Current Approaches to Organic Potato Production
Dr. Derek Lynch

Initially, I thought I'd give an overview of what I've seen of the current practices in the industry. I've changed my topic a little bit, but hopefully it's the same topic. Hopefully there's a connection between the research needs and the current practices, or else we're all in trouble. I'm going to give a short overview of some of the research we've been directly or indirectly linked with. By "we" I mean theOACC, the Organic Agriculture Centre based in Truro. The particular research I've been doing in organic potatoes over the last few years is funded by the three Maritime provinces very much with input by growers in those three provinces.

Some of these research needs have been mentioned already, but I just want to mention a few of the projects that haven't been discussed here in detail. Working with Raymond Loo over the last few years, we've been involved with variety performance trials looking at a range of varieties, their performance, consumer preferences, etc. when they're produced under an organic production system, including some of the gourmet or specialty varieties as well. We also looked at alternatives to copper (Cu), and there has been a project here in the last year on compost teas, not so much as an alternative to Cu but for late blight control. That was initiated by Robinsons; Steve Watts and Roger Henry were invoved in that, and some of the results have been presented recently by Dr. Tony Sturz a couple of weeks ago on the Island, and those results are available. It was both field and lab trials with compost teas, and Colorado potato beetle control. I would just like to mention that there's a good poster at the back– Tara Moreau's project at the Nova Scotia Agricultural College (NSAC) over the last couple of years, her master's thesis looking at a range of foliar sprays for Colorado potato beetle control. Some looked quite promising.

Another area we haven't discussed much at all is what is an appropriate controlled atmosphere for storage in an organic system. If we get into processing varieties, what products could we possibly use as a sprout inhibitor. There has been some interesting research in this area. Kris Pruski at NSAC, Bob Prange, and Barb Daniels-Lake down at Canso have been looking at ethylene over the last few years. Whether that would be approved for controlled-atmosphere storage or sprout inhibition in organics is another question. It certainly is approved for bananas. Would it be approved for potatoes? I don't know.

I'm going to focus mostly on nutrient management–in the last year I've been involved with some trials in the region. But before I do, there are a couple of last considerations that I think about when we talk about organic research. First of all, is it relevant, not only to the organic industry, but is it relevant more broadly? Are we getting at anything fundamental, are we doing something groundbreaking, or is it just backbreaking? We certainly can make it backbreaking when we're using low-analysis materials, as you'll see with some of the trials. Some of my crew ended up whispering things about prison work...Applicability is also a consideration. Here I've listed the logos of the four certifying bodies in Atlantic Canada–the major certifying bodies in Atlantic Canada. There are differences, as some of you well know, in terms of their interpretation of the national standards. That is important, of course, when you start to consider inputs and materials brought onto the farm. Some of them will be approved by some of the certifying bodies. So there are some differences, and hopefully we can discuss those issues later. There are regulatory hurdles. Here I'm thinking about the minor use program, in particular, the new program with the Pesticide Management Regulatory Agency (PMRA). With a relatively small industry for the near future in organic, how quickly can we access some of the materials that

look promising? How quickly will that system provide that opportunity?

Moving on to nutrient management…this has been covered quite a bit already, especially when you get into processing varieties, the high-end demand of the processing varieties, if we get into organic production of processing varieties. Bernie has covered that topic very well. The second point I think is key is that we need to get a handle on mineralisation of our organic N in the soil. This is going to be critical for organic systems where we would want that to be the major contribution–where we would hope it's the major contribution rather than a supplemental end source.

I'm going to talk about the two main sites. One is at NSAC (our own organic plots at NSAC), and the other is here on the Island–Kentdale Farms in Winslow (Fred Dollar's farm). So we were really looking here in those particular trials at processing varieties. We put in Shepody, not because we think it necessarily would be used in organic, but because we know so much about the N dynamics of Shepody. It was sort of our reference variety. We also had that line from McCain's that Yves had mentioned which has been promising for late blight resistance. We wanted to look at yields, quality, moisture, and N dynamics. We were putting in a high rate of compost as one of the treatments to see how that affected soil moisture, and then we were going to be looking at N losses over winter. It was a randomised complete block; within each variety we had control.

