

**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 ONE: Looking Back, Looking Forward**  
October 19, 2006 - 8:15 a.m. – 10:00 a.m.  
Keynote: Sir Gordon Conway

*Introduction*

**Ambassador Kenneth Quinn**

President, World Food Prize Foundation

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When we decided to look at the Green Revolution Redux, there was really only one person who can be the keynote and to lead us through it. The best person I could think of to do this was Gordon Conway. I have come to have enormous admiration and respect for his work. The Doubly Green Revolution, I think, is the foundation of the view that, as we go forward to produce more food, it has to be done in a way that sustains our environment. And, you know, he was working in Borneo and in Thailand when I first arrived in Southeast Asia, and I think it's always that on-the-ground experience that anchors and brings ultimately great wisdom.

It's my great honor to introduce to you Sir Gordon Conway.

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**KEYNOTE ADDRESS**

*Looking Back, Looking Forward: Major Accomplishments and Challenges*

**Sir Gordon Conway**

Chief Scientific Advisor, UK Department for International Development  
President (retired), Rockefeller Foundation

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Thank you very much. I'm very grateful to Ambassador Quinn and John Ruan for inviting me to address you on this 20<sup>th</sup> Anniversary. It's great to be back here. As Peter McPherson says, "This is a wonderful opportunity to have great conversations," and for me in particular, coming back to the States after nearly two years, to see many old friends and colleagues.

(Can we have the lights down so people can see the..., so I don't feel like... I'm heavy meat and potatoes – I didn't want to feel like a rabbit.)

One of my jobs is to pay a tribute to Norm, and I decided that this sentence is the best tribute that Norm could have. There are many fathers of the Green Revolution. Norm Borlaug

was the supreme father, but there are others in the room. Swaminathan is the father of the Green Revolution in India, Vo Tong Xuan in Vietnam, Yuan Longping in China.

And I want to start with a little history. Many of you know this, but let's just remind ourselves. The Green Revolution didn't begin in the 1960s, it began in 1943, and it wasn't even called the Green Revolution then. It began with this cooperative program between the Mexican government and Rockefeller Foundation, and it was a team of four people – soil scientists, plant breeders, plant pathologists. And they worked on maize and wheat and beans. And to begin with, what they were doing was producing synthetic maizes and rust-resistant wheat.

And this came this key point when Norm said, "Let's put a lot of fertilizer on and get the yields up." And of course when you put a lot of fertilizer on on those varieties that we had at the time, the varieties fell over, they lodged. So lodging was what Norm engaged himself with. It was lodging in a sense, and that challenge, was at the heart of the Green Revolution. I'm afraid lodging is itself lodged down at the bottom of the slide – sorry about that. These are English-sized Power Points.

And of course the Green Revolution was then based on bringing in the short-straw genes through Norin 10 in wheat, Dee-geo-woo-gen from rice, IR8 was the miracle rice, and then the same revolution going on in China. And the consequences were dramatic, just remember that. Look at that increasing yields that occurred in India and Pakistan.

The biggest in many ways was the reduction in surprises. Cereal prices came down. It meant that the poor, both the rural and the orphan poor, benefited from this reduction in price. But there were limitations. The Green Revolution tended to focus on ideal environments. There was, to begin with, a heavy reliance on synthetic pesticides. Not all the poor benefited, and it passed Africa by. The top left is a typical Green Revolution environment in Java; the bottom right is what is typical in Africa.

And today we see the consequences of not having a Green Revolution that was totally successful – eight hundred million people in the world chronically undernourished, over 200 million of those in Africa; 180 million children severely underweight for their age; 400 million women who are anemic, which means they are at risk when they give birth. And you can see the areas of global food deprivation, most of Africa, the yellows and the greens there. (Can we get this one down, too, do you think, these lights here, so people can see this?) The yellows and the green show the areas of deprivation; nearly all of Africa is food deprived.

Part of the reason for this is the low level of cereal yields in Africa. You look at China, up four to five tons on average, South Asia over two tons, and Sub-Saharan Africa is absolutely flat at one ton per hectare. You could roll a ball on that graph. I usually like to say to my British audiences that that's the level of production we had in Britain under the Roman Empire. I always say I think we lost a lot when the Romans left, but that's another issue.

