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Agricultural Transportation Challenges for the 21st Century

Transportation and Logistical Challenges of Biotechnology

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Issue

Biotechnology is beginning to revolutionize agricultural production, especially for grains and oilseeds. Varietal improvements that have resulted in herbicide tolerance and insect resistance are increasing yields and reducing production costs for farmers. The next wave of advances in seed genetics will bring new varieties to the market with characteristics tailored for end-user feeding and food processing. Increased yields and production of end-user-specific varieties will create new challenges for transportation and logistics.

Background

Since 1987, the USDA has approved or acknowledged 3,855 field trials of new agricultural products that are derivatives of 48 different plant species. More than 80 percent of these trials have occurred during the past 4 years. Corn continues to be the major crop involved in these field tests. As new plant varieties have come to the market, producers have been quick to incorporate these advances in biotechnology into their farming operations.

In 1996, U.S. farmers planted the first commercially available, insect-resistant corn and herbicide-tolerant soybeans. The corn varieties were modified with a gene from *Bacillus thuringiensis* (Bt) to have built-in resistance to the European corn borer. The soybean varieties were modified to have tolerance to the herbicide Roundup®.[26] In 1997, U.S. farmers planted 4 percent (3 million acres) of their corn acreage in Bt corn varieties and 15 percent of their soybean acreage (11 million acres) in Roundup Ready® soybean varieties. Estimates for 1998 are that 10 percent (8 million acres) of U.S. corn acreage was planted in Bt varieties and an additional 10 percent was planted with herbicide-tolerant corn varieties. U.S. soybean producers are estimated to have planted as much as 30 percent (22 million acres) of their soybean acreage with herbicide-resistant varieties this year.

These first bioengineered crop varieties had specific agronomical characteristics that resulted in improvements in yield and reductions in production costs. Beyond herbicide tolerance and insect and disease resistance, however, are a broad range of varietal characteristics that can be tailored

[26]Roundup® and Roundup Ready® are registered trademarks of Monsanto Company.

through biotechnology to meet the specific needs of different end users. For instance, the ability to produce corn and soybeans with specific amino acids and protein profiles offers the potential for improved feeding rations at lower costs for livestock and poultry feeders. High-lysine and high-methionine corn and soybeans, for example, provide essential limiting amino acids in rations without the need for synthetic feed additives. Low-phytate corn varieties can help reduce the environmental problems associated with livestock and poultry production by reducing phosphorus concentrations in animal waste. The modification of oilseeds through biotechnology can improve nutritional and health qualities of vegetable oil and margarine and provide functional benefits in food processing operations. High oleic acid soybeans contain less saturated fats than regular soybeans and have improved heat stability. High-stearate canola and soybeans have the potential to increase the functionality and shelf stability of margarine and shortening. Finally, biotechnology offers the potential for designing crops, such as corn, with unique polymers and chemicals for use in industrial and manufacturing applications.

Grains and oilseeds with specialized end-use characteristics can command significant price premiums for farmers. Some specialty grains, like high-oil or waxy corns for instance, have historically yielded below the standard "dent" varieties, which has made the production of these speciality grains less profitable for farmers despite the price premiums. However, biotechnology offers the potential to stack specific end-use qualities and agronomical characteristics that are already increasing yields for producers. This ability to "manufacture" grains and oilseeds according to specific end-use needs with the yields of commercial varieties represents a tremendous opportunity to increase the volume of grains and oilseeds produced for specific end-use markets.

Large-scale shifts away from commodity-based grain and oilseed production seem right around the corner with new seed varieties coming on the market at an ever quickening pace. Seed companies are reducing the development cycle of new products by as much as two-thirds every decade. With the ability to produce seed in South America during the North American winter, seed companies can make new seed varieties available to farmers faster than ever. Improvements in genetics may outpace changes in handling and transportation that will be necessary for producers and end users to capture the increased economic value of speciality crops.

Implications

Biotechnology offers the potential to produce significant volumes of specialty grains and oilseeds with high-value traits designed for specific end uses. Moving these crops from the farm to the processor or end user will present a major challenge for the U.S. grain-handling and transportation system. The present U.S. system has evolved to move undifferentiated bulk grains and oilseeds. The efficiency and cost effectiveness of this system rely upon the fungibility of commodities that are easily standardized by a few grades or classes. The ability to preserve the identity of specialty grains and oilseeds from farm to end user will be necessary if the increased value of these crops is to be realized by users and reflected in price premiums sufficient to encourage production.

Widespread acceptance of specialty grains and oilseeds is dependent upon the ability of the handling and transportation system to deliver these crops to end users in consistent volumes, at

consistent levels of quality, and with consistent end-use characteristics, at competitive prices. This means adapting some parts of the existing grain-handling and transportation infrastructure to allow for identity preservation. It may also mean developing entirely new marketing channels and delivery systems. Regardless, identity-preserved handling and shipping costs will have to be low enough that they do not erode the end-use value of specialty grains and oilseeds. Without sufficient price incentives for these crops at the farm gate, producers will not produce volumes sufficient to justify end-user shifts in feeding rations or processing operations.

Handling and transportation alternatives must emerge that reflect the very real economics of producing and using specialty grains and oilseeds. One alternative may be producing specialty varieties in areas directly adjacent to the intended end users so truck hauls can be short and cost effective. Another alternative may be concentrating production in the traditional growing regions in densities sufficient to generate volumes that can move longer distances competitively by barge or by rail under multiple-car and unit-train rates. Whichever market solution evolves, the future of biotechnology in grain and oilseed production is very much tied to the ability of the U.S. handling and transportation infrastructure to facilitate low-cost, identity-preserved shipping for these new types of agricultural commodities.

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