

2006 Norman E. Borlaug/World Food Prize International Symposium
The Green Revolution Redux:
Can We Replicate the Single Greatest Period of Food Production in All Human History?
October 19-20, 2006 - Des Moines, Iowa

SESSION FOUR: Looking to the Future

October 20, 2006 – 9:00 – 11:50 a.m.

Hans Herren

Introduction

Gordon Conway

I'm going to hand over to Per to introduce the two further speakers. And then with luck we'll have our discussion at the end of the session. But maybe Bob and Hans would come up onto the stage while Pedro is walking forward and the three of you perhaps would like to go down and then come back again towards the end.

Per needs no introduction. I was told not to introduce him, but he's my very good friend.

Moderator

Per Pinstrup Andersen

Thank you very much, Gordon. This was the most efficient introduction of any speaker that I have ever heard, very appropriate. Thank you very much. It's great to be here, and it's great to join others in congratulating this year's laureates. Congratulations – it's wonderful, wonderful news when you were selected.

We have a slight change in the program. Michael Osterholm was unfortunately unable to be with us today. What we will do then, we will take the two interventions of the two speakers that we do have with us, and then if time permits, we will have a short period of Q&A. Should the speakers be extremely short, we may invite the other three speakers back up and we'll have a panel discussion with all five. But that's going to require probably more time than we're going to have.

Hans Herren, the 1995 World Food Prize Laureate and President of the Millennium Institute, and Robert Watson, the World Bank Director for Environmentally and Socially Sustainable Development, are co-chairs of the International Assessment of Agricultural Science and Technology for Development. Believe it or not, it does have an acronym, but I'm not going to give it to you.

This assessment is a global, multisectoral comprehensive effort to analyze the knowledge and uses of science and technology in agriculture, now and for the future. The implications for agricultural production in the future will be analyzed as well. They will jointly outline some of

the major challenges facing agriculture in terms of supporting the global population in the coming years, as well as suggest to us some future scenarios on how agriculture might look after a few decades. In other words, they're going to take a look at the crystal ball, but it's going to be a very informed look.

Let me introduce both speakers at this time since they will be addressing the same topic, and I will be very brief since you do have written a longer CV in the material that you received for this symposium.

Hans Herren received, as I've already mentioned, the 1995 World Food Prize. He received it for his work to prevent massive famine and crisis in the face of the mealybug that was devastating Africa's cassava crop. He is the founder and chairman of BioVision, and he is the president of the International Association of the Plant Protection Scientists. An internationally renowned entomologist, he was Director General of the International Center for Insect Physiology and Ecology in Nairobi (ICIPE).

Continuing Dr. Herren's presentation will be Bob Watson. In addition to directing the Assessment that I already mentioned, Dr. Watson was a director of the Millennium Ecosystem Assessment from 2002 to 2005 and has also chaired the International Panel on Climate Change. He currently co-chairs the International Scientific Assessment of Stratospheric Ozone. Prior to his current position, he was a science and technology policy official in the Executive Office of the United States President, and he has been an official and lead scientist at NASA.

So we have some real expertise in front of us, and I look forward very much to hearing their presentations. Hans, you have the floor.

Agriculture and Food Production: Quo Vadis?
The International Assessment of Agricultural Science and Technology for Development

Hans Herren

President, Millennium Institute, Washington, DC

Co-Chair, International Assessment of Agricultural Science and Technology for Development

1995 World Food Prize Laureate

Thank you, Per, for the introduction. It's a pleasure for me to be here again almost, I think, for the eighth time, so I'm trying to really make it every year, this pilgrimage to Des Moines, to meet many colleagues and people I've worked with, although I'm sort of moved beyond the grassroots, working more now in the policy area.

I'm very honored also to be working with Bob Watson on this International Agriculture Assessment of Science and Technology for Development. I think this will really look back but also show what kind of future we may have in terms of agriculture for the next fifty years. And as you know, we are here because you're interested in food, and that's the most important thing when it comes to life.

