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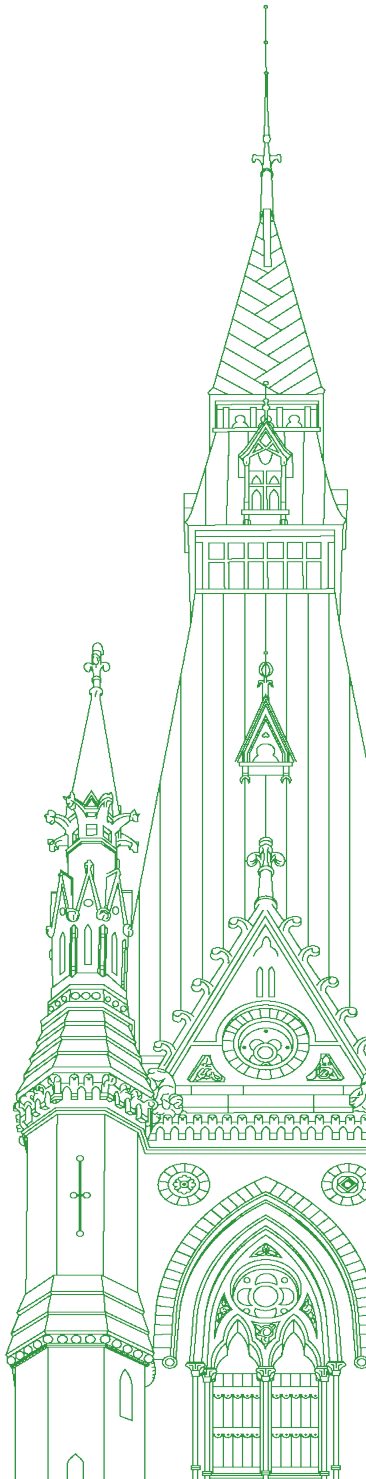

Chair: Mr. Kody Blois

Standing Committee on Agriculture and Agri-Food

Monday, May 9, 2022

● (1100)

[*Translation*]

The Chair (Mr. Kody Blois (Kings—Hants, Lib.)): I call this meeting to order.

Welcome to meeting number 18 of the Standing Committee on Agriculture and Agri-food.

I will start with a few reminders. Today's meeting is taking place in a hybrid format, pursuant to the House Order of November 25, 2021. The proceedings will be made available via the House of Commons website. So you are aware, the webcast will always show the person speaking, rather than the entirety of the committee. Screenshots or taking photos of your screen is not permitted.

[*English*]

Colleagues, I would remind you to follow the health protocols.

Otherwise, this isn't our first rodeo, so we'll get right to it.

Pursuant to Standing Order 108(2) and the motion adopted by the committee on Monday, January 31, 2022, the committee is resuming its study of the environmental contribution of agriculture.

I would now like to welcome our witnesses for this two-hour panel.

With us today by video conference from the Department of Agriculture and Agri-Food, we have Dr. Gilles Saindon, who serves as the assistant deputy minister of the science and technology branch; Dr. Louis-Pierre Comeau, landscape and soil carbon research scientist; Dr. Ed Gregorich, research scientist, agrienvironment division; Dr. Reynald Lemke, research scientist with environmental health; Dr. Judith Nyiraneza, research scientist, crop nutrient management; and Dr. Mervin St. Luce, research scientist, Swift Current research and development centre.

Welcome. We're happy to have you here before our committee.

We're going to allow for up to 15 minutes for opening remarks from the entire panel of witnesses we have today, and then we're going to proceed to questions.

Perhaps, Mr. Saindon, you would like to start. We have 15 minutes collectively for you and the other witnesses today. I turn it over to you, my friend.

[*Translation*]

Dr. Gilles Saindon (Assistant Deputy Minister, Science and Technology Branch, Department of Agriculture and Agri-Food): Thank you, Mr. Chair.

My name is Gilles Saindon and I am the assistant deputy minister in the Science and Technology Branch at Agriculture and Agri-food Canada. It's a pleasure to see you all as you study the environmental contribution of agriculture.

I am participating in this session today from the unceded traditional lands of the Algonquin Nation here in Ottawa.

Thank you for the opportunity to talk about the Government's initiatives related to the science of soil health for Canada's agriculture sector.

Over the years Canada's agriculture sector has consistently taken steps to reduce its environmental impact, with support from Agriculture and Agri-food Canada (AAFC) science activities aimed at developing innovative, environmentally friendly practices. These efforts have allowed the sector as a whole to increase productivity without significant increases in emissions.

AAFC research and programs have and continue to guide agricultural production towards sustainable and resilient agroecosystems and agricultural landscapes. In the context of a changing climate, we aim to manage agriculture's use of natural resources in a way that enhances the resiliency of the sector, fosters new economic opportunities and supports long-term competitiveness without exceeding the system's natural capacity.

[*English*]

Soil conservation and health have always been core priorities for producers and for AAFC, building on a long history of our scientists conducting world-class research through a network of 20 research centres distributed across Canada.

These scientists identify innovative practices that help to build resilience in soil; reduce erosion; increase soil organic matter and cell carbon, which is in turn partially offsetting the agricultural sector's greenhouse gas emissions; and, of course, improve crop productivity in the process.

These and other efforts have contributed to the widespread adoption in the Prairies of reduced and zero-tillage practices, reduced use of summer fallow, and improved crop rotation.

Due to these actions by producers, agricultural soils in Canada have gone from a net carbon source to removing 9.6 megatonnes of carbon dioxide from the atmosphere in 2020. As a result, farmers are not only conserving soil health and productivity but are also making a significant contribution to combatting climate change.

Agriculture and Agri-Food Canada is working with the provinces and territories, farmers, and other Canadian agriculture and food stakeholders in continuing to develop and implement innovative solutions that contribute to improving the quality, yield, safety and sustainability of the food produced by Canadian farmers.

AAFC's science experts are contributing to the development of foundational science knowledge as well as informing the design of policy and programs to support producers' efforts across Canada to adopt novel practices and technologies.

Beneficial management practices, BMPs, are practices that reduce or eliminate an environmental risk. BMPs developed, tested and recommended in Canada cover a range of agri-environmental practices including nutrient management, shelterbelts, reduced tillage intensity, energy efficiencies and renewable energy, as well as other practices related to greenhouse gas emissions and increasing carbon sequestration.

The scientific body of knowledge has shown that BMPs such as reduced tillage, planting trees, silvopastures, rotational grazing, improved crop rotations and converting marginal cropland to permanent grassland can promote carbon sequestration, which improves soil health while offsetting emissions, particularly in regions where soil has previously been degraded.

In 2018-2019, AAFC began the development of Agroecosystem Living Laboratories, where farmers and scientists work with other stakeholders to codevelop, test and implement best management practices and technologies on working farms.

This work is further advancing under the natural climate solution fund, which seeks to leverage nature to fight climate change. Under this fund, an investment of $185 million for 10 years supports the expansion of the Living Labs network across Canada.

● (1105)

[*Translation*]

The primary objectives of these living labs are to store carbon on agricultural land to keep it out of the atmosphere, reduce greenhouse gases, improve land management practices and support other environmental benefits such as biodiversity, water quality and soil health.

Although we have had successes, many unknowns remain. Our scientific work continues to decode the complexity and interactions across the landscape, identifying opportunities from natural climate solutions or from new digital technologies, such as artificial intelligence and satellite imagery, which are also being integrated into crop and soil monitoring and forecasting.

Today I am joined by five Agriculture and Agri-food Canada scientists, to help answer your questions: Dr. Louis-Pierre Comeau in New Brunswick; Dr. Ed Gregorich in Ontario; Dr. Reynald Lemke in Saskatchewan; Dr. Judith Nyiraneza in Prince Edward Island; and Dr. Mervin St. Luce in Saskatchewan.

These experts are all well recognized, both nationally and internationally, as experts in their fields and in the development of sustainable cropping systems.

[*English*]

I would like to reiterate that the agricultural sector has an important role to play as one of Canada's oldest and most important environmental stewards. Agriculture and Agri-Food Canada is working to support farmers in this goal to ensure that the sector's environmental impact continues to shrink while its economic output and the health of our soils continue to grow.

[*Translation*]

Thank you for your time.

I'm happy to take any questions.

Mr. Chair, my colleagues would be pleased to introduce themselves to give you additional information on their area of expertise, which will help direct the questions to the witnesses who can best answer them.

[*English*]

The Chair: Thank you very much, Mr. Saindon.

We will start with the question period.

We're going to start with the Conservative Party. I believe it's Mr. Barlow.

Mr. John Barlow (Foothills, CPC): Thank you very much, Mr. Chair.

I appreciate the officials making time for us today.

Mr. Saindon, I appreciate one of your comments. You said that as a result of carbon sequestration and soil health, Canadian farmers have sequestered 9.6 megatonnes of GHG emissions from the atmosphere and that they are a significant contribution in the fight against climate change. Certainly I couldn't agree with you more, but there have been some reports recently that I would say are unfortunately putting some misinformation out there about the role that agriculture plays.

Just as maybe an easy question, is there some potential there for AAFC, in some of the work you're doing, to push back on some of these reports saying that agriculture is a problem rather than offering some of the solution?

● (1110)

Dr. Gilles Saindon: I would like to say that yes, producers are surely out there and are quite active stewards in preserving carbon and adding to carbon sequestration.

Perhaps I will move to my colleague Dr. Ed Gregorich here on the panel, who is an expert in this area. He can probably elaborate a bit more on this question.

Dr. Ed Gregorich (Research Scientist, Agrienvironment Division, Department of Agriculture and Agri-Food): Yes, I think agriculture definitely has a role to play in reducing its environmental footprint but also in greenhouse gas emissions. I know that there have been reports about various technologies, but this is something that we can actively do, or farmers can do, because they manage the land and are able to use different management practices to reduce that environmental footprint, whether it be greenhouse gas emissions, water quality or whatever.

