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Cargill: Biotechnology and Value Creation in Wheat[1]

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Abstract

About 40 percent of the world's food supply came from rice and wheat-based foods. The genome of wheat (a genome is a set of chromosomes) was much larger than those of other crops such as rice. Deciphering the wheat genome was a much more complex process. Wheat had six DNA strands (e.g., humans have only a double-helix DNA strand) and almost twice as many genes as humans. GM wheat would be available for production by 2004. The objective of this case is to describe: segregation and identity-preservation issues in the wheat value chain, the role of Cargill in that value chain, and issues surrounding the introduction of genetically modified wheat.

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The use of genetic engineering in crops provided a signal that changes were underway in the way commodities were produced and marketed. Genetically modified (GM) products had value only if they could be produced and marketed in sufficient volumes to meet the needs of processors. Most of the markets for these products were likely to be small initially, so they represented niche markets. Grain handling systems would have to develop cost-effective, identity-preserved marketing channels in order to provide these products to their end user, if the product benefits were to be realized.

Thus far, the concern over GM crops had been limited to corn and soybeans. Wheat was much different. About 40 percent of the world's food supply came from rice and wheat-based foods. The genome of wheat (a genome is a set of chromosomes) was much larger than those of other crops such as rice. Deciphering the wheat genome was a much more complex process. Wheat had six DNA strands (e.g., humans have only a double-helix DNA strand) and almost twice as many genes as humans. GM wheat would be available for production by 2004.

Mr. Warren Staley was the new chief executive officer of Cargill which ranked fourth in sales among food and beverage companies (behind Philip Morris, Con Agra, and PepsiCo) in 1999 according to *Food Processing* magazine. It was a marketer, processor, and distributor of agricultural, food, financial, and industrial products and services with 85,000 employees in 60 countries. It also was the United States' largest grain exporter (Hayenga and Wisner). Warren was in charge of implementing Cargill's new corporate strategy. Obviously, the introduction of GM wheat would affect Cargill who owned a wheat breeding unit, Goertzen Seed Research, and was focusing on value creation in food and feed grains, especially in flour milling.

Mr. Warren Staley

Warren R. Staley had succeeded Ernest S. Micek as chief executive officer of Cargill on June 1, 1999 and had served as president since February 1998. Mr. Staley, a native of Springfield, Illinois, joined Cargill in 1969 after receiving a BS degree in electrical engineering from Kansas State University and an MBA from Cornell University. He was general manager of the company's high-fructose corn syrup operations at Dayton, Ohio, before being named assistant general manager of corn milling operations at Tilbury, England. Mr. Staley was general manager of Cargill's European corn milling business from 1978 to 1982. He was general manager of Cargill's Argentine operations from 1983 to 1987 and then was president of the international feed and meat businesses and head of North American operations until he was elected Cargill president in 1998. He also had been a member of the Cargill board of directors since 1995.

Mr. Staley's first year priorities as Cargill's chief executive officer had focused on ensuring a continuation of the overall strong performance of the company's

businesses and to lead the implementation of the newly developed strategic plan. The strategic plan was developed by a senior management team and had received final approval by the board of directors in February 1999. With the time horizon for the strategic plan extending to 2010, Warren had announced that " . . .*There likely will be some changes in Cargill operations and businesses. Cargill's core businesses have always been our grain and grain processing operations. We do not expect that to change. But we will create platforms so that our business units can offer integrated solutions to our customer's problems in all of our businesses."*

Strategic Intent 2010

Cargill recognized that it would need to retain its skills as a low-cost provider of ingredients and commodity products and simultaneously remake itself into a high-value provider of innovative customer solutions.
Their strategic intent was about creating distinctive value for their customers. That means they aimed to deliver innovative customer solutions that were hard for others to match.

Cargill's vision and mission statement read:
Cargill's corporate vision expresses the collective aspirations of the people who work here. It unifies us, directs our efforts and sets us apart from other companies.

Vision Statement

Our purpose is to be the global leader in nourishing people.

> We will harness our knowledge and energy to provide goods and services that are necessary for life, health and growth.

Our mission is to create distinctive value.