I'm also known to be one of the controversial persons, maybe for different reasons. And what I want to do today, I will discuss a little bit some of the good news, so we have some good news; but I think we have some bad news. And maybe this news we need to be concerned about. And we're going to look forward then to some good and bad news. And my colleague friend, Bob Watson, will then move on, on the IAASTD – that's how we pronounce it – International Agricultural Assessment of Science and Technology for Development. And we'll leave it up to you to decide if it's good news or bad news.

Now what are some of the key achievements of industrial or modern or also contemporary agriculture – and in particular through the knowledge of the science and the technology? Basically what we can do today, we can transform enough solar energy, which is new one or stored one, because we use all the fossil and nonrenewable energy in agriculture, to actually sort of produce 10,000 new people every hour and to make sure that they survive.

We produce enough food today for the world's population and plenty also to throw away down the sink. As you all know, 25% of the food sold in this country is actually wasted.

Another bit of good news – caloric intake has gone up. And you have seen – as discussed before, many people have shown this – the number of undernourished are falling, globally, not everywhere in the same rates. We have lower food prices, and we can debate if this is good or bad. For the farmers I don't think it's a good thing, maybe for the consumers in the cities.

And the transformation of the agricultural society into industrial ones has happened. And again here this provides that agriculture is really the basis of growth and development. And we also know that investment in ag research has a high return.

So we've been successful in producing more food faster than the population has gone up. So that's good, and that leads to the lower prices. And here this graph shows again – this comes from FAO – the different trends over the years where we have total food production which has gone up again and the per capita production also. Food prices have come down, and again here sort of the undernourished people, up and down – it's down a little bit in the latest count.

So I think these are major achievements we have done, and again they were really supported through knowledge, science and technology in agriculture over the last maybe 50 to a hundred years.

And I like good news, because I've been in Africa for a long time. All these bad pictures of hungry people, I mean, sure they are there; but I think we have now many other and better pictures to show you – kids who eat, go to school, are well-dressed. We have made major progress in sustainable agriculture where we can multiple or double maize yields in a very sustainable manner, and not only double yields but we can also do it by improving farm productivity. At the same time that we double maize yield, we can also produce fodder for cattle, and then manure goes back to the land, and we can control weeds. So there are systems that have been developed which really truly are sustainable agriculture.

Tsetse flies are in many areas no longer an issue, although there are in way too many areas. And one thing I'll come back to at the end is about energy. And a big problem certainly in

Ethiopia and in many areas which are infested by tsetse flies is a lack of energy. And a project in Ethiopia just shows that a big valley, Giba Valley has been freed of tsetse flies and to very simple technologies. It doesn't always have to be bio- or whatever technologies; it can be very simple. Farmers now produce ten times more milk, having controlled the tsetse flies. They also farm six times more land; they can till it because there's energy around because their oxen don't die anymore just as soon as they get them.

New, simple methods to control malaria – cleaning the ditches, making sort of water flow, and using community activities will make malaria a thing of the past and land again good to use. This was wasteland two years ago in Kenya in an area of 30 square kilometers where simple methodologies to control malaria have already brought people back into this region. And again we don't need DDT to control malaria. Science and technology have brought up brand new methods, and we have uncovered old methods, and with this it can be done.

Money has been brought back into the economies, with bees, for example. And again women in many places in Kenya and other places are making good money, sending their children to school, because they have become beekeepers. In Ethiopia in Addis Ababa, on those eroded hills, women have been working very hard, making gardens and selling vegetables, being very happy. The next step – what they are doing now, actually – they are building a restaurant so they can even make more money. But these are happy faces – things are changing, things are looking good.

But. But. We are also having a problem, and this is coming at a big price. And here I'm talking now at the global level, not so much just Africa. The scorecard of the ecosystem condition is really changing, and it's going down. So if you look at the agrosector in the circle there, it's the areas where we grow food and fiber went down. Where the quantity is down, the biodiversity is down, the government storage sort of up and down because if we grow more forest, we're better again.