They definitely have a role to play, and we have the information that will allow us to show that in terms of data and modelling efforts.

Mr. John Barlow: Thanks. I appreciate the answer.

One of the areas, I would say, where the Government of Canada, departments and bureaucracy could play a role is this. There was a report recently that basically said that we have to reduce animal husbandry and animal agriculture if we want to fight climate change. I would argue that grazing is protecting some very delicate ecosystems, including native grasslands that make up a large part of my riding.

There is a product, an organic compound, out there, 3-NOP, which is a feed additive, especially for dairy cows, that could reduce methane emissions anywhere between 30% and 80%, as studies have shown.

This food additive has been approved in the EU and for use in the United States, but it continues to languish waiting for approval here in Canada, because instead of treating it as a feed additive or feed supplement, we're treating it as a medicinal compound, so it's going through veterinary health medicine rather than just as a feed compound. It could play a significant role in reducing emissions and protecting the environment. Why is Canada treating this product, which is an organic compound, so differently from other countries, especially the EU, which is very risk-averse in approving new technology?

Dr. Gilles Saindon: Mr. Chair, in this particular, I think we're surely aware of 3-NOP as a feed additive that could be put in the ration of a ruminant. We have done some research in the past, as a matter of fact, out of our Lethbridge centres in Alberta, where we demonstrate these massive reductions in greenhouse gas emissions from beef cattle in that particular case, but you're right that it works also for dairy cattle.

On the regulatory side, I think I would have to defer to my colleagues from the Department of Health. They are the ones looking after the regulatory component of this aspect. I would say at this point in time that I'm not really in a position to be able to answer in terms of why there was a decision to go that way.

Mr. John Barlow: Thanks, Dr. Saindon.

I guess my push here.... I realize it's in health. I know about the studies that were done at the feedlot in Lethbridge and in Nanton and also in my neck of the woods.

Why are Ag Canada and your studies not pushing back on the fact that there should be some harmonization here when some of these new innovations and technologies come out, which are proven and being used by some countries that we trade with? I would encourage you to push hard on Health Canada to get this product approved as quickly as possible, knowing that you have done the studies in your department that show how effective it is.

I want to quickly change subjects here. You mentioned emissions reductions and carbon sequestration. I'd like to know what role, if any, your department had in the announcement at COP26 for the 30% reduction in fertilizer emissions. You talked about the innovation and technology that's happened, like 4R nutrient stewardship, for example. You talked about zero till. We are probably up to 70% more efficient in fertilizer use than any other country in the world.

What role did your department play in that announcement at COP26, if any?

● (1115)

Dr. Gilles Saindon: Thank you, Mr. Chair.

Again, that's a question that my colleague from the strategic policy branch may be better positioned to answer.

The information that we provided to them is more related to the way we manage and use fertilizers here in this country. Perhaps I will ask my colleague, Dr. Reynald Lemke, to talk a bit more about this in the context of his work on fertilizers.

Dr. Reynald Lemke (Research Scientist, Environmental Health, Department of Agriculture and Agri-Food): Thank you very much, Mr. Chair. I'll do my best to respond.

From my perspective—

Mr. John Barlow: I'm sorry. I don't want to cut you off, but I'm out of time.

Did Ag Canada have any input on that announcement from COP26, yes or no?

Dr. Reynald Lemke: There would have been information provided in terms of what the emission levels were and the technical aspects. Really, that's all I can respond with.

The Chair: Thank you, Mr. Lemke.

Mr. Saindon, you have my apologies. Because I was listening in French, I thought you had been finishing up, but you did offer that some of your colleagues—some of the researchers here—could perhaps give the committee an index of what they do. There were about six minutes left and I didn't see any hands, so I quickly moved to questions.

I invite anyone who may want to quickly give a sense to the committee. I apologize that I moved pretty quickly.

Dr. Gilles Saindon: Thank you, Mr. Chair.

I welcome this offer. We'll go as per the lineup we had prepared. I'm not quite sure who was going to go first.

Dr. Louis-Pierre Comeau (Research Scientist, Landscape and Soil Carbon, Department of Agriculture and Agri-Food): Maybe I can go first.

Thank you very much, Mr. Chair, and good morning, everyone.

My name is Louis-Pierre Comeau. I speak to you from Fredericton, New Brunswick. I would like to begin by recognizing that the land where I am is the traditional unceded territory of the Maliseet and Mi'kmaq people.

[*Translation*]

I grew up on the south shore of Montreal and spent part of my childhood on my family's sugar bush. I received a a biology degree from the National Autonomous University of Mexico, a master's degree in soil science from University of Saskatchewan and a Ph.D. from University of Aberdeen. I also completed postdoctoral studies at the Chinese University of Hong Kong.

[*English*]

As a research scientist with the federal government, my research focuses on landscape and soil carbon. Specifically, I'm investigating a way to replenish soil organic matter from wetland, agricultural and forest land.

My long-term scientific goal is to contribute to knowledge about why some carbon molecules can remain stable in the soil for thousands of years. I currently lead a pan-Canadian survey project that investigates the relationship between land use practices and carbon storage.

Thank you.

The Chair: Would someone like to go next?

Dr. Reynald Lemke: Yes, Mr. Chairman. Thank you and good morning to everyone.

My name is Reynald Lemke. I'm a research scientists working out of the Canada Research and Development Centre in Saskatoon. I will mention that it is on Treaty 6 land and the homeland of the Métis.

I am a soil scientist by training. My research program considers the factors that control soil-emitted greenhouse gases from agricultural soils to accurately quantify those emissions and also to identify opportunities to constrain or reduce emissions. My work has primarily focused on soil-emitted nitrous oxide, leading to research into the influence of nitrogen fertilizer management, crop type, crop rotations and tillage intensity on nitrous oxide emissions.

Nitrogen and carbon are intimately linked in the soils. These same factors also influence soil-emitting carbon dioxide; thus, my work also considers the impact of these practices on soil organic carbon status.

Thank you very much, Mr. Chairman.

The Chair: Thank you, Mr. Lemke.

Who would like to go next?

Dr. Ed Gregorich: My name is Ed Gregorich, and I am a research scientist at the AAFC in Ottawa. I am a soil biochemist and I study soil health and carbon cycling and sequestration in soils. My research is focused on understanding the effects of agricultural practices on soil health and soil organic matter.

I'd like to thank you for inviting us here today and I look forward to answering your questions.

● (1120)

Dr. Judith Nyiraneza (Research Scientist, Crop Nutrient Management, Department of Agriculture and Agri-Food): Good morning.

Thank you for the opportunity, Mr. Chairman.

My name is Judith Nyiraneza, and I am based in Charlottetown in P.E.I. I am a soil scientist by training. I conduct research on nutrient management in potato-based systems. I am now leading the P.E.I. living lab project, with an overall objective of enhancing soil health and water quality.

In this project I am working with growers to test different management practices, including cover crops ahead of potatoes with and without manure, and testing different tillage regimes. We are evaluating their effects on soil organic matter, potato yield and nitrogen cycling in the potato plant and soil systems, and on soil aggregation.

I would be happy to answer your questions.

Dr. Mervin St. Luce (Research Scientist, Swift Current Research and Development Centre, Department of Agriculture and Agri-Food): Good morning, Mr. Chair. Thank you for this opportunity.

My name is Mervin St. Luce, and I am a research scientist in soil fertility and cropping systems at Swift Current in Saskatchewan. The major aims of my research program are to gain a better understanding of nitrogen cycling and dynamics in cropping systems and to develop best management practices to enhance soil health and nutrient use efficiency.

I have conducted and continue to conduct research on the impact of pulses on nitrogen dynamics and use efficiency in various cropping systems, the influence of 4R nutrient management practices on crop productivity and nitrogen use efficiency, and the influence of management practices on soil organic carbon dynamics.

Currently I am co-leading a project aimed at improving yield and nitrogen use efficiency in canola production across Canada, and also leading a new project on developing a soil spectral library for rapid and cost-effective assessment and monitoring of soil organic carbon across western Canada.

Thank you for giving me this opportunity. I look forward to answering your questions.

The Chair: Thank you very much to all of you.

My apologies to Mr. Barlow that he didn't have your background before, but I know he'll be able to re-engage moving forward.

Mr. Louis, you're now up for six minutes. We will move over to you, my friend.

Mr. Tim Louis (Kitchener—Conestoga, Lib.): Thank you for that, Mr. Chair, and thank you to all of our witnesses for being here. We don't have enough time to get to all the questions I'm sure we have.

Maybe I would start right from the top.

Dr. Saindon, just in general, in your opening remarks you briefly mentioned programs that can help farmers adopt more sustainable practices and more sustainable technologies. In all the conversations we've had indicate that they want to do their part, and there are programs out there. I know there is the climate action fund and the agriculture clean tech program, and you also mentioned codeveloping and testing and implementing best practices from the natural climate fund.

Can you explain a little bit about those programs and how the industries themselves can work together and get involved so they can have input as well?

Thank you.

Dr. Gilles Saindon: Thank you, Mr. Chair.

If I may, I'll just say a few comments at the beginning and probably go to my colleague in Prince Edward Island, Judith, to talk a bit more about the living labs, which is a direct engagement with producers.

As you mentioned, we have a number of programs. You've mentioned clean tech, which is a program that is in place to help with the implementation of clean technology on the farm.

As part of nature-based solution programming, we have two components. One is the development of living labs, which I mentioned in my comments with $185 million over 10 years to implement these living labs across the country. There is also an on-farm climate action fund, which is $200 million over a three-year period. It was launched a little after, but they are companion programs. One deals with the development of science for new BMPs, one is in collaboration with stakeholders, and the other one is to provide funding for the producer to implement some of the existing BMPs on their own farm.