> We will succeed in business only by creating value for our customers, our suppliers, employees, shareholders and neighbors. We will build stronger customer relations and create solutions: Explore, Discover, Create, and Deliver.

Our approach is to be trustworthy, creative and enterprising.

> We build customer relationships on integrity. We develop solutions that our customers need. We are forward thinking and action-oriented.

Our performance measures are engaged employees, satisfied customers, enriched communities and profitable growth.

> Engaged employees focus on satisfying customers and are committed to livable, sustainable communities. With those accomplishments, we will enjoy the profitable growth necessary to sustain performance over time.

Cargill's long-term philosophy of reinvesting its cash flow into growth opportunities had been a hallmark that allowed it to remain a private company. Cargill had periodically revised its mission statement over time in response to industry and firm changes. However, its core beliefs remained fundamentally the same.

Our Basic Beliefs

Our basic beliefs are the cornerstones of the relationships we build with customers, suppliers, business associates, shareholders and the communities in which we do business:

- ***Integrity.*** *Our word is our bond.*
- ***Excellence.*** *Making Cargill the best at whatever it does.*
- ***Growth.*** *Creating opportunities for individuals and our business.*
- ***Teamwork.*** *Pooling individual knowledge and skills through effective communication to build shared success.*
- ***Long-term perspective.*** *Having the patience and foresight to build sustainable businesses for the long haul.*
- ***Desire to compete.*** *Seeking to win in open, level playing field.*

Joint Ventures and Acquisitions

One visible sign of the strategic intent was the number of joint ventures that Cargill had entered into in recent years. Several were related to wheat. All of these relationships were formed around opportunities for increasing the value of existing commodities or taking advantage of new markets. Warren had indicated that "*We will partner with organizations whose beliefs are similar to ours. Integrity, honesty, and teamwork must exist among all partners.*"

Wind River and Cornerstone LLC's

Cargill and Garden City Co-op, Inc., Kansas, formed an LLC (with Irsik & Doll and Sublette Co-op) that owned and operated a grain handling facility in Garden City, Kansas. It had a combined storage capacity of more than 1.4 million bushels. The latest grain handling technology was installed to create a highly automated, high-speed, loading and discharge facility that was capable of loading and unloading 110-railcar unit trains. A similar joint venture (Cornerstone LLC) had been formed in Colby, Kansas with four cooperatives.

Horizon Milling

Cargill's 16 flour mills were placed into a joint venture with five flour mills owned by CHS Cooperatives. This joint venture was called Horizon Milling and had a daily flour milling capacity of approximately 290,000 hundredweights of flour.

Continental Grain

Cargill acquired Continental Grain's grain merchandising assets in 1999. This acquisition enabled Cargill to achieve broader economies of scale and allowed them to dedicate some facilities for use in identity-preserved marketing channels. Also, it gave Cargill an estimated 35 percent market share of the US export volume of corn, soybeans, and wheat (Hayenga and Wisner).

Other New Initiatives

Joint ventures and partnerships were only parts of Cargill's new initiatives. Other visible signs of its strategic intent included advertising and image programs, as well as other partnerships.

Advertising

Cargill rarely used widespread promotional advertising because its customers were primarily industrial processors; but by the 1990s, Cargill was heavily involved in food production, and market research indicated that some people had little knowledge about Cargill and its role in the global food industry. Consequently, it decided to embark upon a print and television advertising promotion campaign in 1999. The theme, "It's not just what we do. It's how we do it," communicated the message that Cargill not only provided a broad base of quality products, but also built long-lasting partnerships with employees, communities, customers, and business associates.

Image

Cargill's identification traditionally had not appeared on many of its physical assets. In fact, if there was any visible identification, it was usually only its logo. However, in 1999, Cargill embarked on a system-wide identification program. For example, its farm service and other related assets were identified physically with the green Cargill AgHorizons™ trademark.

