

Q&A with Dr Cary Fowler

on 'Creating global food security: a vision of adapted soils and crops'

Chair: Dr Beth Woods,
Member of Australia's Commission for International Agricultural Research

Q: Beth Woods

The Chair's prerogative is to ask the first question, and I am particularly interested in somebody whom I have always thought of as being a champion of plant resources and plant genetics straying into my husband's field: I declare right up front, I'm married to a soil scientist. I'm really interested to get your sense of trying to work with this, at scale, and thinking about the issue of improvements that can be made that aren't easily reversed. What do you see as the particular obstacles on the one hand, and the particular opportunities to improve soil condition and make long-term impacts on productivity and long-term outcomes for food production?

A: Cary Fowler

I am definitely not a soil scientist. In my current job, I feel like I've had to draw on every moment in my life and every experience I've had. The earliest experience I had with soil was driving around western Tennessee with my grandmother, who was a farmer, and having her point out which fields were good and which weren't, when nothing was growing in them.

And she would tell me that 'That field is going to produce so many bushels of corn, or so many bales of cotton'. Intuitively, I realised she was teaching me either to be a farmer or at least not to get cheated on buying land, because I should know what land was good and what wasn't. Only recently I realised that she was teaching me to look at organic matter in the soil, and which soils were rich and which weren't. I have to wonder where I was all these years in not realising how intricately linked soil health and fertility is to our future, to sustainability.

One of the things that we are trying to do with this program that we are co-sponsoring with the African Union in Africa is to join up soil health and fertility with crop adaptation.

A lot of the crops we want to promote are legumes, which will help enrich the soil and of course provide good nutrition. But we realise that food systems are very complicated and have many different elements to them, and not every element is created equal, but that doesn't stop you having a sequence of things you need to do to improve food systems.

Africa is using only 3–4% of the fertiliser in the world. When I started at the State Department, the Secretary of State asked me, 'Why is it that so many countries, particularly African countries, are coming to us saying they need fertiliser?'. And I said, 'Well, you know, if you don't have enough production in your garden, you decide to add some more fertiliser'. But the soils in Africa – and I'm generalising terribly here – need more than fertiliser, because with really poor degraded soils, fertiliser-use-efficiency is not great. For many farmers in Africa, it would be an irrational choice to apply fertilisers. Why? Because they wouldn't get enough increase in production and value to justify the cost of the fertiliser.

This is a terrible situation, and so we need to make these long-term investments. I really give credit for my epiphany in this to one of the previous Food Prize Laureates, Rattan Lal, who is a soil scientist extraordinaire. I asked him, 'We're dealing with the soil health and fertility problem in Africa, but once upon a time weren't Africa and South America the same? Didn't they have very poor soils in Brazil, for example?' And he said, 'Yes, but with one difference. The soils in Brazil were actually a little worse. So what did they do? They engaged in a multi-decade initiative to improve those soils, and now those soils are supporting export agriculture in Brazil.'

A couple of lessons there. One lesson is: we can address this problem. The second lesson is: we have to make a long-term commitment to do it.

Q: John Muir, iHemp Consulting Agronomist, AgriFutures

I am really impressed by what you're saying, and I just want to help. I work with poor people in Cambodia as a volunteer. Kenaf, which is *Hibiscus cannabinus*, a type of industrial hemp, comes from Africa. Has kenaf been identified? These biomass crops, these superfood crops will grow anywhere; they fit well in rotations in Queensland. Did it get identified? And how can we get a CGIAR center to look at it and others of these types of crops that were in the old world and can now be brought in here?

A: Cary Fowler

Well, you know, I've had a number of comments or questions asking about the nature of crops that we've identified as indigenous crops with potential for Africa. And the questions themselves are quite revealing. People ask, 'Well, if they're so good, why aren't people using them more?'. And I sometimes don't know what to say about that. These are crops that have been in use in Africa for 10,000 years. If they weren't any good, maybe they would have gone out of business before now. They're not being used more today simply because we have underinvested in them. We have put billions of dollars of investment into wheat and rice and corn research. I don't begrudge that. Look, Tim Reeves is in the audience here; he was the Director General of CIMMYT; I Chaired the Program Committee at CIMMYT when we were doing research on maize and wheat. I am a big proponent of that. But we also need to be putting investments into some of these other crops to realise their potential.

For us in the US Government, we want to start by focusing on Africa. That is where the greatest need is right now. But I think down the road these are efforts that could be brought to Asia and South America.