And you can see again the consequences. You can see the lack of increase in developing countries' cereal yields. The black lines are the big increases that occurred during the Green Revolution, but we're now back to the increases that occurred before – except, interestingly in the case of maize. You see on the right there that big increase in hybrid maize production. And

that of course is fueled by the need to feed animals. There's a certain irony in the world that when we want to feed animals, we get great big increases in yields. When we want to feed humans, we don't – and I think we should cogitate on that.

And we should also recall that the issues are not just in Africa. This is a paper by Montek Ahluwalia produced by IFPRI in which he talks about agricultural growth in India with that big 4.6% increase in the 1980s. But look way down at the bottom there. Agricultural development is growing at only 1.1% in India today. India is now facing the same challenges that Africa is facing. And there's a great deal of cross-learning to be done there.

And then just to get you all depressed, just look at those figures for world grain stocks. The predictions for 2006, 2007 are very low, largely because there's a drought in Australia. So we've got problems in Africa, we've got problems in India, and we've got world problems.

There's an intersection between hunger, poverty and economic growth. And again I'm going to say something that most of you know, but it needs to be said. Economic growth for most of Sub-Sahara in Africa is going to depend on agricultural growth. (And go back, sorry.) And that agricultural growth in turns depends on renewal environment and resources. So the economic growth in Africa is dependent on sustainable agriculture.

But equally, equally, economic growth of course can halve poverty. Agricultural growth can halve poverty. It can provide increases in incomes to farmers, and it has this enormous multiplier effect. Each dollar of farm income produces one to two dollars of income outside of agriculture. And of course it can halve hunger, not only from the production on the farms, but increases in production generally reducing the staple prices of foods.

And an indirect positive effect on all the MDGs. Everybody in this room knows that's true, but it isn't accepted generally, and that story is one you still have the argument, it's still one you have to make, particularly to presidents of countries in Africa, most importantly to presidents and prime ministers of countries in the donor communities, and particularly ministers of finance. The key target for all of us should be the ministers of finance, to persuade them that agricultural growth is key to economic growth in Africa.

What's the way forward? Well, I've argued that the way forward is the Doubly Green Revolution – something like the Green Revolution but more sustainable in the sense of being equitable and environmentally friendly. It's essentially the same as M. S. Swaminathan has talked about in terms of the Evergreen Revolution.

What do we mean by sustainable agriculture? A little bit of intellectual diversion here. The Romans knew what it was. I'll leave you for a minute to translate it, but for some of those of you who are not very well educated, let me just say that what it says is that agriculture is an art, and it's a noble art, and it's as well as science. It teaches us what crops to grow in what places and then: *quo terra*, that the land; *reddat fructose*, will produce fruit; *maximos*, maximally; *perpetuo*, in perpetuity. It's the first definition, about 100 B.C., of sustainable agriculture, and it works today.

And what we mean by sustainable agriculture, rather what I mean by sustainable agriculture, is that if you think about these properties—productivity, stability, equitability and resilience—what we’re trying to do is to find situations in which all of those are high. That little spot in the middle there is what I call sustainable agriculture – when you’ve got high productivity, high stability, high resilience, and high equitability.

In practice, it means trying to help a lady like Mrs. Namurunda in Western Kenya who has a hectare of land. And with her hectare she might be able to get two tons of maize or whatever, but along come weeds, along come pests, and along comes a drought, and she gets less than a ton. And if she gets less than a ton per hectare, she can’t feed her family, she can’t look after the children when they’re sick or ill. So the challenge is to try and get that up. If she can produce two tons per hectare, she’s got enough to feed the family, and she’s got some land in which she can produce a crop that will give her cash, and she can then get the children treated when they’re sick and get them to school.

To do this, we need appropriate technology. So basically there are four kinds of technology we need to invest in. Traditional technologies, intermediate technologies, conventional technologies, and advance technologies. I’m just going to give some examples of these, using World Food Prize Laureates to illustrate what I mean.