Higher Education Initiative

Cargill had launched an initiative in 1996 aimed at developing partnerships with universities that were located in its core business area and instituted academic programs which provided opportunities for students to become involved with Cargill through internships and other similar programs. Cargill had grown from 60,000 employees in 1991 to over 85,000 in 2000. Thus, it was important that students be exposed to career opportunities within Cargill. Major initiatives were started in the Colleges of Agriculture and Engineering at five schools (Iowa State University, Kansas State University, University of Illinois, University of Minnesota, and University of Wisconsin). In addition, smaller programs were set up at 14 other universities. Funding was granted over a five-year period for study-abroad programs, Cargill named scholarship programs, computer laboratory renovations,

hardware and software acquisitions; faculty internships and fellowships; student and faculty field trips to Cargill facilities; classroom and laboratory technology improvements in agriculture, business, and engineering schools; diversity scholarship programs; speaker series; and other leadership programs.

Community Programs

The Cargill Foundation historically has been involved with various community organizations and charities, but it began several new innovative programs designed to focus on educational success and the development of necessary skills that enabled socio-economically disadvantaged young people to work in a rapidly changing global environment.

Financial Information

As a privately held company, Cargill did not issue an annual report to the general public. However, the company did release quarterly financial data (Exhibit 1). Sales had decreased over the past five years, although total assets had increased by 15 percent. The sales decrease was due primarily to depressed demand for commodities worldwide. An increase in global capacity in various industries (e.g., corn wet milling, soybean processing, fertilizer production, and wheat wet milling) led to an expectation of increasing worldwide demand due to free trade agreements, and increased income that could be used on protein and other foods. Other changes in tastes and preferences meant that ingredient production had increased faster than demand, which resulted in downward pressure on prices. Favorable weather improved farming practices that increased productivity, and additional land in various regions such as Brazil had resulted in an increase in the supply of agricultural commodities at a time of weak demand, which also depressed farm prices.

In January 1999, Cargill announced a net operating loss in the past six months that ended November 30, 1998, and was largely due to financial trading losses in Russia and emerging markets. However, that was offset by a one-time after-tax gain on the sale of its international seed business to Monsanto. As part of its focus on core operations, Cargill announced an agreement to sell off its coffee businesses in June 2000 and confirmed that it planned to exit the rubber industry. A Cargill press release noted that its operating earnings for fiscal year 2000 were higher than those for 1999 due to strong performances from several businesses, including financial markets, family, and beef processing. It also made progress in the restructuring and implementation of its corporate strategy focused on value creation and superior service.

Cargill's businesses were organized into five segments. Agriculture Services provided crop and livestock producers worldwide with customized farm services and products. Origination and Processing linked producers and users of grain, oilseeds and other agricultural commodities through origination, processing, marketing and distribution capabilities and services. Food Ingredients and Applications served global, regional and local food manufacturers, food service companies, and retailers with food and beverage ingredients, meat and poultry products and new food applications. Risk Management and Financial provided Cargill customers and the

Exhibit 1. Selected Income and Balance Sheet Data for Cargill, 1996 to 2000

Category	**1996**	**1997**	**1998**	**1999**	**2000**
Sales	55,979	55,695	51,418	45,697	47,602
Earnings	902	814	468	597	480
Current Assets	14,991	16,500	19,930	16,356	15,355
Property and Other Assets	6,022	6,921	7,139	8,221	8,813
Total Assets	21,013	23,421	27,069	24,577	24,168
Current Liabilities	11,908	12,800	15,507	12,272	11,377
Net Worth	5,942	6,592	6,836	7,592	7,888

company with risk management and financial solutions in world markets. Industrial supplied customers worldwide with fertilizer, salt and steel products and services, and develops industrial applications for agricultural feedstock.

One product that offered opportunities and challenges for value creation was wheat. Wheat was the second most commonly grown food and feed grain in the world (corn was first) and was the most widely traded grain internationally. Relative to other crops such as corn, soybeans, and cotton, wheat had not attracted a great deal of attention in recent years. Changes were beginning to take place in the wheat value chain, and Cargill was playing a key role in those changes.