There was also an announcement in the budget about supplementing these funds for on-farm action, but that will just come in in the months to come.

Maybe I'll pass it to Judith, who is speaking from Charlottetown, because she spends quite a bit of her time working with producers along the lines you just mentioned.

I will pass it briefly over to Judith, Mr. Chair.

● (1125)

Dr. Judith Nyiraneza: Thank you.

P.E.I. has been the first site to initiate this integrated approach to agriculture innovation. With this new approach, we have growers and scientists working together to identify the research priorities in the agro-environment. They identify the research priorities and also discuss together the way to address their issues. P.E.I. partners, who are scientists and growers, have identified that the main issues for us are declining soil and water quality.

A good aspect of this initiative is that it's user-centric, so we are following the growers' expertise to make sure that the beneficial management practices we're using are not only scientifically sound but also practically sound. We are taking into account the knowledge from the growers and what they have been testing in the past, and we are sharing ownership in agriculture innovation. We feel equally responsible for the results and the impact of the management practices we are testing.

Mr. Tim Louis: Thank you, Doctor.

Perhaps I can direct my question to Dr. Comeau.

This past weekend, I spent time with environmentalists and farmers in my riding, in Wilmot. We were planting trees in a wetland, the Mike Schout Wetlands Preserve. I had a number of good conversations with farmers who want to do their part and see if they can do some land use practices and convert some land.

Dr. Comeau, can you explain some of the benefits of those wetlands for carbon storage and how at a local level farmers can get involved and do their part and be recognized for it?

Dr. Louis-Pierre Comeau: Sure. Thank you for the question.

Across Canada, wetlands are where most of the carbon is being stored. It's important to protect the wetlands and to refurbish them to make them safe so that they can continue to store carbon and potentially increase carbon storage.

In many cases, planting trees that are natural for those environments is very beneficial. There are programs that should start soon or are planned to start, which Dr. Gilles Saindon could discuss, that could include financing for tree planting in riparian areas.

We are currently working on a road map for different BMPs, and this would be one of the BMPs that could be implemented that would be beneficial for a different aspect of the environment and also beneficial for carbon storage and increased carbon sequestration.

Mr. Tim Louis: Thank you.

In the six minutes, I wanted to ask questions about artificial intelligence and half a dozen more, but it will have to wait.

Thank you.

[*Translation*]

The Chair: Thank you, Mr. Louis.

Mr. Perron, you now have the floor for six minutes.

Mr. Yves Perron (Berthier—Maskinongé, BQ): Thank you, Mr. Chair.

I'd like to thank the witnesses for taking the time to participate in today's meeting. I'm impressed with the amount of knowledge we have access to this morning because of them.

Mr. Saindon, correct me if I'm wrong. It is my understanding that the on-farm climate action fund has a lot of rules, so producers have to fill out paperwork and forms. It's a good program, but would it be possible to consider something more decentralized that puts the decision-making power in the hands of the producers who actually work on their land?

In your view, is it realistic to do it this way, to go through a process to assess submitted practices and reward them financially, which could sustain them in the long term?

I don't know who could answer this question. Perhaps Mr. Saindon could.

Dr. Gilles Saindon: I believe I can answer the question.

Thank you for the question.

This gives me an opportunity to clarify something about the on-farm climate action fund, which totals $200 million. The department announced a few weeks ago that 12 agencies will be in charge of receiving applications from agricultural producers, which will make it easier to decide how to allocate the funds. This will be done not by the department, but by these 12 agencies.

I believe that somewhat answers the question.

● (1130)

Mr. Yves Perron: In your opinion, will the amount of money invested in the program be sufficient for a number of years or should we invest more?

Dr. Gilles Saindon: The funds announced are for the first three years. As I mentioned earlier, there was an increase in the 2022 budget. Another $470 million was allocated to the program. At this time, the terms are not known, but the funds will be used to cover additional years.

Mr. Yves Perron: Thank you.

I would now like to return to the Canadian Organic Standard.

We're trying to help producers be more environmentally efficient. At the same time, the government announced that it would no longer fund the review of the Canadian Organic Standards. It wasn't a huge amount of money. Personally, I'm having a hard time understanding this decision.

Don't you think we should be funding this review, especially since it's a federal standard that allows our producers to secure their certification and the international market in terms of exports?

Don't you think we should be giving more encouragement to our organic producers, who already have to pay to be certified?

It seems to me that handling the review of this standard is the least the federal government could do.

Dr. Gilles Saindon: Thank you for the question.

Yes, we are doing some research in organic agriculture, but we're not really part of the decisions or processes around funding standards. I believe that is part of the Canadian Food Inspection Agency's mandate.

Therefore, I'm not really aware of the fact that the funding may have been reduced or changed. We're not really in a position to directly answer that question.

Mr. Yves Perron: We have several soil and carbon capture experts here with us. I'm not sure who would be best suited to answer the next question.

Mr. Barlow addressed the feed additive 3-nitrooxypropanol, or 3-NOP. Here, 3-NOP is considered medicine, but elsewhere it's considered part of feed. I'm not a scientist and I don't want to question that, but I do want to better understand the process, given that it can greatly improve performance with respect to gas emissions.

As a side note, could one of the witnesses give us an order of magnitude as to the effect that leaving soils in permanent pasture can have?

Since we began our study, we've heard a lot of praise for pastures as being extraordinary carbon sinks, but we were also told that we might need to reduce livestock farming. Mr. Barlow pointed out the contradiction earlier.

How do we know which version offers the best solution?

I'm willing to believe either version. We're going to need meat. If we stop producing meat, we're going to have to import it. I see a problem there.

I don't know who would be able to talk to us about this briefly.

Dr. Gilles Saindon: I will turn the floor over to Dr. Gregorich, our carbon storage expert.

The Chair: Unfortunately, time is up.

[*English*]

If you have 15 seconds, you can try to answer. If not, Mr. Perron will have to wait until next time. In fact, let's just wait. Mr. Perron will have to do it next time. He'll get three or four rounds.

We're going to go to Mr. MacGregor.

● (1135)

Mr. Alistair MacGregor (Cowichan—Malahat—Langford, NDP): Thank you very much, Mr. Chair.

Again, thank you to our witnesses. We are presented as a committee with an incredible wealth of knowledge today.

The theme of my question is on soil biology. I'm not sure who would best be able to take this question. Building into my question, we know that in the soil, under healthy conditions, there's an incredibly complex relationship between various micro-organisms and the plant itself. They involve protozoa, bacteria, fungi and nematodes. When those are all in balance, we have a system that allows a plant to prosper and to be very productive.

What I want to know is, from AAFC's perspective, what is the current state of federally funded research into soil biology specifically, and what promising pathways do you see as a result of that research?

Dr. Mervin St. Luce: I will attempt to answer these questions.

Soil biology is very important for soil health and nutrient cycling. You mentioned some of the specific biological components. They basically help plants to grow, capture nutrients and hold water.

As part of the soil health research, we're currently focusing a lot on soil biology. A lot of efforts have been placed in genomics, as well in finding out specific biological components that are critical to the agroecosystem for resilience and sustainability.

This research is not done on its own. It's part of the entire soil health effort, which is made up of the biological component, the physical component and the chemical aspects of soil. Not all of the efforts are going to be placed in soil biology, but in recent years, more effort has been placed because of new technology that has been developed to be able to better understand and identify various beneficial micro-organisms in the soil.

Mr. Alistair MacGregor: Thank you for that. That leads me to my next question.

Mr. Barlow mentioned that the federal government has a fertilizer reduction plan of 30%. There are organizations down in the United States—I'll name one, the Soil Food Web—whose focus on trying to achieve a harmonious balance in soil biology has allowed farmers to both increase their yields and reduce their fertilizer inputs. Those input costs are a huge part of a farmer's bottom line.

If the federal government has this ambitious plan to reduce fertilizer inputs by 30% by the year 2030, and we're already seeing research showing promising benefits to this effect, is AAFC going to devote more resources to this kind of research to help to meet that goal by 2030?

Dr. Mervin St. Luce: I can't speak on this point about AAFC's decision on increasing funding or not funding specific areas, but I can say that this is a very important area of research. We know that healthy soils have healthy and diverse microbial populations. They also assist in nutrient cycling.

In terms of adding nutrients to the soil, whether through inorganic fertilizers or organic materials, we depend a lot on the microbial population, diversity and action. A lot of the nutrients that plants take up come from the soil.

It is an important area, but I can't speak on the specific funding from AAFC at this point.

Mr. Alistair MacGregor: Thank you.

I realize the discussion document on the fertilizer reduction target is available for comment until June 3 of this year, so it's early days. However, there are smaller farms that are really trying to trail-blaze in this area.

We're all fearful of an “Ottawa knows best” approach, but there are farmers who are doing this and leading the way. What recommendations can our committee make to the federal government for how we best support those farmers who are already showing us a path with both reduced inputs and greater yields?

This is the crux of the matter, because climate change is such a huge existential threat to us. How can we best support those small farms that are actually leading the way right here and right now?

● (1140)

Dr. Gilles Saindon: I'll say a few words on this in terms of the previous question on investment. It's an area of priority where we will see some increase in investment. The perfect example would be our next generation of living labs. As they are expanding across the country, they will have that element and component in mind when starting this new research, and that will be part of our effort.

I'd also like to add that it would be an opportunity for some of the farmers that have been mentioned here. The small farmers all probably have an opportunity to work through these living labs, promoting a new way of doing business. That would be quite a good starting point.

The Chair: Thank you, Mr. MacGregor. Thank you, Mr. Saindon.

Now we have Mr. Epp for five minutes.