For the compost we wanted high rates of total dry matter going in, 27-50 tonnes dry matter. These are very high rates of this pelletized manure. This is the New Brunswick product out of Fredericton. We estimated about 30% N available, and I'll show you the analysis of that material. We knew this would be excessive, but we wanted something on the high end because we wanted, as I will show you, to evaluate a new tool for assessing soil N availability. Here is the analysis of those two materials. The compost had relatively little immediately available N, whereas the poultry manure had about 12% as immediately available inoganic N. That's sort of an intermediate between a compost and a raw manure. This is a steam-treated pelletized dried poultry manure. We probably could have waited for the C:N of the compost to go down, to be a little bit more mature. Again, I wasn't looking for a N-source compost; I particularly wanted a material that I was putting in for dry matter, not for N. I was taking a bit of risk, and it came back to haunt me, actually. I'm not trying to say that compost doesn't work for an N source; I've done lots of studies with compost, and you can certainly find compost much more mature that will provide the N, and we've seen some of those results. So bear in mind that in this case I was looking for a low-N-content compost so I could put it on at high rates.

Here are the typical trials. We soil tested, and we put on rock phosphate beforehand to soil test requirements. The plots were 4 rows, 10 meters long. You can see just how much compost that was, and that's where the prison work complaint came in–putting it on by hand and getting it on at the right rates. We did total plant samples to look at N using protocols that Bernie suggested–how to do that at topkilling. We were taking sampling for inorganic N every 10 days to 2 weeks, and for moisture as well. So there was a lot of in-season sampling. At harvest we took 2 rows, 8 meters long–the 2 middle rows–and graded, took weights, and then looked at N in the tuber, etc. You can really see the difference in the responses in the plots. Here's harvesting later on. We planted in early June. We would have liked to get in a little bit earlier. By the time we got through the five sites we were pushing our luck, I think, and that effected yields at the last site in particular. But it's still an interesting story. Almost ideal conditions at the Kentdale Farms. Here's the rainfall distribution. Marvelous conditions for soil N mineralisation,

nice temperature, lots of moisture. You'll see that when I talk about soil N availability.

Here are the yields. There was no difference between the varieties in terms of the total yields. This is the control–no N added. Fred's rotation is potatoes one year in four on his organic farm–potatoes, hay for two years, then barley, and back into potatoes. He tends to get 250 cwt or so with no N added (he's adding K and P if needed). So this is what we found with our control plot. The numbers at the bottom are percent marketable yield. The way we graded them we found very few culls; there was a low cull rate for size or defects at this site. However, here's the response to the pelletized manure at about 7 tonnes/hectare. There was a 20% increase in yield. Even though this is a large amount of this material going in, given the current premiums for organic, the economics for this absolutely work out, tenfold or something. But it's more of a philosophical issue, and we will come back to whether one should be supplementing to this rate.

The compost came back to haunt me, as I said, and tied up a bit of the N. So here is the total N. Here is the total N recovery in the plant with nothing added. This is just the Shepody–83 kg with that pelletized manure at 300 total. We bumped it up and the yield response was close to perhaps the ideal for Shepody–150 kg. This is excessive; you can see it in the tuber. You're getting higher nitrates as one moves up into this range, as well as lower specific gravity apparently, and we've got to look at that. This is total N recovery in the plant; 20% of that material was available, it appears, at least when we went in in early June. You might be able to go up higher than that. But that's only because there was a fairly sizeable amount of N already in the soil and available. Leftover nitrate...Are we overfertilising? Other than the tuber nitrate issues, what's leftover kicking around in the soil? Here's soil nitrate to 30 cm right after harvest–very little for Fred's routine of four-year rotation. There was about 50 kg, and we'll go back in the spring and see if it's still kicking around. There was no difference between the varieties. The industry average is about 60 kg left over across the region, and obviously excessive here.

