ILSI 2021 Annual Symposium Session 7: Greenhouse Gases from the Food Supply Chain: Paths to Mitigation and Sustainability

Transcript of the presentation, If You Can't Measure It, You Can't Manage It. The Why, the What and the So-What of Greenhouse Gas Assessments in the Dairy Chain, Jeremy Hill, PhD, Fonterra, New Zealand

Jeremy Hill:
Thank you for this opportunity. I'm really delighted to be able to be sharing today the work that we've done around the greenhouse gas assessments across our chain. It's work that is applicable globally. And I want to talk particularly around what we've done to help develop common methods, the application of those methods in our chain and how we're then using the information that has given us to make improvements. Those improvements are in farming practices, but they're also giving us a strong indication of where we need to put in place mitigation technology, particularly around methane, which we're going to come to. Now in presenting the data I'm going to present today, I want to make the point that we have done the accountancy so that the calculations in CO2 equivalents, if you want, on the basis of the way that the New Zealand government measures its inventory and how that is a part of its commitment to the Paris agreement.

Jeremy Hill:
Now, as the speaker following me will clearly show, that's only one way of doing the accountancy, there are other ways that, quite frankly, are probably better, a better way of reflecting particularly the global warming impacts of methane. And again, as you'll see, as I take you through this presentation, you'll see why that is particularly important when we look at the emissions from livestock chains and indeed the dairy chain. The other thing we'll hear later today is around the importance of soil organic carbon, the soil microbiome, and why that's important. Again, because of the accountancy system that is used, you're not going to see that as part of my presentation either. But I can tell you that we are very actively involved, both in New Zealand and internationally in looking at how we can make those assessments and include those within the accountancy system that's used. Now, I need to... I cannot see for some reason, the forward buttons disappeared from my screen.

Speaker 2:
So just click on the presentation, then you should be able to use your arrow keys to advance.

Jeremy Hill:
The presentation has actually jumped to another screen for me. Can you see, has it changed? [crosstalk 00:02:39].

Speaker 2:
We see...No, it looks perfect. Oh, a slight change. [Crosstalk 00:02:43].

Jeremy Hill:
All right. So just very briefly for those who are not familiar with Fonterra, we're a dairy cooperative. We're owned by 10,000 New Zealand dairy farmers. We produce a lot of milk at peak. A peak day for milk production in New Zealand, we produce over 80 million liters of milk a day from those 10,000 dairy farms, which goes to one of 29 factories that we have in New Zealand. And we produce around about two million tons of dairy products a year. And then the reason I say tons of dairy products is that the majority of milk in New Zealand is processed into products that are exported to one of 130 markets around the world. New Zealand is very, very atypical for many dairy nations in terms of our emissions profile, as a result of, as you'll see, a low population and a significant amount of dairy production, 95% of which is exported. Okay, I am having a problem with...

Speaker 2:
I would recommend just try using your mouse instead.

Jeremy Hill:
I am doing... It's... Okay. It's just really slow. I'm sorry. For some reason there's a big delay. So, my apologies to the audience, I seem to be able to not do anything about that. So, what you see here, and very briefly, is the work that we've done to support the analysis. First and foremost, we did some work in 2008 involving the University of New South Wales Scion, which is the Forestry Research Institute here in New Zealand. They had a set of skills. And AgResearch, which is our pastoral research institute in New Zealand. Both Scion and AgResearch are government-owned research institutes. Together those three organizations working with Fonterra developed one of the first, if you want, more comprehensive LCAs for a large dairy chain. We took that methodology where we were very actively involved in IDF New Zealand. And we took that methodology to the IDF to see whether that could be incorporated and developed into an international standard or guideline, which was done in 2010.

It was updated in 2015. And we are now working on updating that guidance to try and incorporate soil organic carbon methodologies as well. Having helped develop a common method, and this is really important because if everybody's using different methods, what do the results really mean? Having helped develop that common method we then started applying it very early. So, in the 2010-2011 season, we started an eight-year study, which we published in January 2020. I'm looking at 368 benchmark farms that we've monitored around New Zealand over that period to try and determine what the emissions were from those farms and what was the source of those emissions.

This year, we've taken the approach out to all of our supplier farms to provide them with information on their emissions. And I'll come back to that later to show how we're providing guidance and how they can change their farming practices in order to improve those emissions. And I'll try, and there we go. That's a bit quicker. So just covering at a global level and a New Zealand level, what that's told us. Well, we just heard that roughly a third of emissions are coming from agriculture. We would be in agreement with that. I think given the, and I would caution this very strongly, given the accuracy of which we can do this, I would say they're in the range of 20 to 30%.

And we'll definitely come back to some of the difficulties of measuring emissions as part of this session, I'm sure. But within reason they're around 20 to 30%. FAO had it at 24% from previous figures that I've incorporated here. Of that 2.7% of global emissions are from the production of milk, and 4% if you include the meat that comes from the dairy chain as well. Now again, my comment here is, as

determined in carbon equivalents, and a big impact on that is how you account for methane, and Frank's going to cover that in some detail later.

