

2000 D.W. Brooks Lecture: "The 21st Century — An Agribusiness Odyssey"

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Introduction

I am honored to be delivering the 2000 D.W. Brooks lecture this morning. It is a unique opportunity to share our views on why agriculture is one of the most challenging and exciting industries in the world today.

We are all redefining our businesses to adapt to the rapid fire changes in our marketplace — trying to create the new technology, catch the "wave" of a trend, respond to consumer needs, and develop business partnerships all along the value chain from the farm gate to the dinner plate. Transforming the world's food supply by building the systems needed to ensure the quality and quantity of nutrition per acre is a massive undertaking. Our journey during this century surely will be an "agribusiness odyssey." Our vision is of a growing partnership with nature so that we play a leading role in creating a better world.

DuPont

DuPont is a science company. We bring science to the market in ways that help make people's lives better. We will soon pass our 200th birthday, which is not an accident. DuPont is 198 years old, which is not an accident. As the world changed, the company reinvented itself for each era. Our founder moved to a new world in America and, in 1802, began making black powder to support a young nation that was striving to expand and develop, as well as to protect itself. As we moved toward the 20th century and into an industrializing world, the company expanded from explosives to chemicals. Now, we are transitioning to a new curve for the 21st century based on biology and knowledge intensity.

At the same time, the fundamentals that are in our core remain the same. We will focus on basic human needs, such as food and shelter, and see science as a source of solutions to difficult, high value problems. We want to improve the quality of life for people around the world through enhanced value, renewable resources.

We believe we are - and we want to be seen as — a company offering dramatic improvements in people's lives through science-based solutions that make a real difference. We want to be seen as a dynamic company that is on the move, able to foresee the human needs of the future, and to meet them. That is why we've adopted the miracles of science (TM) as our new corporate slogan for all internal and external communications.

Technology Revolution

Before looking ahead at how our industry is changing, I think it is helpful to start with a brief historic perspective. Since the turn of the century — and especially in the last 50 years — farming productivity has increased tremendously with a payoff in the form of increased quantity and quality of food. Technological improvements tend to come in waves, and the waves are coming faster than ever before. These technologies have been geared toward boosting farm productivity, which has improved farmers' bottom line profits, although not enough in today's climate, and has made their lives easier.

Technological evolution and constant product displacement have been a fact of life on the farm as new and better technology-based products have been developed. But in the past, the impact of new products on the marketplace has typically been evolutionary and product displacement has generally been gradual. Farmers have had time to integrate new technologies into their cultural practices and time to respond to market conditions. Companies have had time to reposition themselves, reformulate their business strategies, and readjust business structures to bring new technology-based products to the marketplace to remain competitive.

The first wave of technology led to the mechanization of the farm, reducing the farmer's dependence on hand labor and increasing productivity. Mechanization of the farm has led to a quantum leap in the quantity and quality of the food that farmers produce.

The second wave of technology focused on crop protection. Crop protection products helped farmers dramatically cut crop loss due to weeds, disease, and insects. By some estimates, as much as 40 percent of the world's food would be lost without informed use of crop protection products.

Today, a third wave has formed — biotechnology and information technology and this wave promises to be revolutionary. With biotechnology, we are able to apply the newest and most advanced tools to help plants do things they couldn't do before. Information technology is taking learning cycles to light speed. Researchers are able to distill insights from mountains of data and immediately re-apply that knowledge to continue pushing the frontiers of science. The technology is intersecting all aspects of agriculture, from the laboratory to the loading dock, and will help us improve food quality, safety, taste, nutrition, cost, and convenience.

Biotechnology will continue to revolutionize farming as it paves the way for an era of specialized crops. Agricultural commodities will be replaced by specialty products — designer crops that command premium prices in the marketplace. Biotechnology and information technology will provide major improvements in our ability to feed the world with higher quality, more nutritious foods. Farmers all over the world will be able to take agricultural production to even higher levels of excellence.

New Age of Agriculture

Transforming the world's food supply by ensuring the quality and quantity of nutrition per acre is truly a massive undertaking. However, agriculture is no stranger to change. Production

agriculture has been shaped by scientific breakthroughs that have brought hybrid seed, fertilizer, and sophisticated crop protection chemicals to the farm. I believe we are standing at the threshold to a New Age of Agriculture, the dimensions of which are only beginning to be appreciated.

We will continue to integrate chemistry and biotechnology. Chemistry is not replacing biotechnology, as some have suggested. Instead, we will move up the learning curve on both fronts. Chemistry impacts biotechnology in the plant traits we turn on, via high throughput screening, and in combinatorial chemistry — to name just a few areas.