Here is the other tool we wanted to look at. We're using standard soil extractions. What about any other means of assessing soil N availability? Andy Hammermeister at our centre has done a lot of work with these. I was particularly interested in just looking at nitrate and ammonium absorption on these little membranes. They're called anion and cation exchange membranes. The difference between these and standard soil sampling is that they are absorbing continuously unless they become saturated. You can leave them in the soil, and they are monitoring available N continuously over time. So it's a flux measurement. How do you relate that back? The trick is how one relates that back to real nutrient values. You get numbers like this–available N in mcg/cm^2 of the membrane. It's a nice relationship. Here's our control. This is in that first 30 days up to hilling–the key part for N needs in the crop. Here is our poultry manure at the two rates. The rate is changing; it's not going to be exactly the same over time. Just for comparison, I've shown the soil mineral N at that 30-day point for the different treatments, so that's total mineral N. It was about 30 when we came in in the spring.

So how does one use that? Well, what's the relationship between the N sorbed on the probes and total plant uptake? We got a very good agreement in terms of total plant uptake. Here's our very high rate of that Nutri-Wave..total plant uptake. The question is, "How long do you leave them sitting there, and what period do you calibrate to?" Obviously the slope is going to change even if one hopefully does continue to get these nice agreements. So there's a lot more data to generate on these if one is going to start using these in organic systems to get a sense of the amount of soil organic N that's available. If we went in early in the spring with lower soil

temperatures, would they still be as reliable? That's another question as well. But it looks promising to continue working with them, at least.

Our second site was Brookside. I'll just show it quickly. Everything doesn't work as you hoped. This was going straight in after pasture. We might have expected a lot of wire worms, and we did get a lot of problems with wire worms reducing plant stand. We didn't get a yield response. I don't think we would have. There was a lot of N available. Where you had less rainfall during that earlier period, how did that effect the pattern? Once we had that rainfall event, here are the probes again. You've got that flush. So how these tools work, and how predictive they'll be, is very much a function of temperature and moisture. We have to bear that in mind. If that's the only point I make here, I think that would be it.

Comparing the two sites, bearing in mind that caution around the Brookside site. These are the control plots, 3 days Shepody alone. Here's the total N recovered in the Shepody control plots at the two sites. I think we need to generate some more data to make any kind of definitive statements.

At the last site we thought, "Well, let's go back down to some lower rates". This was at Pirmin Kummer's farm in Port Elgin. We wanted to compare two of those poultry manure products straight against N fertiliser. Pirmin is certified by the World Wildlife Fund as opposed to an organic certification, so it allowed us to run N fertiliser at his site. His standard practice when growing Fabula is to put in about 75 kg of N, given his rotation. The results really supported that. In this case also we banded the material to see how it would work. Here is the response. Again, it was planted very late, so I'm sure the yields could have been higher. But it really supported Pirmin's use of 75 kg of N for Fabula. It looks like we can get a good response with Nutri-Wave even at that lower rate, down to 150 kg. This is a lower analysis poultry manure out of Quebec. It has about 2% N. It is perhaps not surprising that as the total N content goes down, the available N goes down as well, and one has to bump up the total application rate.

In conclusion, I think that it is possible to get high total and marketable yields of processing varieties under strictly organic production practices. Is N supplementation justified? It certainly is currently, given the current premiums for organic potatoes. That line A90... matched Shepody, at least at our sites this year, with respect total marketable yield. Lastly, these probes–PRS Probes–may be an effective tool for predicting soil N availability in organic potato production.

Q: In Quebec we have a (inaudible)

A: The question was about using legumes for N, and concern about phosphorus (P) and legislation for P. That's a very good point. At our second site that I went through very quickly where it was an old pasture plowed down, all of the N was supplied. We really didn't need to supplement whatsoever. What we're trying to do with this research is find out how to quantify that in the spring–how can we tell if the legume is going to do what you're suggesting? The P is another issue in organic, and I'm talking on Friday about fertility in organic systems. We have to look at ways of recycling P back onto organic farms. I think that's the other issue with using these regional nutrient sources–that's just as important as N.

Q: (inaudible)

A: I think that at both sites most of it was coming from the soil N, and that was encouraging.