Mr. Dave Epp (Chatham-Kent—Leamington, CPC): Thank you, Mr. Chair, and thank you to the witnesses for joining us today. I appreciate the amount of expertise that we have access to.

Dr. Saindon, I appreciate that you mentioned in your opening comments that your department's focused on novel practices and technologies.

I recently met with representatives from the fruit and vegetable sector. They're concerned with the eroded capacity of the pest management centre as a result of flat budgets and inflation, which supposedly reduced the number of projects they're able to do. As I understand or as I'm told, there's a $9-million budget, mostly from CAP funding, meaning the five-year cyclical round of funding. They're calling for more permanent funding mechanisms.

Over the past five years, has the number of projects that have been funded been reduced because of the factors of inflation and an erosion in funding? Particularly in the fruit and vegetable sector, this kind of research that feeds into the adoption of newer or novel practices and technologies that have a more benign environmental footprint is critical to the industry and to the success of that sector, particularly as they compete with a much larger industry further south.

I'm wondering if you can comment on that interaction between the amount of research being done and the funding levels.

Dr. Gilles Saindon: Mr. Chair, again, I'd like to thank the member for the question. I'd like to answer it in two ways.

One is that the pesticide minor use program at AAFC has two components. One is to look at new chemistries, replacement chemistries, and look at the option to use them in Canada. That's usually done through what we call the “label extension” of an existing pesticide, whereby we just expand it to more crops. For that, we have an intake of projects on an annual basis. It varies from 30 to 40 projects a year. There is obviously quite a bit of pressure to handle some of these things. At times, the delays are due to the fact that when we do field research, there is always a climatic component. It's always more complex and takes more time to gather all the data needed, so that puts some pressure.

In terms of developing alternative pesticide management practices, I think the department has just received additional funding of $7 million to deploy new research in these particular fields. We just started a group of 25 new research projects at the beginning of last month on these exact aspects. We have this new research. We have lots of confidence that it will add to a lot of opportunity for alternatives to be developed and deployed with the producers.

Mr. Dave Epp: I'm sorry to interrupt. Is that $7 million permanent funding?

Dr. Gilles Saindon: No, it's part of an announcement that was made. It's funding for two years. We started the project this year and will continue it next year.

Mr. Dave Epp: Thank you.

Related to this whole area, there's discussion particularly around product registrations, and funding has been allocated to add a layer of oversight to the pest management regulatory authority dealing with citizen science. We have access to tremendous amounts of science right here on this call.

Can you define citizen science for me and its potential impact on the registration process?

● (1145)

Dr. Gilles Saindon: Citizen science occurs when we have a science project that involves the public providing some data. It's usually done in a structured way. The scientist will put the general call out there to report insects, damage or new weeds; then the public will provide some of that information to scientists through some kind of an organized channel, and then there is follow-up. It's a group of citizens who help us gather the evidence needed.

It's early to tell how this can help. We don't have a particular component to that right now. You have referred to the public oversight of this Health Canada initiative. I think they are also engaged in a renewal of their own approach. I think they received some funding to look into this, and it's at an early stage. I think one of the components to that was the announcement of having an external panel that will help guide the PMRA decision-making. I don't have much more information at this point in time.

The Chair: Thank you, Mr. Epp.

Thank you, Mr. Saindon.

[*Translation*]

Mrs. Valdez, you have the floor for five minutes.

[*English*]

Mrs. Rechie Valdez (Mississauga—Streetsville, Lib.): Thank you, Chair.

Thank you to the witnesses for joining us today.

This is a bit of a whole new world, so I do appreciate all of the expertise that is on the call today. I'm going to do my best to direct the questions accordingly.

I'll start off with Dr. Gregorich.

During these past few summers, the Prairies and western Canada have experienced extreme weather, as we all know, with floods and droughts. As temperatures continue to rise, what impacts do extreme weather events have on soil health and ultimately our farmlands?

Dr. Ed Gregorich: Those impacts can take the form of the effect on the crop itself. In terms of soil organic matter, it depends on the crop, on the amount of biomass and the amount of material that goes into the soil after they've harvested. If there's a very severe drought and a reduction in the yields, that's a good indicator that the amount of organic matter going into the soil is going to be reduced quite a bit. That in itself is a problem.

Increased variability is also a problem, such as the high rainfall that's happening in Manitoba right now. It's difficult for the farmers to get on the field to plant the crop, or there's delayed seeding, and that again affects the crop.

It's not just drought. Any sort of extreme weather event hampers productivity. Once you start hampering the productivity of the crop and the amount of material that goes in, that affects organic matter levels and all of the organic part of the soil.

Mrs. Rechie Valdez: Thank you.

What types of measures must be taken to mitigate and respond to the threats, Dr. Gregorich?

Dr. Ed Gregorich: It's taking a long-term view of what's going on, and it's not a quick-fix solution when you're talking about this sort of problem. One of the things that we're advocating that helps is increasing soil organic matter, and that takes a long period of time. When you increase the soil organic matter, then it has the ability to absorb more water, and that then weathers that particular drought period. That helps maintain soil structure and so forth.

That one-year period of that loss of the dynamics of the system requires that it has to be a long-term perspective, not a short-term year-to-year perspective. Although it's very difficult to see what happens after a drought like what we've experienced, a long-term view in this sort of thing is needed for building up the soil organic matter.

Mrs. Rechie Valdez: Dr. Comeau or Dr. Nyiraneza, do you want to add to that?

Dr. Louis-Pierre Comeau: If I could, Mr. Chair, I'll quickly mention that there's a wide range of things that are measured after those droughts by a wide range of scientists here at AAFC. Many of them include soil health and biological parameters, as was mentioned previously. There are many aspects of those soil properties that we are currently measuring with a large group of scientists. There are more than 200 scientists doing those kinds of wide analyses, so I could not explain all of them one by one.

● (1150)

Mrs. Rechie Valdez: Thank you. You've given enough context. I appreciate that.

Dr. St. Luce or Dr. Lemke, what further steps could agriculture policy and risk management take to address climate risk and readiness?

Dr. Reynald Lemke: Really, this to me, I think, is a policy question, and I don't believe I'm equipped to answer that.

Mrs. Rechie Valdez: I can pass the question over to Dr. Saindon, if that's more appropriate.

Dr. Gilles Saindon: I think there are a range of activities that we can do in terms of some of the research that is underpinning these actions. I would say that's usually where we and our colleagues on the Prairies focus. That's what they would focus on, the science underpinning these actions.

I don't have a whole lot more context to provide.

Mrs. Rechie Valdez: That's no problem.

The Chair: Thank you, Ms. Valdez.

[*Translation*]

Mr. Perron, you now have the floor for two and a half minutes.

Mr. Yves Perron: Dr. Comeau, how does one go about determining what's effective and what's not? On the one hand, we have to recognize that grassland is important, and on the other, we're told that animals emit a lot of gas. We also need to consider 3-NOP.

What are your observations on this subject?

Dr. Louis-Pierre Comeau: Thank you for the question.

[*English*]

I will try to respond in English so my colleagues can jump in if I miss something.

What is important to keep in mind is the system in its natural state. In some places like in the Prairies, there were natural prairies, with bison. In those cases, it's important to keep them as close to natural as possible. If there were bison, then it's just a cycle to put cattle on them or to use grass harvesting, but in other ecosystems, if we try to convert an ecosystem that was maybe a deciduous forest into grassland, then, where there is a land use change, we might have negative effects. It all depends on what was there originally and how we can continue to produce as much as possible without causing much disturbance in the long run.

[*Translation*]

Mr. Yves Perron: Thank you very much.

Have you done any studies on the relationship between grazing input and input related to livestock operations? Besides 3-NOP, are there any other ways to reduce livestock gas emissions?

Dr. Louis-Pierre Comeau: A lot of studies are done locally, but few are done Canada-wide.

However, many studies show that measured grazing that's well done can increase the amount of carbon sequestered in the soil.

I will turn it over to Dr. Gregorich, who can elaborate on this.

[*English*]

Dr. Ed Gregorich: Yes, grazing does increase it, as does anything that promotes the growth of the crop, and that happens when you have grazing animals returning the residue back to the soil, which helps maintain high soil organic matter levels.

[*Translation*]

The Chair: Thank you very much.

Mr. MacGregor, you now have the floor.

[*English*]

Mr. Alistair MacGregor: Thank you, Chair.

The theme of my question is going to be international collaboration.

During the course of this study, we heard reference to countries like Australia that are engaged in a national soil strategy. One of our witnesses, Mr. Eric Toensmeier, was talking about France, which in the next couple of decades has a national commitment to convert 1.5 million acres of cropland to agroforestry.

Our committee is aware that this year in Glasgow there is going to be the world congress of soil science, where several thousand of the world's top soil scientists are going to come together, and I'm sure soil health and how we can best combat climate change are going to be major themes.

From AAFC's perspective, could you inform the committee on what your collaboration with international partners is like? Are there any countries in particular that your department looks to as places that some of this cutting-edge research is being developed? Can we take advantage of that open-source knowledge to best inform our practices and policies here in Canada?

● (1155)

Dr. Gilles Saindon: Mr. Chair, I can probably take this question.

We collaborate extensively with a number of countries on the way we collect information about climate change, the way the measurements are done and all of that. Some of our largest contributions or activities are probably with the United States, our neighbour to the south, especially in the area of using long-term rotations.

We try to pair with our living labs initiative and expand the scope of this particular initiative, and this has resulted in a lot of international effort that is taking place now with Europe. We have an arrangement with France, and in fact we will be hosting an international conference next year on the use of living labs and this citizen-engaged type of approach to the research. That is something that has expanded in Europe as well as with the European Union in general.

We have projects here and there as well, scientist to scientist. I don't know if any of our colleagues here on the panel have some of these and may want to expand, but it's usually the United States and Europe. At this point in time, those are where we have the bulk of our interactions.

