**SESSION I: INTERNATIONAL PERSPECTIVES**
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Role of Agribusiness in Enhanced Nutrition

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I'm going to talk about the role biotechnology has and will have in the future, and I'd like to start and put that into context. We've talked a bit today, and certainly much more to follow, on the dual nature of the production side of agriculture and poverty and food demand. We've talked about the quality of food and the role that nutrition management of calories will have for the future.

On top of that –the world of agriculture is constantly changing. I think you're aware of the challenges that growers face. I think it's particularly important to think about all the solutions in the context of what will happen over the course of the next 25 to 30 years.The combination of adding another two or three billion people, and an incredible increase in the nutritional content of diets across Asia, Latin America and parts of Africa will require that the amount of food that we produce today will need to be doubled in the next 20 to 30 years.

To do that in a way that is environmentally friendly, that meets both the needs for production and health and nutrition is an incredible challenge. As a private sector company, we clearly see a role in developing new technologies and new tools that can help address this challenge. Specifically, for our company, our efforts have been in the life sciences area and in biotechnology. I think there's an incredible historic contribution that biology has made for agriculture and food production and a long history of innovations that have driven productivity. And I think biotechnology fits into this long list of improvements.

Now, the real, hard-core biotechnology advocates would tell you that cloning genes and recombinant DNA is not really much different than making wine or making bread. And the critics of biotechnology would tell you – "Look, this is brand-new stuff. It's really scary. We need to regulate it intensely and be very, very careful." The position that I take is really the middle ground.

DNA was discovered in the 1950s. The first recombinant DNA experiments now were done 30 years ago in California in the middle 1970s. The first field test of a genetically modified organism was done in the 1980s. The first commercialization of a genetically engineered crop was done in the 1990s. We now have 30 to 50 years of experience with this technology and we understand how to take advantage of its strengths and manage its limitations.

As we go forward and think about biotechnology, a couple of things are important., First of all, the advances that have been made in gene sequencing and genomics are phenomenal. When I joined my company 25 years ago, the first genes from a plant were being sequenced. Today, all

44,000 genes in corn, the genes in rice, the genes in Arabidopsis are all identified. Those sequences are being tabulated in databases, and create a knowledge base for breeding and for the identification of useful, new genes -- to mine across all living organisms -- to make crops even more profitable, more productive and more beneficial for the future.

The other point I would make: As much as biotechnology has been talked about, it is still very much in the beginning phase. The way I would describe where we are with our knowledge of genes and being able to use biotechnology to produce new drugs, new crops, new ways of preparing foods is that it is pretty much like being in the 1960s during the advance of computers and electronics. This technology will roll out and have impact across crop production, food, health and nutrition for the next two, three, four decades.

It's important, I think, in that context that we look at how we make some of the decisions, the policies, the regulations and the infrastructural investments that will allow all in the world to participate as this technology makes key contributions for the next thirty to forty years.

As I said, I believe it's going to reshape the way we deliver drugs. Virtually every new product that's approved today by the FDA is based on the knowledge of a gene, uses a biochemical process for manufacturing or production. It's clearly changed the pharmaceutical industry.

We've seen rapid adoption of biotechnology in agriculture, and I'll comment on those opportunities very specifically. But the use of food enzymes in processing, increasingly the interest in using biomaterials for either fuels or new sources of materials is very exciting and clearly a tremendous opportunity as we look forward.

But let me focus on agriculture biotechnology and really take a look for just a few moments at the last ten years of agrobiotechnology.

In many ways the last ten years have been a remarkable period. We've seen the launch of the first herbicide-resistant and insect-resistant crops in 1996, nearly ten years ago. Today in 2005 we estimate that there's over 200 million acres of biotechnology crops being grown around the world. To put that in perspective, that's about 10% of the world's farmland.

So despite some of the challenges, some of the issues that you're very much aware of that have been associated with biotech and the controversies, this is still the most successfully launched new technology in the history of agriculture. And the reason for that is the incredible benefits that it provides to growers in terms of yield increases and cost reduction and economic benefits.

The other thing I'm very proud of with this industry is – if you look at the area under those curves, that represents over a billion acres of crops that have been planted with biotechnology now over the last ten years. The environmental record, the safety record with this technology is outstanding. And I think that reflects not only the quality of science that's being done but also the fact that there is intense scrutiny and regulation for these products across the world.

As we look at where the technology is going, the analysis that we would run and others would agree with is that just in the next five years we could see it doubling in terms of the acres where biotechnology is utilized. Expansion into Latin America, more utilization of corn, increased plantings across Europe and Africa as well as the introduction of new genes into new crops as we go forward.

I'd like to comment just a little bit about this last ten years and give you a quick summary using information that's updated through 2004. There are now 17 countries that are planting biotechnology crops. And what you'll see is that those are the major agricultural production countries, including China now, India, Australia, Argentina, Brazil, of course, the U.S., Canada and many other countries.