Integrated Pest Management – Hans is here in the room. Parasite of the cassava mealybug, 1995. Integrated Nutrient Management, Pedro Sanchez. Bringing together organic and inorganic material to produce high yields through green manures, reduced tillage, rotations and intercropping. A good example of one of these is in Western Kenya, the MBILI program where they’re growing two rows of maize with two rows of legumes and getting five tons of maize and a ton or more of legumes at the same time.

And most important intermediate technologies that really work, traditionally somebody gets the water up by pulling a bucket up. What we now have are treadle pumps that work extremely well. They’re virtually foolproof, the treadle pumps that are on the market today. They’re cheap, they’re foolproof, they don’t break down. All you need to do, as he’s doing on the right, is to change the rubber washer. Great revolution.

But the problem with many of those intermediate technologies is that they’re labor intensive, they often require high levels of skills, and they’re not necessarily available. So that’s why we really have conventional technologies, and they’ve delivered a great deal in recent years, and you can see quality protein maizes with Evangelina Villegas and Surinder Vasal here.

And another story that I really want to just pause on, if I can get it – that’s the eradication of Rinderpest. The World Food Prize was given to Walter Plowright in 1999, I think it was. Rinderpest is a dreadful disease of cattle. It’s been with us for thousands of years. And you can see up on the left, when it comes, the kind of outbreaks that occurred in this past century. There was a big one in Nigeria in the 1980s. But it now looks as though it has been eradicated. The last two hot spots were in Somalia and Southern Sudan. And FAO claims that so far there is no evidence for the past five years of any rinderpests there. So there’s a real likelihood that we’ve finally got rid of rinderpest from the face of the globe. That’s a story equivalent to getting rid of

smallpox. It's a fantastic story. I'm delighted that Walter Plowright was awarded the prize for that.

And then there are the advanced platform technologies. ICT, biotechnology, nanotechnology and new materials. I could lecture on about all of those. What is important to understand is they're now beginning to come together. We're now beginning to get products that are fusions of ICT, nanotech and biotech.

But it's just the biotech I just want to dwell on for a moment. The point of biotechnology is that you can build sustainable agriculture into the sea. And this is what so many of you agronomists and plant breeders have known for years. If you can build what you want into the sea, then it has a dramatic effect. Then farmers will buy it and they will plant it.

Two, three kinds of biotechnology – tissue culture, marker and its selection, and genetic engineering. Monty Jones, who got the prize for the New Rice for Africa, a cross between the Asian rice and the African rice, combining the best features of both, will produce three tons per hectare with very little fertilizer in quite poor conditions. And you can see it now growing all over Africa. For example, here in Uganda, those of you from Asia will look at that and say, "Hey, that's a great field of rice. It looks like an Asian field of rice. It's not, it's an African field of rice.

Marker and its selection, the key to getting drought resistance, which I'll talk about later, and genetic engineering. I don't want to say much about genetic engineering except two things. First of all, note that the majority of genetically engineered crops are now in the developing countries. That trend, that blue line, is an upward trend and is going to go on in that way. It's way over 30 million hectares of genetically engineered crops in the developing countries. And we're seeing a quiet biotechnology revolution in Africa. This is the biotech lab in Uganda opened by President Museveni. Those ladies there, they're still there, those ladies there are at the forefront of transforming bananas. They're probably ahead of anybody else in the world that's doing that work.

Equity in access is crucial to all of this. Having the technologies is one thing; making sure that people have access is another. One answer is the African Agricultural Technology Foundation, which many of you heard about yesterday, an African institution to get technologies into Africa. But the big issue is about getting fertilizers and seed to farmers – not having fertilizers sitting in great big bags there but getting them out to farmers, in the way that happened in the States with Pop and Mom stores and the way that happened with my grandfather. You know, I know many of you are country people, you've all come from country farming families. I just want you to know I also have a country background. That was my grandfather on the right there with his horse and cart, going round the farms of Kenya, selling seed and fertilizer. And what we're seeing today are the modern equivalent agro dealers in Africa now. Small pop and mom stores trading in seed and fertilizer.