The Chair: Thank you, Mr. MacGregor.

We're at time on the question, but I suspect that Mr. MacGregor will get another six-minute crack at it. Perhaps if we want to follow up on that, we can.

[*Translation*]

Mr. Lehoux, you have the floor for five minutes.

Mr. Richard Lehoux (Beauce, CPC): Thank you, Mr. Chair.

I'd like to thank all the witnesses for being here with us this morning.

My first question is for the assistant deputy minister, Mr. Saindon.

According to 2016 Census statistics, 70% of farms are small.

What is the department's approach to small farms in terms of applying new technologies?

In the past, one thing I have worked on is creating windbreaks and reduced tillage. These techniques have been around for over 20 years on small farms.

How does the department encourage small farms to get involved? I feel they could play a much bigger role than they do now.

What is your perspective on this, Mr. Saindon?

Dr. Gilles Saindon: Thank you for the question.

We strive to engage with as many farms as possible, regardless of size, and to make an impact on those farms in Canada.

Through the on-farm climate action fund, we work with partners who have a good understanding of the realities of the farming community.

We work with 12 agencies are going to help us distribute those resources. Those agencies will be in the best position to figure out how best to engage small farms and tailor approaches to them.

Mr. Richard Lehoux: Thank you, Mr. Saindon.

You're considering the possibility of increasing the number of living labs. Will that result in a wider range of smaller labs, which would ultimately be perhaps better suited to the reality that most Canadian farms are small?

Have you considered involving more small farms in this living lab initiative?

Dr. Gilles Saindon: I will ask Dr. Nyiraneza to give you some details on that, because the approach to living labs in Prince Edward Island is not necessarily the same as the approach on farms with large acreage, like some that operate in Western Canada.

In the approach to the new generation of labs, the partners propose the living labs. They are the ones who will receive the funding and work with stakeholders to identify the ideal locations to host initiatives to improve on-farm practices.

Dr. Nyiraneza, can you tell us a little bit about the farm in Prince Edward Island? It's not a large-scale operation like we see in Western Canada.

● (1200)

Dr. Judith Nyiraneza: Thank you very much.

In the living labs initiative, the agricultural producers are responsible for managing projects related to it. Producers get together and they define the farming practices they want to test. They also consider farms whose owners want to participate in groundbreaking projects. This is done on a voluntary basis. We don't target farm sizes in advance. Instead, we work with progressive producers who really want to get involved in this and be partners.

Mr. Richard Lehoux: Thank you.

In terms of adaptation related to these new precision farming methods, what role can Agriculture and Agri-food Canada play in adapting programs to small farm realities? Sometimes it's not that they don't want to be involved in projects, they don't have the financial means to do so.

Mr. Saindon, are the programs well adapted in that regard?

Dr. Gilles Saindon: It would be quite difficult for me to answer your question. Right now, we've determined the upcoming funding envelopes, but as for the actual projects, nothing has been announced yet. So it's a little early for me to answer that question.

In terms of using precision farming techniques, we're doing research in that area with some collaborators. This isn't necessarily done on large farms. At the Research and Development Centre in Saint-Jean-sur-Richelieu, we work with people from the horticultural sector, who don't have large farms. We try to use precision farming techniques to help these producers.

It should not be taken for granted that we're only targeting farms with large acreage.

The Chair: I'm sorry, but time is up.

Thank you very much.

Before we move on to the next round of questions, I'd like to point out that a buffet has been set up in the room. I think it's a good idea and it will help us continue with next round of questions.

[*English*]

This will allow people to grab their lunch, so I would invite you to do so. Just please be respectful of those who are going to be continuing our questions.

The only other thing is that it does look like we might have bells starting at 12:30 p.m. We would like to seek your consent to go 15 minutes after the bells start so that folks who want to attend in person can, but we can continue the round of questioning. Is that fine? Okay.

We will go to Mr. Turnbull for five minutes. Please feel free to grab your lunch, but please be mindful of the noise.

Mr. Ryan Turnbull (Whitby, Lib.): Thanks, Mr. Chair.

Thanks to all the panellists for being here today. It's great to have so many esteemed experts in the room, and on a topic that's so important, so thank you for all your research and for being here today.

I want to start with a quote from a report I have been reading on "Sustainable Diets and Biodiversity", which was produced by the FAO.

On page 34, it says "appropriate agro-ecological food production systems can perform better (around 180%) than agro-industrial ones".

Mr. Saindon, maybe I will start with you. Have you been seeing across all your research that farmers can actually get higher yields by practising agro-ecological methods?

Dr. Gilles Saindon: I may have heard of these points raised in the same way as you, maybe in reports. I have not witnessed this myself, but maybe some of my colleagues may have been closer to this reality, so maybe I will turn to them to see if they have any views on this.

Mr. Ryan Turnbull: Maybe I could direct it to Dr. Lemke, who I think has done a study. I have just read a little bit about monocropping having perhaps a negative impact on soil health and crop yield.

Dr. Lemke, maybe I could go to you.

● (1205)

Dr. Reynald Lemke: Thank you, Mr. Chair.

It's not an easy question to answer, but it's certainly a good question.

In terms of an agro-ecological approach, it's not a very definite term, so it's not easy to give a definite response to, but certainly one of the factors is biodiversity, whether at the cropping system level in terms of a more diverse rotation or in management factors that encourage and maintain below-ground biodiversity as well.

There certainly has been research showing that diverse crop systems or rotations tend to be more resilient and tend to favour carbon sequestration and other benefits. If you're including a legume into that diverse rotation, you're also reducing your need or requirement for synthetic nitrogen across the rotation.

Indirectly, there are many aspects of an agro-ecological approach for which we have evidence of beneficial outcomes. As to whether we can get to 180% of a monoculture approach, I can't really respond to that directly.

Mr. Ryan Turnbull: Okay. Thank you.

What about nutrient uptake in the plants themselves that are being cultivated? Is there higher nutrient uptake with biodiversity within the soils and within the cropping system?

Dr. Reynald Lemke: The short answer is that in a more diverse system, particularly a well-balanced system, supply nutrient cycling tends to be favoured, and that would, at least in theory, mean that we would have a more efficient use of those nutrients that are being cycled, so I guess the short answer is yes, in the sense that nutrient supply generally is favoured.

Mr. Ryan Turnbull: Thank you for that.

Mr. Saindon, I'll go back to you.

In his comments, Mr. Barlow started off by saying—and I think we can all agree—that our farmers and individuals across the country who are part of our agricultural industry are making contributions to the fight against climate change. If we look at a spectrum or a continuum of systems from agroindustrial systems to agro-ecological systems, where would Canada be right now? Is it closer to an agroindustrial system, or closer to an agro-ecological system?

The Chair: You have about 20 seconds.

Dr. Gilles Saindon: Thank you, Mr. Chair.

That's a very interesting question. I think the answer would be that we have a range. We probably have people who are very close to an agroindustrial system, with shorter rotations and a large scale and all of that. We've seen some of these things. However, we have other people who are really at the other end of the spectrum.

The answer is that we have a range in this country.

The Chair: Thank you, Mr. Turnbull. Thank you, Mr. Saindon.

Now we're going to go back to our six-minute round of questions and we're going to go to Mr. Falk. You're up for six minutes.

Mr. Ted Falk (Provencher, CPC): Thank you, Mr. Chair.

Thank you to our witnesses this morning from the Department of Agriculture. We appreciate your testimony and the information you're providing us.

I'm from Manitoba. Some time back, Keystone Agricultural Producers showed that agriculture is a carbon sink of about 30 megatonnes per year. Is Ag Canada familiar with this study? Do you have an opinion on it?

Dr. Ed Gregorich: I'm sorry. What was the question?

Mr. Ted Falk: Keystone Agricultural Producers in Manitoba produced a study that showed that agriculture is a carbon sink of about 30 megatonnes per year. I'm wondering if the Department of Agriculture is familiar with that. Has anybody had the time to look at it and can anybody provide an opinion on that?

● (1210)

Dr. Ed Gregorich: I'm not familiar with that specific study, but as our ADM mentioned, across Canada we are a net sink in terms of soil carbon. It is improving and has improved over the years. In terms of the exact amounts—30 megatonnes or nine megatonnes—there are a range of estimates, and that relates to how it was measured and who was measuring it.

I guess the short answer is yes, we are increasing carbon.

Mr. Ted Falk: Are we increasing carbon sequestration?

Dr. Ed Gregorich: Yes.

Mr. Ted Falk: We talk a lot at this committee about carbon sequestration and storage. What eventually happens to that carbon?

Dr. Ed Gregorich: It can store in the ground for long periods of time. That's the thing. It will stay there as long as we maintain it, and that's part of the challenge. Once we increase it to a certain point, it will stay there for quite a while, unless there's some sort of degradation process that occurs.

That's the nice thing about carbon sequestration in agricultural soils: It gets it into the soil and it can stay there for a very long time. They can do radiocarbon dating and they find carbon molecules that are hundreds or thousands of years old in the soil, so there's a long-term reservoir capacity in the soil. Getting that up a bit is possible with management. It takes a while, but it sequesters and stores for the long term.

Mr. Ted Falk: We know from science that our oceans are our biggest sequestrants of carbon. They inhale carbon and they also exhale carbon. Is that something that agricultural land would do as well?

Dr. Ed Gregorich: Yes, there's a natural intake and outtake of carbon. The plant material goes into the soil and it's used by the micro-organisms. Their process of using it exhales the carbon.

We can put a chamber on the soil and measure CO2 coming out, but it's the net balance of that input and output that we're talking about. That net input, when it's greater than the output, is a sign that carbon is being stored in the soil.

Mr. Ted Falk: Currently, would the balance be negative here in agriculture?