In the U.S. as we have growers completing their harvest this year, about 90% of the soybeans grown in the U.S. will utilize the biotechnology trait, about 50% of the corn acres, and about 80% of the cotton acres. So, extensively utilized in the U.S., but also the benefits that are occurring around the world are very significant, and that's what I'd like to highlight.

A recent report has summarized the last ten years of the benefits of biotechnology crops. And this is a report independent of my company and others. It's a report that has showed that the cumulative effect of introducing genes into crops to resist insects and to better control weeds has been a massive reduction in pesticide use, has been a contribution to economic profitability of farmers that's quite significant because of increased yields and lower costs, and contributions environmentally as farmers substitute genes for chemical sprays, genes for plowing fields and traveling with their tractors, that have resulted in very significant reductions in greenhouse gases and other environmental parameters.

So that has been the last ten years of biotechnology. As I said, it's largely been based on two broad classes of genes. The gene on the left, the BT gene, which comes from a microorganism, when introduced into a cotton plant or a corn plant, produces a remarkable level of insecticidal activity. These are dramatic results between the cotton plant, the biotech crop on the right-hand side of that picture, and the traditional conventional cotton on the left. The other gene has been to engineer selective herbicide tolerance. In our company's case, it's to a product called "Roundup," which enables very efficacious weed control, often substituting for plowing and cultivation and the application of multiple herbicides, to provide literally weed-free fields.

These are important breakthrough technologies. Crop loss due to weeds and insects even today is nearly 25% of the world's crop production. Having technologies like this that provide these breakthroughs for controlling insects and weeds is what has contributed to their global awareness and high level of global adoption.

I gave you the information on the U.S. as a point of reference. What I'm very proud about has been the rate at which this technology has moved around the world. It surprises a lot of people to know today that three out of four, 75% of the farmers who are utilizing biotechnology seeds are actually farmers that are in the developing world.

These benefits, if you think about it – there have been very few technological breakthroughs that I'm aware of where the latest innovation of gene sequencing, gene transfer can be put into a seed that can be shipped, handled and planted by farmers anywhere. And the benefits that we've seen with this lack of barrier to adoption, lack of barrier to intense investment, I think, has contributed dramatically to the global utilization of these tools in a very rapid timeframe. There are some exceptions to that, and I'm going to come back and talk about that specifically.

Let me use a couple of examples to illustrate the role of this technology. , For instance,  BT cotton in India, where the introduction has had profound effect on increasing productivity, yields, reducing pesticide use. Cotton is a critical cash crop, so higher levels of production immediately bring enhanced profitability to the small farmers who are growing the crop. I would have to acknowledge the leadership, the vision and contribution of the Barwale family and MAHYCO for making this happen in India. They sought us a decade ago and said, “We need this technology for India. We need to take the risk. We are prepared to invest, to make sure that Indian farmers have this tool.” And as a result of those efforts, India has now joined the launch of this product. From 2004 to 2005 the acres planted of BT cotton have doubled, and it’s had a profound effect on cotton production.

Similarly dramatic has been the role of the genes for controlling insects in corn production. Small farmers don’t often have access to the latest insecticides, to the best spray equipment for applying them. So again building that gene into the corn plant so that the corn plant can resist the feeding damage of worms and caterpillars not only enhances yield and production, but it literally prevents the damage to the grain that is often the source of contamination by aflatoxins and mycotoxins that can improve grain quality both for animal feed and for human consumption.

These are key examples of this technology moving around the world, moving very quickly, and having benefits in the developing world that are often more dramatic than what they do as they substitute for other alternatives in a U.S. field or in South America.

Now, it’s clear that there are many opportunities to apply biotechnology in many crops, and no single company or any single entity can ever hope to contribute to all of these. I absolutely believe that the model going forward will be partnerships between private companies, public institutions, donor organizations that allow for the facile transfer, the development and the distribution of these products in countries.

A couple of the areas that I would highlight from some of the work that we do in this area: We were one of the first companies to complete the genetic sequence of rice, and we made that available as a donation to the rice institutes so that information could be used for rice breeding for the future.

Another example of an area that we’ve been a participant in for a long period of time through the Danforth Center, which is another institution in St. Louis, has been the work to develop disease, virus, and insect resistance in cassava, an important root crop for much of Africa.

And finally an area that I would highlight is the work that has been done to contribute intellectual property, to clear the way for the full utilization of the technologies for golden rice and the development of the improved varieties that you’ve heard about that are going to be key for the future.

So let me move forward with a couple more examples and talk about some of the future traits that are being worked on to benefit farmers, the food industry to produce fuels and other areas.

One example of a product that has just been launched in conjunction with Cargill and other companies is a new soybean that has reduced levels of transfats. Transfats cause cardiovascular problems and have been significantly recognized as such by the FDA. By breeding a few genes, we can dramatically lower the content of linolenic acid, and in the future we can reduce the levels of saturates and produce oils that are significantly healthier as a dietary alternative to use in the vegetable products across the world.