But overall we are using our natural resources in an unsustainable manner. And why is this a concern? Because we need to be concerned about the production base. This year's three laureates – and I want to congratulate them because again it's nice to see that some of the key elements in agriculture are being rewarded here, strong and hard work to make sure that the production base is there.

Land – people are increasing, the farmland is stable, which means it's less land per person, not even equal but less.

So we have a lot of sort of disconnects in that system. And I want to point to three main disconnects, and there may be more. There's a big disconnect between agriculture and environment. There's a disconnect between producers and consumers and also between policies and the expectation of what these policies should be doing.

When we look at the disconnect between agriculture and the environment, again water supply is a big issue. Without water there are no crops, and we know that crops actually are quite demanding in terms of water. But we can do a whole lot better. We need to cycle nutrients. And the more herbicides, the more pesticides we use in our environment, the fewer workers we're

going to have out there helping us – and we know that already. And we also know that in the desert no hybrid seed, not any seed of whatever origin, will grow. So we need healthy, not only just soil with nutrients, but also healthy soil which is alive.

But what they've been doing over the past years in many places where they've been using a lot of fertilizer, the synthetic fertilizer and nitrogen in particular, we have created dead seas all over the place with this. We have used too many pesticides. We have created a lot of resistant insects, which means we have to use more pesticides. We have to go on and use GMOs because we have sort of screwed up the system so much that we cannot recover.

We have already 400 herbicide-resistant weed bio-types, and it is going to get worse by the concentration or higher use of herbicides on some of these GMO crops. We also have many crops which are resistant to fungi and bacteria.

Whereas again there are always alternatives, and I think we need to ask the question: What is the need and what is the alternative? On the water, sure, we have grown a lot more food, but again we have been pumping water, which is a nonrenewable resource in many areas of the world. We spend more energy every year to pump the water from deeper down. So we have to ask ourselves – how long can we do that? – knowing that energy is also limited. And just to grow plants for biofuels to pump the water up, we have to start thinking how much is going to be really coming out of that system eventually.

We also have been neglecting some important things out there, like the pollinators, the natural pest control. Because most of the pest control actually is handled by other insects, by natural enemies. And the example here, this insect to the right, that insect saved 20 million lives for \$20 million investment, one dollar a life. Can you go do that again with something else? You tell me. And what are we doing? We are eliminating this. We are not offering them a place to survive, to be, and to do their job. So we really have to think more. Pollinators are responsible for the pollination of most of the horticultural crops, vegetables – you won't get any tomatoes without any bees. Do people know that? Well, maybe they do, but I'm not sure they really pay attention.

The disconnect between the producer and the consumers. Well, we were at feedlots and we have seen what happens when a feedlot is near spinach fields, problems. There's also produce markets and supermarkets who are imposing certain things to consumers and demanding the impossible from the farmer. So I think again there has to be some discussion. The partnership is a two-way street, and I think we have to go from the producer to the consumer and back via different steps. And the consumer must also have a say. It's not so that because we start this, we know better, they have just to do what we say.

The disconnect between the policies and also expectation – we dream of agriculture, of the landscape, a place to go and sort of to rest and to enjoy. But actually we're promoting with our purchasing of the food, the way we buy food and the cheap food price we demand, we are actually asking for more monocrops rather than multicrops and medium-size farms. And we also just are building over the best land over the world in many places, as we all know.

Now, the farmers will be much better off if the people in the urban areas or even in the countryside but not living on farms would have to pay a little bit more money for all the things which the farmer produces. Now this ecosystem service is very important, and the disconnects I just talked about relate to these ecosystem services – or the multifunctionality of agriculture, because agriculture is not only growing food. It's doing a whole lot more, and maybe even more importantly, it provides the water we drink every day, the air we breathe, a lot of it, and the fresh air – that's why we like to go to the countryside, for example. It produces also the shelter, fibers. So these are a whole lot more. But in particular the products which are less tangible, they're not food or fiber but are water and air and recreation, I think should be paid. So farmers actually should start to charge for this, and I think we would see a big change out there in the environment.