The Wheat Value Chain

Breeding

Private firms had developed crop varieties such as corn largely because these were hybrids. That is, producers purchased hybrid seed because hybrids could not self-pollinate. The United States Department of Agriculture (USDA) reported that public expenditures on wheat research were almost 85 percent of total wheat research expenditures. Wheat seed had the lowest increase in price between 1975 and 1992 (0.97 percent per year) relative to hybrid corn (4.75 percent), hybrid sorghum (5.08 percent), and non-hybrid soybeans (1.92 percent). Seed companies

were able to obtain 35 (sorghum) to 48 (corn) percent of the improved hybrid seed value compared to 24 percent for wheat. This resulted in private firms investing over 10 percent of seed sales in hybrid seed research, compared to only five percent on wheat. Publicly funded breeding programs accounted for the majority of wheat varieties grown in the US.

Exhibit 2. The Relationship of Wheat Class and Protein Levels Relative to Various Products

	Wheat Protein Percent					
Class	**9**	**10**	**11**	**12**	**13**	**14**
Durum						Pasta
Hard white/red				Chinese-style Noodles	Loaf Bread	
Mixed		Household Flour	Japanese-style Noodles	Flat Bread		
Soft white/red	Cake, Biscuit, Pastry					

Production

Wheat was produced on farms in various regions of the US. The USDA classified wheat into classes for identification purposes based on kernel color (white or red), growth habit (spring or winter), and kernel hardness (hard or soft). There were six wheat classes: hard red winter, durum, hard red spring, soft red winter, soft white, and hard white wheat. In general, hard red and white wheats were the only classes used in bread making, which made their protein level (i.e., percentage) of great interest to bakers (Exhibit 2).

Protein level helped determine the wheat's end use, but the level of protein depended upon several factors. First, the class and variety of wheat were major determinants. Higher protein wheat varieties were typically of the hard red class, whereas lower protein wheats were of the soft white or red class. However, within each class, protein was extremely variable depending upon the variety.

Because no value-based marketing program existed for wheat (i.e., producers were not paid typically on protein percentage), wheat breeders often bred varieties for improvements in yield or tolerance to drought stress rather than improving protein,

because these were easily identifiable traits that improved a producer's gross revenue. Weather played a large role in determining the protein content through its effect on kernel size and growth. Thus, it was relatively difficult to forecast, with any degree of accuracy, what the protein level was to be in a wheat crop until after harvest.

Milling

After harvest, producers delivered the wheat to country grain elevators, where it was aggregated and shipped to main terminal elevators. Here the wheat was sorted, graded, and measured for protein. Then, the wheat was milled into flour and other products. The dry milling process yielded flour that was composed of protein (primarily gluten) and starch. At this stage, the miller separated the starch from the wheat grains and also removed the bran and germ. During this process, several steps occurred. First, the wheat was cleaned and moistened. Then the wheat was sent through various pairs of rollers, which broke the kernel into fine particles and separated the bran and flour. The particles were rolled and sifted until as much flour as possible was created. One bushel of wheat weighed 60 pounds, which produced about 43 to 44 pounds of flour as well as by-products composed of bran and mill feed. Although seasonal variations occurred, the price of wheat generally comprised about 80 percent of the cost of bakery flour and the value of the by-products. Protein was contained in the endosperm of the wheat.

Baking

Bakers were able to change the tenacity of dough to obtain various specialty products such as raisin and whole grain breads, cakes, and pastries by varying the proportion of gluten. Consequently, the protein level in wheat helped determine what its end use would be. Because it was difficult to forecast what the protein level would be in any given year, bakers required a substitute for protein (such as vital wheat gluten) in years when protein in wheat was low in order to maintain the quality of their products. Furthermore, bakers purchased ingredients several months in advance of when they were needed. Thus, bakers also required a stable source of protein from year to year.

North American Flour Milling

Cargill did not enter the flour milling industry until 1972, and yet it had become one of the world's largest flour millers with significant investments in the United States, Argentina, Brazil, Paraguay, India, and Venezuela. It supplied flour for food processors and manufacturers, retailers with in-store bakeries, food service firms, and retail grocers. The new joint venture called Horizon Milling would likely open new doors for Cargill's flour milling operations.

Guy Shoemaker, president of North American Flour Milling, believed that the flour milling industry was going to undergo change in the future. He indicated that "*We want to supply flour for our customers that has the consistency and quality that they want.*"

Senior vice president, Gary Yee, added "*We're talking about pretty specific quality requirements. That means we need to be able to source wheats that have our quality targets bred into them.*"

As part of its new strategy, North American Flour Milling was beginning to mill identity-preserved wheats that had specific quality traits designed for its customers. North American Grain was supplying these wheats through identity-preserved marketing channels.