Q: David Guest, School of Life & Environmental Sciences, The University of Sydney
Cary, you have made some really important points. Thinking about the links between healthy soils and adapted crops, I am wondering if we could go even further. In the early part of the 20th century there were a couple of people, Albert Howard and Abe Balfour, who talked about the health of soil, water plants, animals, humans in the environment as being one, and indistinguishable. I am wondering if there is an opportunity for more transdisciplinary research that breaks down the disciplinary silos that we tend to use when looking at questions like food security. Are there opportunities to link up agronomists, soil scientists, pathologists like myself, and animal health people, economists, anthropologists, health, nutrition, in really transdisciplinary 'One Health' research? Is that a way forward?

A: Cary Fowler

Yes, absolutely; I think it's tempting. It's very encouraging and energising for me to be at a conference like this with a lot of young scientists and researchers. I think the area that you start in, you have to realise, is just a start. It's your anchor for your career. It's not the end of your career. And to do something truly at scale and meaningful and long-term sustainable – all those good words – you will have to get a little bit outside your discipline. I'm currently reading a biography of Norman Borlaug. As you know, Norman Borlaug won the Nobel Peace Prize for his work on wheat. Some people say he saved more lives than any other human being in history. But, interestingly, what a lot of us know about Norman Borlaug now is that he was a wheat researcher and that he bred dwarf varieties and high yielding varieties of wheat.

Read his biography! Why? Because you'll see that he wasn't just a scientist breeding new varieties of wheat. He had to overcome countless problems – financial, bureaucratic, administrative, political – all those things. If he hadn't done those, we wouldn't know who Norman Borlaug is today. If you were visiting from another planet and reading that biography, you might not identify him as Norman Borlaug the great scientist. You might say instead that he was a great organiser or facilitator or promoter, or whatever.

So I think that your point is that we do have these professional silos, and we need to be thinking constantly outside them, because I don't know of a single world problem worthy of that name that can be solved within the confines of a single discipline.

Q: Maylee Thavat, Department of Foreign Affairs and Trade

You emphasise the importance of trade to food security. I note the recent 2023 *OECD-FAO Outlook*, which says that agricultural trade is becoming more a balance between food importers and exporters, with obviously a growing distrust in the trade system. I was wondering whether you could make a few comments on what you see as the US's leadership role in reform efforts in the World Trade Organization, noting that agricultural trade negotiations on this issue have stalled on that, for more than 20 years.

A: Cary Fowler

This is a little bit out of my field, but I'll just say that for the year or so that I've been at the State Department, I have personally had, and the US Government has had, a number of discussions with other countries, particularly after last summer in the northern hemisphere when food price spikes were really going up and we saw food export bans being placed by a number of countries.

We are pretty consistent and quick off the mark to talk to countries about not having those kinds of trade restrictions. (A) They don't work: they actually don't usually work for the political purposes that the countries install them. And (B) they just cause a lot more volatility in the marketplace, and that filters down to farmers who then make rational decisions based on irrational policies. And that doesn't work out very well in the long run either. We may be about to see another round of those kinds of restrictions. I hope not.

Q: Helen Scott-Orr, the Crawford Fund in NSW

In the emphasis on crops and soils, does your strategy include integrating livestock into the systems, particularly for soil health and for rotations, and in view of traditional Indigenous practices in different areas? Also, are you integrating agroforestry, in view of the climate emergency, because the whole integration of the landscape, I think, is so important.

A: Cary Fowler

The quick answer is yes and no. On agroforestry, we've considered agroforestry species in relation to our work on indigenous crops in Africa, and support for improvement of those crops. We think that some tree crops on our list have a lot of potential and really ought to be pursued. On the livestock question, I would have to defer to our US Agency for International Development and the 'Feed the Future' program, which I actually have a role in. But for the particular initiative that I'm talking about, the State Department has not tried to bite off more than we can chew, so to speak. With the programs I described and with limited resources and limited staffing, we are just focusing on what we think we can do. Like all governments, ours has a 'best by' date – a shelf life – and we are trying to keep to what we can do in the time that we know that we have available to do it in. In this case, that is a year and a half.

Q: Yasmina Sultanbawa, The University of Queensland and the Crawford Fund in Queensland

Thank you for a very insightful presentation. It's very close to my heart because I work with a lot of Indigenous people in Australia and their 65,000 years of knowledge and their nutrient dense food. How do we bring together the local food systems and global food systems and introduce them to trade? Because when you say 'under-utilised' crops, it's all about scaling-up. How do we make them available for the wider community? And then global food crops – how do we bring them together, and also in a trading context?

A: Cary Fowler

There are some versions of this question that I often get back in the United States, actually. If you look around the world and you look historically, you will see food systems that can only be explained by the kinds of incentives that have been put forth for the food system, including in particular to farmers. Our major crops have been heavily subsidised in one way or another.

That hasn't been the case with the crops that we don't know much about – with the traditional and under-utilised and indigenous crops. So we first have to realise that their status in diets, in developing countries in particular, and even here, is based on history and based on these kinds of incentives. We have to get those incentives right if we expect to broaden the food basket, so to speak, and improve nutrition.