Dr. Ed Gregorich: It depends on where you are in the country and what the management practices are.

Across the country, our department has indicators that have shown that the organic matter levels have been going up since 1980 in terms of storing more carbon. They're plateauing out. The increase isn't as high, but that is the good news across Canada. As a country as a whole, that's what's happening.

Mr. Ted Falk: Would your studies indicate that we actually want more carbon for a healthier soil?

Dr. Ed Gregorich: We would want more carbon, of course. The goal is to get more carbon into the soil—as much as we can—and maintain those high crop yields. Growing a large crop will get more carbon into the soil.

Mr. Ted Falk: Our goal is to increase the carbon in the soil. Is that correct?

Dr. Ed Gregorich: That's right, because that affects everything. Once you get carbon in, it affects this carbon sequestration. It's also important in terms of overall soil health as well.

Mr. Ted Falk: Is there enough carbon accessible for the soil to sequester?

Dr. Ed Gregorich: Yes. Again, it depends on where you are and what the system is. Optimizing that total amount is possible, and it is being done.

Mr. Ted Falk: Okay.

Do we know of any specific crops—I'm sure we do—that are better for soil sequestration than others when it comes to cereals or oils?

Dr. Ed Gregorich: Well, there's a fine line. It's really the quantity, but also the type of crop. Alfalfa and deep-rooted crops are being promoted because that gets it deeper into the soil. Crops that have large root systems going into the soil are important as well.

Mr. Ted Falk: That's very good.

As my question, then, if we need this carbon for our soils to be healthy and the soil does actually emit some of that carbon back into the atmosphere, what would we specifically like to achieve for optimal success?

● (1215)

Dr. Ed Gregorich: I guess the optimal success is at least maintaining our soil organic carbon levels. The goal should be to increase it, but, as I said before, there are a lot of vagaries in what happens on a year-to-year basis and in the regions as well. Applying your question across Canada is really difficult. Even breaking it down within a region is difficult because of the variability and what happens on a year-to-year basis.

The Chair: Thank you, Mr. Falk. We appreciate the line of questioning.

Thank you, Mr. Gregorich.

Ms. Taylor Roy, you have six minutes.

Ms. Leah Taylor Roy (Aurora—Oak Ridges—Richmond Hill, Lib.): Thank you very much, Mr. Chair.

Thank you to all the witnesses here. I too am very impressed with the amount of knowledge and research that's being done in the department.

Dr. Saindon, I was very encouraged to hear you say that all our programs are based on scientific research in collaboration with the farmers, which is really what we all want.

I actually want to continue on with Mr. Falk's line of questioning. I find it very interesting that right now you said we had been increasing since 1980, but currently we are plateauing. I'm wondering why we're plateauing. What do you think can be done to continue to increase carbon capture and sequestration in the agricultural sector?

Dr. Ed Gregorich: Across the country—we're talking about a country-scale level here—a lot of what drives what we're talking about is large-scale change in land management. What built up the carbon in the 1980s, 1990s and early 2000s was that there was more no tillage in western Canada. No till or reduced tillage and less summer fallow, which keeps the bare ground, really drove that process more. In eastern Canada, there was a large conversion of the pasture lands into crops. That was driven by an economic situation.

Across the country, the big driver was in western Canada, because there's more land and because of the trends in the land management system out there. That drove that increase, and now it's plateauing out. In eastern Canada, again, the land management has been changing over the last 20 years or so, and that drives not as much storage in the soil.

Ms. Leah Taylor Roy: Just to be sure I understand, the issue is that we've been taking grasslands and grazing lands and they've become croplands now.

Dr. Ed Gregorich: That's in eastern Canada, yes.

Ms. Leah Taylor Roy: Is it in western Canada, as well?

Dr. Ed Gregorich: No, it's not as much there, but that's what drove the process in eastern Canada.

Ms. Leah Taylor Roy: What was it in western Canada?

Dr. Ed Gregorich: It's fine. It has been stable and—

Ms. Leah Taylor Roy: It's stable.

Dr. Ed Gregorich: Yes.

Ms. Leah Taylor Roy: Are there still ways to increase...?

I agree. Our agricultural sector, I have to say, has contributed a lot to carbon sequestration and helped with climate change. There's a lot more that can be done, and I think that's what we're exploring.

How are they rewarded for what they've done, and what's the balance going forward? What more can be done without hurting that sector in some way?

You were talking about the reduction in nitrogen fertilizers. Can you explain a bit about the impact that reducing nitrogen fertilizers would have on carbon capture, or whatever?

Dr. Ed Gregorich: I think my colleague, Dr.—

Dr. Mervin St. Luce: Yes, I can take this question.

Ms. Leah Taylor Roy: Thank you, Doctor.

Dr. Mervin St. Luce: As my colleague explained, carbon sequestration requires carbon input, and that carbon input would depend mostly on the crop. The crops depend on the nutrients, especially nitrogen, for biomass reduction in carbon—I mean, reduction in nitrogen fertilizer. There can be a reduction in biomass production, but it depends on the environment. It depends on the soil. Different soils have different levels of organic matter, which is the storage potential of the soil, both in terms of the nutrients, the holding capacity, and the food for the microbes to “do their business”, as we describe it.

There is no one answer to this. There is no one-size-fits-all answer, especially in western Canada, where we have brown soils, black soils and black-brown soils. It depends on the level of organic matter. Having less fertilizer applied, for example, in a black soil zone may not impact yield as much as having less fertilizer applied in a brown soil zone, which has very low organic matter. It also depends on moisture, which is the main driver, especially in western Canada.

We want to keep biomass production, but we have to do that in co-operation with lowering the soil's potential to provide nutrients for the crop.

● (1220)

Ms. Leah Taylor Roy: Is it possible to increase...? How would we go about increasing the biomass in the brown soils?

Dr. Mervin St. Luce: That's a very good question.

We have to meet the crop demand, and that is a very difficult process to enact. Research has been ongoing in this area for many decades, and we are still pushing forward to be able to match the crop demand with the supply from both the fertilizer and the soil.

We definitely want to maintain yields, especially with the new varieties that have high yield potential. We are updating the fertilizer recommendations, as time goes by, for new varieties.

As we all know, climate change is having some impact. Whether it's drought or excess moisture, that can also have a major impact. Even if we have the right amount of fertilizer applied, unless we have the right conditions, we will not get the optimum yield that we targeted.

The Chair: Thank you, Ms. Taylor Roy. Thank you, Dr. St. Luce.

[*Translation*]

Mr. Perron, you have the floor for six minutes.

Mr. Yves Perron: Thank you very much, Mr. Chair.

Mr. Saindon, we spoke earlier about the on-farm climate action fund. Does this program recognize past contributions of agricultural producers?

We want to improve practices, but some people have been innovating for many years. If the program doesn't recognize those contributions, would it be possible to do so?

We've had witnesses on this committee who assured us that they could measure the current agri-environmental performance of soils and that their method was feasible.

Could we have your comments on that?

Dr. Gilles Saindon: Thank you for the question.

Some appreciable gains have been made over the years as a result of initiative taken by agricultural producers. We recognize that.

Currently, we refer to these contributions as net gains, meaning that we have soils in balance at a certain level and a greenhouse gas emissions record of X in Canada. Everything that was done in the past represents a net gain. As Dr. Gregorich said, we have to ensure that we don't lose those net gains.

When it comes to new funding—

Mr. Yves Perron: I 'm sorry to interrupt you, but I don't have much time.

You say we need to make sure we don't lose any net gains. I, for one, feel that these individuals should be encouraged to maintain their practices. Much like when we allocate funds to a producer to allow them to plant trees, we need to make sure that they will be able to keep them in the long term.

Don't you think that support and encouragement should be provided permanently, or over the long term in other words?

Dr. Gilles Saindon: I understand your question, but I don't really have any guidelines for preserving net gains made on farms. When we provide funding to foster new farming practices, we'd like to see those practices sustained for as long as possible. Yes, in the current environment, these initiatives should be permanent.

As to whether the funding will be aligned with that, I'm not in a position to answer that question.

Mr. Yves Perron: Thank you, Mr. Saindon.

I'd also like to talk about transportation. We've spoken at length about carbon storage and better agricultural practices. I mentioned grassland earlier. Any of the witnesses who would like to tell me if anything else can be done to reduce greenhouse gas emissions from livestock besides using 3-NOP, please go ahead, I would be interested.

I'll give you an example. Let's say cattle are grazing in a remote area. An ecosystem is created. Now, if you move that cattle hundreds or even thousands of miles away by train or truck, that's bound to hurt agri-environmental performance.

In your studies, do you take into account transportation-related factors peripherally connected to farming?

Do you feel we could improve our regional processing infrastructure to keep transportation at a bare minimum?

● (1225)

Dr. Gilles Saindon: Yes, transportation is a major contributing factor to our greenhouse gas emissions record, and we do account for it. The more economic gains there are in terms of transporting the original or processed product, the more positive the effect.

Mr. Yves Perron: If any other witnesses would like to respond to my question, they're welcome to do so.

They say that, for better carbon storage, it's preferable to use plants with deep and wide root systems and that some plants are more effective than others.

Is this taken into account in best practice incentive programs aiming for fair prices or fostering crop rotation?

Are these criteria used when planting? How do you encourage this?

What research has been done into this?

Dr. Louis-Pierre Comeau: If I may, I can try to answer the question, Mr. Chair.

Yes, we do take that into account. As mentioned earlier, each region is different and has its own unique characteristics. In many regions, the deeper roots of some plants are more effective. It may be different in other areas. That's why we have 20 research centres across Canada—it's a big country—with researchers in every province and every region. They study the ecosystems so they can make specific recommendations based on each microenvironment.

As my colleague Mervin St. Luce mentioned, there's no one size fits all approach, but we do have researchers working hard across Canada to make specific recommendations on this.