Another example of a technology that I think represents an example of biofortification that is quite significant is the work that's been going on now to introduce the health benefits of the Omega-3 fatty acids into land-based crops. I think you all are aware that Omega-3 fatty acids have tremendous recognition for their cardiovascular effects. And clearly those are available in the diets traditionally through the eating of fish products or fish oil.

But fish in the ocean don't manufacture Omega-3 fatty acids. They derive that from the food chain from the ocean algae. We have isolated the gene from ocean algae, put it into soybean plants, and literally here in Iowa are breeding and testing soybean varieties that have normal yields that are producing 20% now of their fatty acids as a key Omega-3. This allows for now the concept of delivering this important material into a variety of food applications – yogurts, soy milks, salad dressings – that can allow for the introduction of this important nutrient.

For those of you who are the nutritionists, we picked a particular form of Omega-3 called steridonic acid, which is much more bioavailable than the ALA found traditionally in plants but not nearly as reactive and unstable as the EPA and DHA, although it's rapidly converted to EPA. And that will allow the broad fortification of foods with this key ingredient.

And I've had nutritionists tell me that if people would have the one or two or three grams of Omega-3 they need every day, the risk of heart attack could be reduced by 50% – obviously a significant benefit.

Another example of fortification that we're working on again in conjunction with Cargill is to introduce into crops the key limiting compounds that they don't make enough of for either animal feed or human.  Corn, which is a major focus of our company, is known to be deficient in key amino acids and proteins. But by introducing a single gene into corn, we can raise the amount of lysine from the levels in controls to a thousand parts per million and literally with new breakthroughs achieve four parts per million of lysine production – which will allow chickens to grow efficiently without added protein in the meal, and clearly there are human health benefits of this technology as we go forward. Other improvements of this kind are moving forward.

Some of the breakthroughs that are on the drawing boards that are looking exciting in the laboratory are genes that can be tested and introduced into plants that allow plants to use fertilizer more efficiently for the future. But I think the one that is the most exciting involves genes that can help manage water. Because water in the future will be the key determinate of agricultural production. Seventy-five percent of the freshwater today is used in farming, and that cannot maintain itself as the population grows.

We have, over the last several years, had the opportunity to isolate and identify specific genes that can confer a remarkable level of drought tolerance. And we've had the opportunity to share this research with a number of people as we've progressed it through commercial development. Today in Illinois and Iowa, we are testing corn plants that have a new gene that confers remarkable levels of drought tolerance.

A picture's worth a thousand words. This short video that is a time lapse through the day in the life of a corn plant. For those of you who didn't think it would be exciting to watch corn grow, keep looking at the difference between the conventional corn, the conventional corn hybrid on the left, and those with the new biotech gene on the right. Dramatic levels of drought tolerance that have never been achieved through traditional breeding at this point. This single gene adds 20-bushel-per-acre yield under drought conditions compared to the conventional corn.

And there are lots of opportunities, clearly, for this technology. We're testing it in soybean, we're testing it in cotton. We see how we can design opportunities for these genes to work in many, many different geographical markets.

And so it's clear that this technology, as we move forward, will have a fit in the developed world, and it will substitute for water, for irrigation. It will provide insurance.

The question I want to pose and I want to highlight is that this technology has an even more remarkable benefit for the developing world.

A drought tolerance gene in white maze in the hands of an African farmer could be a really breakthrough product that can again provide nutrition, provide that economic leverage in terms of production and benefit.

And we have a goal that we're working on with a number of companies, with other institutions like Rockefeller and USAID to make sure that, unlike the first wave of biotechnology products, that these technologies get developed in parallel for Africa. And so we're prepared and are working to think through the plans for putting in place the regulatory systems and the production systems to ensure that this technology reaches Africa within a few years of its introduction in the developed world.

So let me close and just make one last set of comments. I believe at this point that for all practical purposes around the world, the debate around biotechnology is over. We've had a decade of experience, we've grown a billion acres of biotechnology crops, we've quantified the benefits, and we've carefully managed the risks.

The potential for new genes that can improve fertilizer use efficiency, can increase water use efficiency, that can change the health profiles of cooking oils, and that can reduce cardiovascular risk and other key diseases, is here. Everything I showed you today is being developed in terms of a commercial pipeline.

With the exception of the European Union, and most of sub Saharan Africa, the large part of the world is using this. Now, it's clear that the EU has made a political decision, but just in the last few months with new approvals and new progress, I expect to see European farmers using this technology in the near future.

In Africa, we certainly have an infrastructural issue in terms of regulatory approvals and processes and government support, and clearly I think it'd be an understatement to say that the issues that affected acceptance in Europe had a carryover effect to Africa. But I believe that if we can make a concerted, committed effort to work together, that we can see that in the next twenty and thirty years, as biotechnology reaches its zenith, that Africa will not be left out and that it can beneficially drive the impact of biotechnology for the future.