And the same kind of revolution occurring now in output markets. Gene banks like that on the left in villages with, as you see, the secretary of the gene bank over there with a mobile phone to his ear, finding out where the best price for the maize is, loading it in trucks and going off and selling it.

In a sense we know what to do. We know about the technologies and how to develop them. We know about input markets and how to make them work, and we know about output markets and how to make them work. What we know less about is how you connect those to the economies, the world and urban economies, and in particular how you get the policies right. This is the trick in all of this. It's not a technology trick as such. It's not even really a problem that we face at village level, it's a problem that we face at national level. How do we get nations to get together and get the policies to work to make all this happen? That's the challenge we face.

I'm just going to give you one brief case study. It's not ideal, but it shows you something of the way. The Loess Plateau in China – 90 million people live there, terribly degraded, a big World Bank project.

And now, (please, let's go faster) they're now planting trees on the hills, making it into a sustainable land. On the lower land they've created brand-new terraces that really work. So the farmers, small farmers with only about a hectare of land, are now producing enough wheat so they can sell some wheat. They're also producing enough maize so they can feed cattle. They're using all kinds of technologies relatively simple but effective, for example, biodegradable plastics to keep soil and water conservation. And building, as you can see, plastic-covered animal houses for their animals. And then planting trees now in the wheat fields, fruit trees, high-quality hybrid fruit trees, and also walnut trees – high-quality Chinese walnut trees that they're selling to Singapore. And then some of them are building plastic greenhouses, growing cut flowers for the market.

What is remarkable about this place is you can literally see people move from poverty to a dollar a day and from a dollar a day to two dollars a day. It's a remarkable achievement that's occurred in less than ten years in this highly impoverished part of China. I'm not suggesting that that can be translated to Africa as a project, but some of the principles there can be applied there.

Finally, I have to say something about climate change, because this... If sustainable agriculture doesn't cope with climate change, it's not going to be sustainable. Temperatures are rising year-on-year. This year may be greater than 1999. We need to remember, though, that climate change is not just about temperature. In fact, it's not really about temperature. It's about water. Picture on the right, Mount Kilimanjaro. All that will be gone by 2020. If you want to go and see it, you'd better go now.

The consequences of climate change are about water – more rainfall or less rainfall; riverbank erosion, rising sea levels, cyclones, saltwater intrusions. So they're all about the very medium in which crops grow. So we see here in Bangladesh, that lower pale green area, which will be inundated mostly in the next fifty years.

Here in Africa the predictions for greater drought, all those red and yellow, are going to be greater drought in Africa. It is going to have enormous implications. We already are losing large amounts of crops to drought, and you can see here in Southern Africa the impact of drought. The reds and the blues are those parts of Africa where there is a very high risk of drought during the grain-filling period for maize. And that will continue, and it will spread further south in Africa.

So what I want to argue here... See, if you go back to the Green Revolution and Norm's preoccupation with lodging and that it was lodging that spurred his work and what would happen. I want to argue that it's drought today, that we need to look at drought as a problem the way he looked at lodging. We need drought-tolerate varieties and breeds, resilient cropping and farming systems, and drought-resilient livelihoods. And of course we need better water management. That's the big challenge for the next 50 years.

But if we're going to meet that challenge, we need money, we need money to fund the research in Africa. And notice that the public agricultural R&D has been declining in Sub-Sahara in Africa— that middle three histograms there. And if you look at agricultural research spending for the world as a whole in terms of international dollars, Sub-Saharan in Africa only gets 6% of the world's agricultural R&D. That has to change.

I'm pleased to say that at DIFID we've just produced the white paper and are going to double our funding for science and technology over the next three years. We'll go to nearly \$400 million dollars, \$375 million by 2010, and my guess is about a third of that will go to agriculture.

But it's not just aid, it's also about partnerships – something that... said yesterday and I want to repeat. These in Africa are the key partnerships. I'm going to buy a beer for anybody in the room who is not an African who can tell me what all of those mean. Thank you very much.

Now, I've just about made it on time, and it was a real helter-skelter. Now, could I please ask Ismail Serageldin and M.S. Swaminathan, Roger Thurow and Scott Kilman to come up onto the platform and join me here for the next session.