The speed at which all these developments are occurring presents challenges as well. Everywhere we look, we see an "explosion of knowledge". For instance, discovery is moving so fast in genomics that there are hundreds of genes available. We must pick and choose carefully because we can't develop them all. The tools to make the right decisions quickly must be available. Our industry has been accustomed to incremental change as the population grew, but we now face constant step changes, which are measured in months not decades.

The ability to create premium value products based on proprietary, value-added quality traits will shift crop output decisions from farmers to end users of grain. Value creation at the end user level will transform the agricultural system from today's production driven system to tomorrow's end-user, demand driven system. The producer will be paid tomorrow based on value delivered versus today where it is the average price for achieving minimum adequate standards. I believe the changes in agriculture over the last 200 years will be dwarfed by the changes that will take place during the early part of the 21st century.

Enterprise Direction

Seed and crop protection have global market values of about \$50 billion, compared with a total \$500 billion global market for seed, crop protection, feed, and food ingredients. At the retail level, the broad food and fiber industry is \$2-3 trillion in size. The expected growth rate is 1-2% per year as the population increases. At DuPont, we are expanding our operations along the value chain to be able to participate in this growth.

We know that no one company is going to succeed alone. To win in a complex global arena, we must share our strengths with partners, recognize the strengths they have, and leverage our mutual capabilities to best serve customers and gain competitive advantage in those markets where we chose to participate. These collaborations only work if there is real value for the customer and if the system is more effective than it was before. At DuPont, we firmly believe the future will be based on business systems that deliver better value to customers. We have already begun this collaborative process.

In 1997, we entered into a very strong relationship with Pioneer Hi-Bred International, the world's finest seed company, which became a full member of the DuPont family last October 1.

We also purchased Protein Technologies International, the world's leader in soy protein isolates used in the food industry.

We have established a value-added grains business, which includes acquisitions of a wheat enterprise in the United Kingdom and a French hybrid wheat company.

We assumed ownership of a DuPont R&D creation, Qualicon, which has developed a new technology in the area of food safety, a matter of great interest to our food company customers and to consumers as well.

We also moved to strengthen our Crop Protection business with the establishment of a joint venture with Griffin LLC to manufacture and market a line of standard brand pesticides.

These collaborations only work if there is real value for the end user, and there must be sufficient value to adequately reward the capabilities that were utilized, either through additional market share or margin. Many different business systems will be required as well, depending on end user needs. The requirements to deliver enhanced livestock feed compared to crop production for pharmaceutical uses are very different. The ultimate goal is a fully integrated system with efficient production of crops with value added attributes for end users.

Biotechnology

Let me begin by putting biotechnology into context as we see it at DuPont. We believe biotechnology will be one of the most powerful tools at our disposal for sustainable growth in the 21st century. It offers flexibility to create products that are safe, affordable to most people in the world, and responsive to people's needs as they define them, not as we do. Finally, we need to be responsive to the public's questions about the potential power of biotechnology.

These beliefs have guided our actions in the past and continue to do so. Even though we are a science company and our research continues at a consistent and productive pace, the first and most important thing we have done is to listen to the many and varied constituencies that have a stake in biotechnology.

In the process of listening, here is what we have learned:

- The products of biotechnology must be shown to be safe for humans and safe for the environment - both from a scientific viewpoint and from a public acceptance viewpoint.
- The whole scientific and commercial culture of biotechnology with its potential benefits and potential risks must be made more transparent, more accessible, and more understandable to the public and society at large.
- There must be clearly defined "boundaries" to guide how this powerful technology is developed and used. And these boundaries need to be developed in dialogue with the many diverse stakeholders in the biotechnology debate.

The biotechnology industry as a whole needs to act on these group "learnings" as we develop the tools of this technology and the products that emerge from it. I believe that is the only way we will turn the corner on worldwide acceptance of biotechnology. We have not done a particularly good job of this in the past, but it is, in my opinion, the only way to succeed going forward.

One step we have taken at DuPont that may be of interest to you is the formation of an independent, global panel to guide our actions, help us create positions on important issues, and guide and challenge us in the development, testing, and commercialization of new products based on biotechnology. The advisory panel will audit DuPont's progress and provide a public report on a regular basis.

The Next Generation of Biotech Varieties

Let me look briefly into the future. What kinds of next generation biotech products might we expect?

Applications of biotechnology in agriculture are in their infancy. Most current genetically-enhanced plant varieties are modified only for a single trait, such as herbicide tolerance or pest resistance. The rapid progress being made in genomics may enhance plant breeding to help secure better and more consistent yields. This would be of great benefit to those farming marginal lands worldwide. Arable land is disappearing and even if every acre is maximized using conventional agriculture, we start to come up short if we have to feed 8 billion people in 2025 and beyond.

Valuable work is already well underway on a number of fronts. The following examples represent the breadth of work and organizations involved.