And there's all the heating costs. Again, I won't take as much time as my colleague before me, or Bob won't be very happy with me. But still I think we need to talk about the externalities. So there's a lot of issues here again of externalities. And they have to be brought into the whole calculation of agriculture, what the costs are also. You can't just ignore them all the time.

We cannot ignore that we are usually eating too much of the wrong mix of food. We are actually eating ourselves ill and sick. Because we have all these feedlots all over the place, maybe meat is cheap, so we eat more of it than we should, and we create a lot of problems: What do we do with this manure? What are we going to do with all the methane and gases which are produced? So again I think we really have to think a whole lot more about what we are doing if we want to continue to do this for a long time.

So really what is the problem and should we worry? Yeah, we need to worry about these things, because technology won't fix everything. We have seen that in the poor countries, the productivity is low, it's high as we go high income. You have more productivity per hectare. So we need to again work there, that's clear; because to ship food around the world, again, I mean as I say, we should not ship any food at all, but I think we have to do that again with measure.

It loses a lot of energy, and it makes people dependent. And who wants to have a country, to be the president who's dependent on somebody for your food, for your people's survival. I think there is a certain degree of self-sufficiency we need unless – and we'll see that later in the scenario – we have a totally different world.

These trends, yields are not increasing. We've reached a sort of plateau. Biotechnology may come in and may help. So far it really has not done much in terms of yield increase. It may reduce cost of production, it may reduce need of pesticide application. But I think the real yield increase we're still waiting for.

Going beyond – I mean, agriculture is also fish. Fisheries in the oceans have gone down and are not recovering. Many species of fish are disappearing. Our technology, and like in agriculture, we have technologies which we really can finish everything if we want to. We can go fish the last tuna out of the ocean; it doesn't matter where he's going to be, we're going to get him, because we have the technology from satellites to do so. We have a huge amount of technologies which we somehow are not using to the best of what we should be using it. Water –

never mind what's going to happen – we're going to use more water and naturally there is less water out there, certainly less clean water.

We use more fertilizer, as I mentioned. We are creating dead seas already in China, in the Gulf of Mexico, in those places, there's nothing left in there because of again washing down a lot of the fertilizer. And again because agriculture is done in watersheds because there's water, there's good soil, that's a great problem.

And we need to think about, how can we overcome that problem? And there are solutions. We already have put out of productivity 16% of our land. Maybe our new laureates can help us recover a lot and restore this land. And I'm sure again science will help us.

But ecological footprints. You heard about the ecology of footprints. If not you just go to the website, Google "ecology footprints," and you can calculate your own. And actually almost everyone who flew in here probably has a bad one, because all the people who fly really increase the ecology of their own personal footprint.

But globally, since about 1988, we are consuming more than the earth can actually compensate for. All right. You take a piece of paper and calculate how long can you do that until there's nothing left? And we are what, October 20th? All right. Since the 9th of October, this year, we are already using nonrenewable resources. And in 1987, we started in mid-December using it up. Fourteen years later, we are in October. Where are we going to be, in June, next year? Or in ten years from now?

So we have to think about – how are we using our natural resources in a way which is sustainable. And again I mean we cannot create things. We can transform, we can make better use. And one big deal, one big problem really is climate change. And how agriculture will deal with climate change I think is the biggest challenge. And again technology will be needed, but we should not think that technology can fix everything. And climate change again affects the biodiversity, the forestry, water, desertification, etc. So again it's very impacting ourselves all around.

And agriculture is caught there in the middle somewhere because of the agricultural need for water. If it's too hot or too cold, our crops won't grow or we have to make again modification and changes. But again these changes will happen, and we have to be ready.