The next point I want to make is, what does that look like in New Zealand? Well firstly New Zealand is a very small contributor to global emissions at 0.16%. The reason for that is we have a tiny population. So New Zealand population is five million. We've actually got five million cows in New Zealand. So, we've got the same number of people as cows, or cows as people, if you want. And as I said, most of that's exported and I'll come to what that means about our emissions, our detailed emissions profile in a second. About half of our emissions are agriculture and about half of agricultural emissions in New Zealand are dairy. And when we look at what is driving that, around 85% of those dairy emissions are coming from the farm, getting closer to 90%, quite frankly. Of those emissions, 70% is enteric methane, again on the basis of the accountancy use.

So, jumping into that New Zealand context, we have a very atypical profile because of a lack of population and lack of industry, quite frankly. So, what you see is the emissions profile in this pie chart for New Zealand. And from that, you can see that in aggregate energy is around 41% of our emissions and agriculture is around 48. Now that is very, very atypical for a developed economy. Ireland would probably be the next at around 30%. But in Ireland, I think dairy contributes around 10%, unlike New Zealand where it's closer to 25. And because Fonterra is around 80% of the dairy industry in New Zealand, Fonterra's contribution, primarily through our shareholder farmers, is around 20%.

Now that's still only 0.03% of global emissions, so these are big numbers in New Zealand, little numbers globally. Nevertheless, because of that 48%, for New Zealand to meet its Paris agreements, it must include agriculture. And therefore, there is a strong focus on making improvements to our emissions profile, certainly in energy, which you see is still significant, but also from agriculture. Now in aggregate, on a yearly basis, the cows in New Zealand actually produce a lot of methane. And I worked out that would fill 8,000 Graf Zeppelins if you were to capture that methane.

Now, the problem is that that methane is produced in a very diffuse and dispersed way. So, each cow only produces roughly one balloon of methane per hour or around 230 grams per day. Now the important point is, that 230 grams of methane, because as Frank will show later, how you turn that into carbon equivalents makes a big difference. But using the New Zealand accountancy system, that gives us about 0.78 kilos of carbon equivalent per liter of fat and protein corrected milk. And the international standard way of doing this is to correct for the solids content in your milk, or the nutrition the milk is providing, which makes somewhat sense. Globally, of course, the emissions that are represented in that 2.7% of emissions that dairy contributes to global total, the average is 2.5 kilos of CO2 equivalent. And so, there is a big difference between the average and some of the practices out there. New Zealand tending to be at the leading edge of those practices.

Coming back to that 0.78 kilos per liter of fat and protein corrected milk. Where does that come from? Well, as I mentioned before and showed in summary, most of that is enteric methane. We've got a split of where the methane comes from, a split of whether the nitrous oxide comes from, where the CO2 comes from, all the inputs, all the outputs on these 368 benchmark farms that we followed for those eight years. Now, the important point about eight years is, in particularly the system that we use, which is almost 100% outdoor grazing for the entire year, you can be subject to significant climate impacts year to year. So, in order to get an accurate representation of what our footprint was, we published this study over an eight-year period. Since publishing this study, we've continued to do it actually. So, each

year we're continuing to do this analysis and as I'll show later, we've rolled this out to all 10,000 of our farms now.

Another important point is, the benchmark farms, and in fact, as you'll see later, the total supply spans the length and breadth of New Zealand. And that's from what we call Northland to Southland, they're easy names to remember. And the key point about Northland is it's sub-tropical in its climate and Southland is sub-Antarctic. It's a huge difference in climate. Nevertheless, we didn't see a great difference in emissions between those regions. Northland tended to be a bit higher and the reason for that is it tends to have a little bit more brought-in feed. And as you'll see that can make quite a big impact on that emissions profile.

So, looking at this, we also found between the top quarter of performance, or the lowest quarter, if you want to think about it from a methane or greenhouse gas production perspective, and those farms that are producing the highest levels there wasn't a great deal of difference actually if you looked at it on a quartile basis. But what we did find is in those bottom set of charts, really, what is driving some of the differences. So, the efficiency of milk production or milk solids production on the farm, you can see makes a big difference. The application of fertilizer makes a big difference and particularly the excess nitrogen that can get converted to nitrous oxide, and also brought-in feed, as I mentioned before.

In the last year of the study, we also expanded that to 7,146 of our farms, just to see how representative those benchmark farms were going to be. And we got an almost identical result. And we got an almost identical result because actually there wasn't a great deal of difference. In fact, it was very, very little difference between the benchmark farm average data and the broader number of farms that we analyzed. And although down at the bottom, you can see what looks like a 10% difference in brought-in feed I need to put that in context because 96% of the feed consumed on New Zealand farms is home grown. So actually, it's only 10% of 4% in other words, 0.4%. So, it's not a really big difference between the benchmark farms and that broader set of farms that we analyzed.