The Rockefeller Foundation is addressing many of the food supply needs in developing economies. It has funded more than \$100 million of plant biotechnology research and trained more than 400 scientists from Asia, Africa, and Latin America. Rockefeller Foundation-funded researchers in Mexico have added genes to rice and maize to increase tolerance to aluminum - a soil toxicity problem that blights vast areas of the tropics.

In India, scientists have added two genes to rice which appear to help the plant survive being submerged for long periods, a common problem in Asia.

A team of scientists at the Swiss Federal Institute of Technology in Zurich has inserted seven new genes into rice. These genes, which come from different plant and microbial sources, encode enzymes and proteins that give rice the ability to make beta carotene and also allow the kernels to accumulate extra iron in a form that the human body can better absorb. This is important because vitamin A deficiency affects 400 million people worldwide, including 180 million children. And iron deficiency, which a diet of rice can exacerbate, afflicts more than 3 billion people around the world.

Today, nutrition and health benefits beyond those available in foods are provided to society through pharmaceuticals and vitamin supplements. In the future, the potential exists to provide these benefits to a greater part of the world, at significantly lower cost, through foods.

One example involves milk. Today, over 4 billion people do not have access to refrigerated milk. To meet this need, both powdered dairy milk and powdered soy milk are available. We have developed an improved soy milk that provides high quality protein at lower cost than traditional

powdered milk. It is lactose-free, an important benefit to the many who must avoid lactose. And, it tastes good, overcoming a problem that has traditionally hampered the broad use of soybeans.

Potential health benefits include soybean, sunflower, and peanut oils lower in saturated fats; fruits and vegetables higher in beta carotene and vitamins C and E; bananas that deliver oral vaccines for diseases such as hepatitis B; potatoes and corn with modified starch content; strawberries with augmented cancer-fighting nutrients; allergen-free rice; and rice with higher lysine content.

The potential of modern biotechnology to lower the impact of society on the planet, while enhancing the quality of life of a broader percentage of the world's population, is enormous. Biological processes use renewable resources as feedstocks, use solar energy to drive growth, absorb carbon dioxide from the atmosphere, use low temperature and low pressure processes, and produce waste that is less toxic.

For instance, green plants might be used as manufacturing plants to make chemicals. We might create polymers out of renewable feedstocks like glucose and methane rather than from petrochemicals. At DuPont, we have set a goal of getting 25% of our revenues in 2010 from areas other than those requiring depletable raw materials.

An example of a technology we are working on right now is the use of low-cost sugar from cornstarch to create one half of a polyester molecule. We plan to use a fermentation process in which a genetically modified microbe is used to make a key monomer at high yield, rate, and concentration. The resulting polymer has properties unique for a polyester fiber such as stretch recovery, resiliency, toughness, and easy dye capability without the use of chemical modifiers.

Biotechnology Information Sources

Leading biotechnology companies, including DuPont, have created the Council for Biotechnology Information to stimulate a public dialogue about biotechnology that is based on objective scientific research, independent expert opinion, and peer-reviewed published reports. The program includes advertising, increased contact with the media, and direct communication with the public through a 24-hour information line and an Internet site. I will give Kelly their web site address and telephone number.

In keeping with our own commitment to provide access to information, DuPont has also set up a toll-free telephone number for North America (877-333-1027); unveiled a newly designed web site which provides both company information and links to other biotechnology resources; and is providing speakers and information materials that invite engagement and dialogue.

The Biotech Outlook

According to the United Nations, 800 million people worldwide are already chronically malnourished. The U. N. Food and Agriculture Organization estimates that two out of five children in the developing world are stunted, one in three is underweight, and one in ten is "wasted" due to undernourishment. Biotechnology alone won't solve the problems of hunger and

malnutrition, but it can play an important role in alleviating them by making it possible to grow more food with added nutrition on less land and under tough conditions. Former President Jimmy Carter has called biotechnology a key to feeding a growing population in the 21st century.

History has shown us that new technologies are not without risk, but history has also shown us that the benefits of a new technology can be much greater than the risks. Assessment of risks in the light of benefits ought to be the very essence of the current debate over biotechnology.

The opportunities are large and exciting, and we must continue to work with industry, governments, and other stakeholders to see to it that this potential is realized while addressing the questions and challenges before any new technology.

Conclusion

Within our industry, we have the resources and capability to provide leadership to agriculture. The mission must be to serve the customer and create value for them. Those who can remain on the cutting edge of technology and rapidly adapt to consumers' needs will prosper. In today's environment, the only constant is change. We have to be on our toes to deal with biotechnology, e-commerce, the knowledge explosion, and myriad potential new partnerships.

Skills to understand consumer needs and wants, to spot trends, and then the ability to develop and bring products to market that match consumer needs and wants will be of greater and greater value throughout the agriculture industry.

Thank you for the opportunity to share my thoughts on our industry's future. I now look forward to your questions and comments.