And this is a very interesting graph. I just got this from last Sunday, the conference in Arlington. And Bob Corell came, and he's worked in the Arctic Research Center for many years. And this blue band area is sort of the "sweet spot." So we can see the range of temperatures. We came out, the yellow line, out of the Ice Age, and the temperature sort of varied plus/minus one degree – right? And that's our time when we sort of, when agriculture of 10,000 years ago, when it started, so that's where we really did our work. All of a sudden, you can see now that temperatures are rising 1.5, maybe even more. We adapt the limit. We're not doing really very much, as you all know, to reduce CO₂ emissions or maintain. And the more of that stuff in the air, the more temperatures will go up.

And so we are moving out of the “sweet spot.” What does that mean? I’ll leave it up to you to think about it.

For agriculture in particular, much more sort of hot days and heat waves is very negative. In California this year the apples – and I have a little orchard and a vineyard in California, organic, naturally – the apples were cooked on the tree, 117° for several days. I mean, now it’s happening. It never happened before.

Greenhouse gas records for going back in those ice cores, where they’ve been digging and drilling up in the Arctic, as you know. You can see that today we are already at, what, 380-something, parts of CO₂? And the methane, which is something that is produced by agriculture, is already at 1750 parts per billion. Which means it has already doubled in the last 150 years, and we are producing more – rice production, cattle and all this. So can we find ways around this? If not, we’re going to be in big trouble.

CO₂ in the air is a problem. The fact that it goes into the ocean and is absorbed by the water and the pH is lowering in the water means that our coral reefs are melting away – right? You know what happens to calcium in acid. So again – are we trying to do something there? Because that’s where fish breed.

So what is the main challenge that I had? So we have increased population, lot of discussion about this. We also have to remember that the population actually after this will come down rather fast. And there’s a lot of prediction and projections these days already how the population will actually reach this peak and come down. And maybe we need to think about what can we do still to slow down more. The decreasing of the productivity of land is the issue really I think that’s a huge challenge.

The water, it’s the quality, the quantity, and also the distribution and the access. Rich people always say water – water is always more expensive than the gas anyway, as you know. So even in developing countries it costs a lot of money.

Climate change, which will affect, in particular, developing countries. Africa will be very much touched by more droughts in some areas and more floods in others. Again, these are difficult things to deal with. The biodiversity crisis, we need diversity out there, as we know, because if you want to breed more crops and better crops, again I think we’re very dependent on biodiversity and also because of the change. We need this diversity to help nature adapt to the new conditions.

Pollination and pest management, I mentioned this. Energy crisis – this is a big deal. In particular, agriculture uses, in the southern part of the world, a lot of energy; in other parts of the world, too little probably. Can we find some way of doing this better? And particularly in Africa where the animals are struck with all kinds of diseases, people have not enough energy because they are sick; because they eat badly, they have liver cancer, many of them, and then they have AIDS or they have malaria, so they are very weak.

I’m amazed how little mechanization there actually is in Africa, I mean, the small scale, the little one, two-wheeler that walk behind tractor. And I asked in a meeting with Jeff Sachs in

Nairobi once, “Where would you be if you had to walk? You wouldn’t even be out of New York.” Where would you be if you walked? Now the Africans just walk. They walk all the time. They walk everywhere. Their little bag on the head to go to the market and back. That’s not the way to move forward. So we need to find a way of balancing these energy users, the ones who use too much and the ones who have too little. And then we see what kind of energy – is it renewable or nonrenewable?

Ecosystem services, very important. And the cheap policy – I think we have to really review that. Sure, poor people need to be able to buy their food, but we should give them the activity, something to do that they can buy it. But the farmers cannot survive on cheap food. It is not normal that the farmer either in America or in Switzerland or God knows where, if there’s a bad year, he has to pack up and go become a beggar. If an industry has a bad year somewhere, they’re not just folding up. There’s a problem here that there’s no reserve, there’s no resilience in that type of system. And we need to think about it more how we move forward.

So we need better policies all around, from global to national, but we need to increase research and also the institutions of research. We need to really give our agriculture and food system the parity it deserves in the national budget. Ten percent is not enough. And we should not shortchange in the future the food production base for fuels, because we can economize rather than use now the land, the water, the energy we have to just drive around with bigger cars and just like nothing has ever happened.

Thank you very much.