The important point in getting to where you get change is, you need to then get relevant information to all of your farmers, because they are the ones that will be making improvements. The management practice is, if you can't measure it, you can't manage it. And the people that are managing it, given the majority of our emissions in the chain are on farm, other farmers. So key aspects of what we've done this year is to take all this down to the farm level and provide the farmer with a bespoke report for his farm.

The key thing about that report is it takes account of his performance, or her performance, in terms of managing their farm and compares that with two things, the average farm for the region they're in and similar farms to theirs in the Fonterra supply. So, they get an idea of, if you're farming this way, how do you look? If you're farming in this region, how do you look? And then we provide a dashboard of where the improvements can be made. For example, we think you've got an opportunity in brought-in feed, fertilizer application, perhaps even stocking rate, et cetera. Once the farmers got that information, and particularly over these next few years, we have a series of consultations with those farmers, through our farm advisory service, we've got bespoke, sustainable farming advisors that we employ that go in and help the farmer with those improvements.

So, it's been really, really pleasing to see how we've been able to engage at that global level to help develop a common approach, to apply that approach, to see what data has given us in New Zealand. But the FAO also applies that approach to give it a common view globally, and then to be able to take that

down to each individual farm. And again, I'll come back to the point I made at the start. We can easily change the warming impacts. And particularly with methane, if we were to introduce new measures, we can easily account for carbon, well we can't easily account for carbon, but we could account for carbon in the soil if that becomes part of the accountancy system as well. But at the moment we're following essentially the accountancy rules used by the New Zealand government in making its commitments.

What we do know is management practices will probably only take us so far. And even if you have a balance, taking account of regenerative practices, soil, organic carbon, et cetera, you still have the potential to make an impact on global warming by reducing methane, and nitrous oxide for that matter, which is why since 2001 Fonterra has also been investing in the development of mitigation technologies. So, a raft of things that we can do to inhibit, particularly the production of methane, given as you saw that's 70% of our emissions. Very early on, we saw the attractive potential of a vaccine. So, we've been investing for over 20 years. And in the development of a vaccine, it's very, very difficult because this is a different way of getting a vaccine to work. We were trying to essentially vaccinate an animal through the blood to get an impact on the methanogens in the rumen.

And it's quite a challenge. Over the last few years, we've brought together the best vaccine minds in the world in, and certainly in livestock, to help us with this, but it's still quite a challenging task. However, the great thing about the vaccine, as you could see this being applied in both small holder and in scale livestock production. So, we'll still keep trying with this particular approach difficult as it is. There's a [inaudible 00:20:53] of local inhibitors that are, and an increasing number being produced, that are showing potential. The key point coming back to the earlier slide though is, at this point in time you've only got 17 cents per cow per day U.S., to have a solution for 100% of that methane reduction. If you were to get to something more like 50% or 25%, those numbers are obviously much lower.

So, these solutions need to be really, really cost effective as well, of course, practical. And the way I like to describe that, yes, they've got to be good for the planet, but they've also got to be good for the farmer. They've got to be good for the cow's health, and they've got to be good for the milk in terms of residues and milk production, and so on and so forth from the consumer end.

We're working on a number of quite radical technologies as well. These are closer to rocket science than dairy science, quite frankly. There's a whole range of natural inhibitors. Seaweed, red seaweed is well-publicized. And I know Davis, the next speaker from Davis, Davis has been actively involved in doing that research. And then another area is using cultures. Of course, the rumen is a large microbiome. In order to try and modify the rumen by microbiome through either cultures or fermentations. And Fonterra has tens of thousands of cultures that we've collected since the 1920s. In order to make a range of dairy products, cheeses, yogurts, sour creams, et cetera, that in the early two thousands, we mined for probiotic activity for human applications. And now we're doing the same to look at applications in creating fermentations, which we call Kowbucha, to potentially mitigate methane. Some promising results there, but again, a long way to go before we will be confident that would be a practical solution for animals.

The last point I want to make is that, greenhouse gas is only one part of the food system. It's not the only thing you need to address. There are lots of other aspects. It is a very complicated system from a socioeconomic and environmental perspective, and there's a lot of these that are important, and you need to take those into account. So, one of the other things that I do, and I have the privilege of doing, I have a professorship at a university, which is literally across the road from Fonterra's research and development center, where I helped to establish this thing called the Sustainable Nutrition Initiative.

And I do invite you to go visit the site. I'm not going to go through the information in this presentation. There's a whole raft of information around the food system and how it provides nutrients in particular because the key concept of the Sustainable Nutrition Initiative is nutrition comes first.

Any system that fails to provide the minimum requirements of the key nutrients, and we've modeled 29 of them in the work that we've done to all of the global population cannot be sustainable. So, you must have that provision and dairy without going into details is a critical part of that system at the moment. And it actually provides, are weighted around 17% of global nutrient provision. 17%, which is why it is so important to do these measurements. And it's why it's so important to introduce these management practices, to make improvement in the way that we produce milk mitigation technologies to reduce that footprint as well. Thank you very much.