For people who ask why isn't there already more use of these indigenous crops, I would say that actually diets have changed a fair amount in the United States in my lifetime. We eat crops now that I didn't know about when I was a child. It may not happen from one day to the next, but over a period of years food systems do evolve, and tastes evolve and diets change, and I think that can happen anywhere and everywhere. We need to realise what climate is doing to food systems; climate is rearranging all of our food systems.

So for us, the question going forward is, are we going to be in the driver's seat of that, and are we going to refashion those food systems based on nutrition? That's not how any food system in the world today started out, but now we have a possibility of reordering our food systems based primarily on nutrition. And that's what we can do, and I think people will embrace that.

Q: Tony Fischer, the Australian National University and the Crawford Fund in ACT

Thank you very much for your presentation. I think focusing on sub-Saharan Africa is dead right. That is a huge problem facing the world. But I would argue that the modern varieties of all the crops that we are familiar with – maize, rice, wheat, cassava, sweet potato, kelpie – grown right now are perfectly well enough adapted to the environment, including the climate changes that are coming. But they are not adapted – and no new crops will be adapted – to the depauperate soils of Africa. The soils have been run down after a century of farming without turning to nutrients, or by the institutional constraints, or the political constraints, in sub-Saharan Africa. We have the technology to triple the yield of current crops in Africa, but there are all those other constraints. Norman Borlaug spent the last 30 years of his life working in Africa; that is never mentioned in the book, which finished unfortunately in 1970 when he got the Nobel Peace Prize for his breeding, and he worked in agronomy and the political area that you mentioned. I think we need to remember that that big picture is what is holding kids back in sub-Saharan Africa.

Q: Patrick Macdonald, Gardiner Foundation, Victoria

With limited arable land and the globalised agricultural trade, and by adding more crop variety into the current system, does that really work in the current situation for African nations, given the vanilla crisis in Madagascar triggered the Madagascar hunger, and also the majority of the cut flowers exported to Europe are actually coming from Africa? Do you think those cash crops still need to be produced in the African nations, or do they need to look at the staple foods rather than just cash crops, to improve the global food security?

A: Cary Fowler

It is very hard to reply about a specific situation. I think there's a role for cash crops. At the same time I look at Madagascar, and Madagascar is a country that that we were worried about last year, and are still worried about this year. That is because of the drought in southern Madagascar, the decrease in food production there, the childhood stunting rate, and the fact that they were importing a lot of their rice from India and India put a ban on broken rice exports which really affected Madagascar. That, of course, is a situation that might be playing out again today. Without being too prescriptive, I'll just say that I think there's a place for cash crops, but I think there's also a place for looking at the whole food system itself, and certainly through a lens of what is good for farmers and what is good for nutrition.

Q: student at The University of Queensland and a Crawford Fund scholar

In creating global food security, if we look at the countries in South Asia and African countries where there is gender discrimination in the agricultural systems, some people think that education can give support. But there is discrimination in getting this support. So how can we deal with these challenges? Only imposing or creating policies such as government support is not helping to change the cultural systems or change the cultural norms. How can we deal with these challenges?

A: Cary Fowler

I don't have an easy answer for the big question there. But I will mention two quick things that I think are really important about the work that I just described with indigenous crops in Africa. The first, which really excites me and keeps me going, is that most of these crops are tended by women. Women are the predominant farmers for most of these crops, so improving crops grown by women is an empowering effort. And if we improve crops grown by women, we are improving childhood nutrition, which is another thing that is really important to me. Some of the countries in

Africa have very high rates of childhood stunting. I was just in Malawi recently, and the childhood stunting rate there is approaching 50%, in children under five years. Not only is that a humanitarian disaster now, but think about the challenge of trying to develop an economy in a society where half of your upcoming generation is stunted. That's really bad.

The second thing is that there's a group called the African Orphan Crops Consortium. It's low-key, 'flying under the radar'. They have been training plant breeders in Africa on particular crops. Almost half of the plant breeders that they have trained up to PhD level – and they've trained more than 150 – are women. I think something really interesting is happening there. If we get a large number of women plant breeders working on traditional crops for women in Africa, that looks, to me, like a 'game changer'.

Chair: Beth Woods

Thank you, Cary. We have heard a very interesting talk, and then some very interesting additional points brought up in our question-and-answer period. I particularly note the example given by Cary of the multi-decade work on soil improvement in Brazil, and the importance of thinking about trade in this whole discussion; and your last point, the focus on diversity, particularly the role of women. I think all those are critical factors that we will need to bring to bear to deal with the challenges that we face with climate change in a very complicated world. Thank you very much. Please join me in thanking Cary.

Cary Fowler's bio is given at the end of his talk.