enough N to the plant is important to be able to maximise not only total yield but the portion that you're actually able to sell in the market.

One thing I didn't mention earlier is that the trial was done in a section that was completely organic, but just beside it we also had a conventional system to be able to compare it with. If we look in our situation here in North America, or in Maine in this case, the difference in total yield between organic and conventional was about 24% less for the organic; for the marketable yield we're looking at about a 32% difference and a difference in value of about 28% less under the organic system. This is a controversial statement that I'm making right now. If we're basing the data in terms of yield and marketable yield on the potatoes coming out of this area, and if we're having 30% less yield under the organic system, that would mean that to be able to supply the same demand of potatoes in PEI we would need to grow not 110,000 acres but 162,000 acres. In New Brunswick it would go from 58,000 acres to 85,000 acres, and we all know that at this point in time this would not be sustainable. So if you want organic production to really succeed we need to be able to overcome the limitation that the system is imposing.

So the second part of my presentation is my attempt to find a way to solve at least the N aspect of it. We did some trials with pelletized composted manure. There is a company in Quebec called Agrior that produces this product. I think that a product like this might have some potential application if it was available for organic growers. In order to investigate the potential efficacy of

Agrior I did a couple of season trials with the variety A90586-11. What we did in this trial actually was comparing Agrior organic fertilizer to several rates of mineral fertilizer. What I'll be presenting here is the comparison of Agrior to the optimum mineral fertilizer rate with the conventional system. What we see here basically is that the Agrior fertilizer gave us an increased yield compared to even the mineral fertilizer, so in terms of total yield we're talking almost 14 cwt better under the organic than under the mineral fertilization systems. That is quite interesting. Marketable yield followed the same pattern. Again, we are able to actually increase our amount of yield under the organic fertilizer compared to the mineral. Crop value was very positive again. I believe is because we were able to maintain the percent of the small tubers to a similar level in both systems.

In conclusion, I think that the constraints in the organic production systems currently do not allow varieties to reach their full yield potential, and a large part of that, I believe, is due to N. As we saw, many varieties that had a very high total yield did not necessarily have a high marketable yield due to the high proportion of small tubers, and that is a problem. The varieties that did the best in terms of marketable yield were Kennebec, Sante, and Agria. These tend to be the varieties that also had the lower percentages of small tubers. I believe that the novel sources of readily available nutrients such as the Agrior system might provide us some gain under the organic production system.

Really what I'd like to stress again today is that if we're going to grow the acreage under the organic production system, I think we need to look at varieties that have late blight resistance. It's going to be very critical to do that. But I don't think that it's necessarily the only thing that we need to look at. As I said earlier in my presentation, I think both system will have to coexist for a number of years. We have to be able to deal with the issues of late blight, and if we see that late blight is spreading in the area, I think that will create a lot of tension. So in my mind the failure to deal with issues such as late blight could actually increase the use of pesticides in the conventional potato production system. The first reaction that a conventional grower will have if he sees a lot of late blight in the area is try to protect his crop by using more pesticide, and I don't think that we want to see that. Our goal should be to try to minimize our use of pesticide in general in our production system. What I'm proposing here is that we look maybe at a system such as the Dutch model where basically in a situation where late blight is found in organic fields, there would be some level that would trigger a mandatory topkill in the organic production system. I think we need to look at such a system in North America or in the Maritimes if we see an increase in the organic production system. Our goal is to promote organic, but at the same time we don't want to incur more cost to the conventional potato grower and result in having more pesticide use in the area. So our challenge, I think, here as a group where we have both organic growers and conventional growers, is to talk to each other and try to find a way we can basically deal with the issue.