Mr. Yves Perron: Thank you, Dr. Comeau.

Speaking of microenvironments, I'd like to talk about small farms. Earlier, Mr. Lehoux raised the issue of access to technology and precision farming.

Could you elaborate on that for us?

What's the current situation in that regard and how can we make technology more easily accessible to small producers?

Dr. Louis-Pierre Comeau: We don't focus on the access to funding issue in the scientific research division at Agriculture and Agri-food Canada, but we do work hard with all our partners to make knowledge accessible to all farming operations, large and small.

We study precision agriculture on farms, regardless of size, and we share our knowledge with them.

We partner with both small and large farms. We do our best to help as many people as possible.

Mr. Yves Perron: Thank you.

The Chair: Thank you, Dr. Comeau and Mr. Perron.

Mr. MacGregor, you now have the floor.

[*English*]

Mr. Alistair MacGregor: Thank you, Mr. Chair.

The theme of my first question is going to be very similar to what Monsieur Perron just asked.

We've clearly established that higher soil carbon content allows our farmers to better withstand extreme weather events. The higher soil carbon content allows us to both retain more water during drought years and act as a sponge when we get excess precipitation events.

What I also want to know about is the plant breeding side of things. We know that looking after healthy soils is going to help us better withstand that, but I also want to know about the role in plant breeding. We know that these extreme weather events are going to become more and more common in the future. Are our current crop genetics going to be able to withstand this rapid pace of change that is affecting western Canada in particular? What can research tell us about plant breeding techniques that might better help future crops adapt to these rapidly changing climates?

Dr. Gilles Saindon: I'll take this question on the plant breeding side.

You're absolutely right that it's an important component. For good production, you need good soil, you need good management conditions and you also need good genetics. It's a constant balancing act in this particular case.

As an objective for some of the components in breeding, we have researchers working in the area of nutrient use efficiency and people working on water use efficiencies. We know that these components are genetic—they're controlled within the plants—so it's a component of our breeding program, and it's one of many. We also have to have resistance to diseases and to insects, and we have to choose accordingly. That's a component that is already in some of the programs.

What we're probably going to see more and more is increased effort to look at the root systems to try to have plants with bigger root systems. This will help with sourcing water and nutrients, adding carbon to the rhizosphere after harvest and leaving more residue. We'll try to keep that in balance with the portion of energy that goes into the grain that is harvested—

● (1230)

Mr. Alistair MacGregor: Can I interrupt? I have a quick intervention on that.

One thing I also want to know about is whether, in the face of this rapid change, traditional plant breeding techniques can keep up with the rapid change, or do we need, policy-wise, to explore the promise that technologies like CRISPR may provide to us?

That's what I want to know from our scientists, because this is a very big question for our agricultural sector over the next decade.

Dr. Gilles Saindon: On this particular component of plant breeding innovation and the use of biotechnology in general, yes, all of these tools are very useful. However, when you look at yields, it's usually many genes at a time, so to fix them one gene at a time may also be quite a challenging task.

We welcome any technology that would be able to bring these genes faster to a finished product.

Mr. Alistair MacGregor: My next question is similar in theme to what Mr. Turnbull asked. He was talking about agro-ecological principles.

I have farmers in my own riding, and I know farmers in every single province, who are engaged in what is called “regenerative agriculture”. They are really trying to lead the way in upsetting the paradigm. What they would like to know is, if they're putting in all this hard work and they're driving the change, what is AAFC's understanding of the term “regenerative agriculture”? What kinds of policies and programs is it going to put into place to help those farmers meet their goals and try to put this paradigm shift into greater practice across Canada?

I don't want a political answer.

Dr. Mervin St. Luce: For this question, I wouldn't be able to speak on the policy component.

In terms of regenerative agriculture, there are so many different definitions of this terminology. Basically, it's looking at food production within a natural system as much as possible. That includes both pesticide reduction and, depending more on the soil, building the soil diversity ecosystem to be able to produce food.

Within our current sustainable production systems, this is being encouraged. Diversifying crops and systems could be described as part of enhancing regenerative agriculture. We have different crops providing different carbon sources, different types of carbon, into the soil, encouraging different micro-organism abundance and activity. Each micro-organism has a different role to play, so our current production system in some way already includes regenerative agriculture. It's not, based on my understanding, an organic system entirely. It encompasses both a normal conventional system with some organic principles to be able to maintain the soil and produce food in a sustainable and clean way.

I can't speak to the other aspect of your question.

● (1235)

The Chair: Thank you, Mr. MacGregor.

The bells haven't started, colleagues. I would like to ask for your indulgence for two or three minutes for a line of questioning. Once we're done, I'm happy to carry on as you see fit, whether or not there may be a couple of minutes for each party to finish up any final questions.

We have gone through four rounds, and I think the questions have been extensive, but as has been mentioned, we have folks who have a lot to offer, so I'll just quickly move forward.

Mr. Lemke, I'm particularly interested in asking you a couple of questions. You mentioned you're with the research station in Saskatoon. I had the opportunity to be there a couple of weeks ago. I was really impressed with the work that's happening.

Obviously, there is a tension right now in terms of the 30% reduction in emissions associated with fertilizer. It has been quoted as a 30% reduction of fertilizer, which is not the government's policy, but it is a 30% reduction in emissions.

How important is plant breeding going to be for the government to reach its goal, particularly the focus on perhaps certain varieties that can maintain yield but perhaps require less fertilizer? I know these are 10-year cycles, for example, but do you see aggressive plant breeding as an important public policy tool to close that gap, especially at a time when markets are signalling to perhaps use even more fertilizer to drive yields even higher with the food crisis right now globally?

Dr. Reynald Lemke: Thank you, Mr. Chairman, for the question.

The short answer is that I think the selection of varieties moving towards the highest nitrogen use efficiency and water use efficiency that we can manage is certainly extremely important. It's a bit of a longer-term endeavour.

At the moment, from my perspective, we have technologies and management strategies that could achieve a considerable reduction of emissions from fertilizer use without impacting yield. There's a lot of work to do in terms of applying that to the landscape, but we have an understanding from the research and evidence from the research that would suggest that we have the tools we could apply and would be successful.

In the longer view, absolutely, moving towards varieties that have higher nitrogen use efficiency is extremely important for a number of reasons, not just for the greenhouse gas emissions but also for other environmental benefits, as well as in terms of economics.

The Chair: I don't want to test the patience of my colleagues. Quickly, on smaller versus larger crops, we hear that a lot in terms of research dollars. It's the way in which Government of Canada programs are designed sometimes for smaller crop varieties. Particularly in the prairie provinces, it's more difficult to be able to get that research in. You're involved with the research centre.

Is that a fair comment in terms of some of the difficulty in trying to balance the different propensities for these crops to be able to put forward the research dollars necessary to match government investment?

Dr. Reynald Lemke: I'm not sure if I'm understanding your question. Could you rephrase it?

The Chair: Sure.

As I understand it, the way in which Government of Canada programs for research funding work is that there's an expectation that the private sector matches what government will have on the table. There's been some feedback from stakeholders, particularly smaller ones, let's say oat growers—crops that are perhaps not as prevalent in terms of their abundance on the prairie, yet are still important for rotation—that they sometimes find difficulty in driving meaningful research projects.

Has that been your experience? Can you comment on that for the benefit of the committee?

Dr. Reynald Lemke: I would defer to Dr. Saindon to respond. I don't think I am equipped to reply to that.

Dr. Gilles Saindon: If I may, Mr. Chair, I could add a couple of comments here.

It's a good point. We have a number of mechanisms that we use to fund our research in partnership with industry. For the large commodities, often we refer to those, as we have the agriscience cluster in place to help them.

However, we do have another point of entry, which we call agriscience projects. They are usually much smaller in scale and in size and may be more focused on some of the lower-acreage crops or commodities. It's not only that we do research with crops; we could also do it with livestock and all of that.

Is it possible to cover each and every commodity in the country? Probably not, but we're not the only science supplier. We have science that is done by universities as well, where we also have choice or an opportunity. We try to complement each other as best we can.

● (1240)

The Chair: I appreciate that. Thank you, colleagues.

We have about 20 minutes left.

Mr. Barlow indicated that the bells might start in about 10 minutes. Would you like me to proceed to five, five, two and a half and two and a half minutes, as we would have before?

Some hon. members: Yes.

The Chair: Okay. I'll turn it over to the Conservatives for five minutes.

Mr. John Barlow: Thanks. I'm going to share my time with Mr. Epp as well.

I want to pick up on some of the questions here, particularly on crop technology and gene editing. It's great when we have this technology, but the problem that we face right now is commercializing it. It sounds like Health Canada is sitting on a very important report on how they're going to regulate gene editing. There may be a bit of cold feet there.

I'm not going to ask you to comment on that, but maybe you can comment on how important gene editing is to environmentally sustainable crops, in terms of the impact it could have on yield and on reducing fertilizer use, disease prevention and those types of things. How important is gene editing to the future of agriculture?

Dr. Gilles Saindon: I think gene editing is a very important technology, like biotechnology in general. We've incorporated these technologies over the years in our breeding and activities at AAFC. That's an avenue we are exploring for ways to help us make advances in some of these genes that could be transferred quite readily using these technologies.

Of course, as you mentioned, we are in the process of having some input on the regulatory framework that is required before we can deploy. I think there is a lot of interest in the scientific community in using these technologies, as they will be very useful tools.

Mr. John Barlow: Thanks.

Can you maybe give me a quick answer on this, Dr. Saindon?

Do you have an idea when that regulatory framework will be announced? My understanding is that it was supposed to be announced very early this year. We're now into May, and it still has not been announced. Do you have any idea when that framework will be available?

Dr. Gilles Saindon: No. I'm afraid I don't have an answer for that question.

I know that we're consulting, but I don't have an answer.

Mr. John Barlow: I have one last really quick question before I pass it off to my colleague.

I would be remiss if I didn't ask this, and you may not have that expert here. However, with the influx of avian flu, and now that we have African swine fever in the Dominican Republic, which is very close to Canada, how big a priority is this for your team, and what steps are being taken to try to address this?

Dr. Gilles Saindon: I would say, from a departmental perspective, that these two diseases you mentioned are big items for the department to look at. From a science point of view, I think the science we do at AAFC is focused on animal husbandry. Animals that are sick, ill or affected by diseases are more in the realm of the Canadian Food Inspection Agency and the vet college in a university.

Mr. Dave Epp: Thank you. Thank you, Mr. Chair.

We've had a good discussion around plant breeding and how climate impacts are affecting agriculture.

We met recently with representatives of the eastern Ontario clean plant hub, the program up in New Liskeard. Again, with reference to the chair's comments earlier, they're concerned, because this an area that deals with the propagation through tissue culture of a number of crops and new incoming viruses on grapes, apples, asparagus, garlic, hops, tender fruit and potatoes.

The land for that program was sold in 2021. The research scientist, Dr. Becky Hughes, retired in 2012, and it has been maintained by technicians since then. The industry wants to know whether AAFC will continue that research position, because they believe that they can carry on that program elsewhere with an agreement between OMAFRA and the University of Guelph, but they are looking for AAFC to continue that research position. Can you comment?

Dr. Gilles Saindon: Thank you for the question.

I cannot really comment. That's a discussion at the provincial level between the University of Guelph and the producers, so I'm not privy to those discussions, and they should have—

● (1245)

Mr. Dave Epp: It's actually the AAFC research scientist that they are looking for. Dr. Becky Hughes was one of yours.

Dr. Gilles Saindon: It's located in New Liskeard? I will have to check into this—

Mr. Dave Epp: Okay. Thank you.

Just to circle back quickly to our soil organics discussion, we've had an excellent discussion here.

Dr. Gregorich, you stated that some carbon could be cycled into the soil for the long term. Would it be fair to also state that the more biomass produced through our cropping production, the more the potential for sequestration and the better for both the environment and the crop production? Would it be a fair comment to do all production practices that enhance biomass growth without exceeding environmental limits on nitrogen application?

Dr. Ed Gregorich: Yes, that's exactly the point I was trying to make. I wasn't being too clear.

The point is that if you increase yield—increase biomass production in any way—it ultimately gets more carbon into the soil.

Mr. Dave Epp: Thank you.

The Chair: Thank you, Mr. Epp. Thank you, Mr. Gregorich.

We'll now go to Mr. Turnbull, I believe, on the Liberal side, for five minutes.

Mr. Ryan Turnbull: Thanks.

Following up on the previous discussion, Mr. Gregorich, I think you answered Mr. Falk's line of questioning by saying that yes, we want more carbon in the soil. To follow up on that, what is the potential? How much more carbon can we store in Canada's soils? Do we have any idea of what the potential is?

Dr. Ed Gregorich: I can't give you the exact number. The goal is always to increase. It's first of all to maintain, and then to increase the carbon. Even giving you a number wouldn't really help answer your question. The point is that we're always trying to increase that carbon level to maximize the amount that can be stored. The soil's potential for storage is huge. It's a very large carbon sink.

Someone here mentioned oceans being large, but the amount of carbon in soil is three times that in the atmosphere. It's a huge pool. Not all of that is being farmed, but the part that's being farmed is managed in this way to put more residue, more carbon, into the soil, so as a—

Mr. Ryan Turnbull: I appreciate the response.

Mr. Saindon, to go back to you, we had Professor MacRae here with us last week. He identified about 10 different barriers that our farmers experience when trying to adopt some of the more sustainable practices and technologies, some of which we've talked about today.

He mentioned financial cost being one of them, as well as lack of advisory support, inconsistencies with family tradition, reputational impact and the difficulty to get information, equipment and input, all as significant parts of the equation. Do you see, Mr. Saindon, any of these barriers in your interactions with the industry? What are we doing to address those challenges so that we can increase the uptake of these practices?

Dr. Gilles Saindon: What I would like to say on this, I think, is that it's an interesting list, a good list, and I am not necessarily disputing the list that you've provided, but I'd like to focus on information sharing. I think it's the heart of our activities in the living labs approach. It is to share at both the conception level of our activities and also when we generate the results and we broadcast the results back to the community.

I think it's that sharing of information that is critical and that's core and central to a lot of our activities that we do with industry under the science cluster, the science projects, the living labs and you name it. I think that's something that is important—

Mr. Ryan Turnbull: Thank you, Mr. Saindon. I appreciate that. I'm sorry to cut you off. I'm going to try to squeeze in one more question.

In terms of CAP—and I know that it's going to be renegotiated—has there been any discussion about how sustainability protocols could be built in when dealing with provinces and territories? Is there going to be any funding for what we call “transition advisory services” that could help increase the information sharing and provide some advice and support to farmers who want to move further down the line to more agro-ecological practices?

Thanks.

Dr. Gilles Saindon: Unfortunately, I don't have that information with me. In fact, it's part of the discussion that is led by some other officials in our department and is part of their activities in their work with the provincial government. Perhaps that's part of the negotiation, but I'm not privy to these discussions.

● (1250)

Mr. Ryan Turnbull: I have a last question.

How can we incentivize a more rapid uptake? What mechanisms can we implement from a policy perspective that might increase the uptake of some of the more sustainable practices that I think you're doing lots of research on?

Dr. Gilles Saindon: Obviously, we want to work on the best management practices that we codevelop with the sector, with the partners, with the players and with the farmers. When they work with us on their farm at that level, that's probably the best recipe for success in demonstrating that it's working and in spreading the word among producers.

[*Translation*]

The Chair: Thank you, Mr. Turnbull and Mr. Saindon.

Mr. Perron, you have the floor for two and a half minutes.

Mr. Yves Perron: Thank you, Mr. Chair.

Earlier, we talked about seed research, breeding, and so on. I'd like to know how much research and development that entails.

How long does it take to test and measure the impact of genetic modifications over the medium to long term?

Why is it important that your department be responsible for that?

I don't know who will be best suited to answer my question.

Dr. Gilles Saindon: I can give it a try.

Do you want to know how long it takes to produce seeds or do you want to know how long it takes to decide—

Mr. Yves Perron: I wonder how long all that takes, including the development of validation protocols and testing.

Dr. Gilles Saindon: I would roughly estimate that the breeding cycle takes about 10 to 12 years. If biotechnology is involved, that can shorten the cycle. The breeding process can be done faster, but it never takes less than 6 to 8 years. However, field evaluation in the agricultural setting still takes about 4 to 6 years. That doesn't vary much.

Mr. Yves Perron: In your opinion, would it be important to enact regulations to guide the process or would it be better to let the industry manage these things?

Dr. Gilles Saindon: Actually, the regulatory component assesses the safety of genetic material released into the environment. Here in Canada, we have regulations in place for genetically modified organisms.

At the moment, we're looking at how to regulate products made from clustered regularly interspaced short palindromic repeats, or CRISPRs. We're discussing that right now.

Mr. Yves Perron: Can you tell us about the importance of maintaining good farming practices over the long term? Of course, I'm not expecting a political answer.

For example, if a producer gets funding to plant trees and cuts them down after five years, I wonder what the agri-environmental gains will be.

Dr. Gilles Saindon: It's indeed important to make sure that the action we take is sustainable, when we plant trees and install windbreaks, for example. When we create permanent grasslands, it's important not to plow the fields, otherwise it won't help. Once the fields are plowed again, annual plants move in and the same cycle starts over as far as greenhouse gas emissions go.

The sustainability of these new approaches is paramount.

Perhaps my colleagues could provide further details on this.

The Chair: Thank you, Mr. Saindon and Mr. Perron.

Your time is up.

[*English*]

Mr. MacGregor, we'll go over to you.

Mr. Alistair MacGregor: Thank you, Mr. Chair.

I only have one question, maybe for Dr. Gregorich, because he's had the most interventions on carbon soil sequestration.

We've had testimony here about agroforestry being one of the most efficient practices for carbon sequestration. I made mention earlier of France as a leading example worldwide, with an ambitious plan to convert many acres of cropland into land that supports agroforestry. In Canada, of course, the federal government, in a different department, has the two billion trees initiative.

Dr. Gregorich, I'm wondering, just to wrap things up, if you have any further comments to add on agroforestry, in particular on which crop species would be the best, and maybe on how AAFC can tie in with the government's committed goal of two billion trees to help our agricultural sector?

● (1255)

Dr. Ed Gregorich: Thanks for the question.

Planting trees is a broad topic. It's everything from replenishing and putting in shelter belts to riparian trees, which was mentioned before, to silvopasture, which is putting trees in pastures, and then intercropping, which you were referring to in France. They're encouraging that.

I'm not aware if there's any research being done right now on the specific varieties of crops and the interaction between the crops and the trees. I don't think there is in Canada, but the point is that with the whole idea of putting trees on farms, there's a whole wide range of different management practices in that regard. However, that is important, and it is being considered by the department.

Mr. Alistair MacGregor: I'll wrap up by thanking all of our witnesses for joining our committee today.

That's it for me, Mr. Chair.

The Chair: You stole the words from my mouth, Mr. MacGregor.

Thank you, colleagues. Thank you to all the witnesses for your research work in the field. We appreciate what you do and we appreciate your testimony here today. I know it was very helpful for folks.

We'll call it a day. Thank you to our translators. Thank you to our clerk, who is filling in for Ms. Harrison. We're wishing her well in her recovery.

We'll wrap it up there. Thanks, everyone.

The meeting is adjourned.