Hard White Wheat

One large change in quality was the development of hard white wheat varieties. Research at General Mills found that consumer panels preferred products made with 100 percent white wheat 90 percent of the time relative to products made from red wheat. Traditionally, millers removed the red bran from red wheat and bleached it to create white bread. If the bran were left in, the bread would have a reddish brown color. If whole wheat bread was made from white wheat, it would not have the dark color and slightly bitter taste, and it also would provide consumers with six times as much fiber as existing white bread which would help improve human nutrition.

Hard white wheat also had other benefits. Because the bran did not have to be removed during milling, more flour could be created from the bran. Thus, a miller could obtain more flour from a bushel of wheat.

The introduction of hard white wheat into the US presented several problems for wheat marketing channels. First, white wheat must be kept separate from hard red wheat, or face being severely discounted. Second, because white wheat varieties were developed for specific end uses such as noodles or bread, the wheat must be marketed through an identity-preserved marketing channel that allowed end users to purchase wheat from suppliers. Finally, because of a small supply (250,000 acres projected for 2002), increased marketing investments in identity-preserved marketing channels were needed to locate end users.

Goertzen Seed Research

The identity-preserved hard red wheats were grown from seed germplasm developed by Goertzen Seed Research (Haven, Kansas), which had been acquired jointly by Cargill's North American Flour Milling and North American Grain in 1994. Improving endosperm quality was one of the primary goals of the Goertzen wheat-

breeding program. A flour miller wanted the maximum amount of flour extraction per bushel, whereas a baker wanted protein quantity and quality. Cargill also owned a Bake Lab near its Minneapolis headquarters, where various wheat samples were analyzed for baking qualities. Cargill informed breeders of the importance of milling and baking quality traits. Consequently, public and private wheat breeders gradually were developing "loaf bread," "noodle," and "cracker" wheats.

Cargill had also long sought hard white wheats. Goertzen Seed Research developed an early hard white wheat variety, Snow White, and contracted with producers for its use in Cargill's mills. However, it was not well adapted to the Great Plains. Cargill cooperated with wheat breeders at Kansas State University in the development of their first hard white wheat varieties in 1999 and developed one of the first identity-preserved wheat programs in the Great Plains with the Karl/Karl92 hard red wheat varieties which possessed excellent baking qualities in 1993. To encourage producer adoption, Cargill had developed a program that paid producers economic incentives to grow hard white wheat. Because these wheats had to be kept separate, North American Grain developed identity-preserved programs near its elevators in western Kansas and eastern Colorado.

Certified Seed and Farmer-Saved Seed

The key problem with identity-preserved hard white wheat was providing sufficient economic incentives to ensure that producers planted enough wheat to satisfy demand for large-scale flour mills, so as to obtain the cost savings from the higher extraction rate. However, wheat producers were unique in that much of the wheat was grown from farmer-saved seed. Certified seed from public varieties and seed varieties of private companies was defined as seed that had passed field inspection and seed testing standards for varietal purity, absence of certain wheat, and other crop seeds and certain diseases. In addition, most certified seed and private seed were treated with a fungicide to control seedborne and seedling diseases. Typically, certified seed also exceeded 85 percent germination.

Non-certified seed was called farmer-saved or homegrown seed. Certified seed was more "pure" (less weeds or foreign material) because it had been cleaned, but it also had higher costs. The overwhelming majority of producers planted certified seed the first year and then used farmer-saved seed for one to two years until seed purity declined, and then they purchased certified seed again. Very few producers plant certified wheat seed on all of their acres.

Mixing red and white wheats would result in severe discounts. If white wheat and red wheat were planted next to each other in a field, the potential existed for cross-pollination. Seedcoat color was a maternal characteristic. If a red wheat plant pollinated a white wheat plant, the wheat remained white. But if that wheat plant were saved back as seed, then the next generation would be a red wheat plant.

Thus, it was imperative that producers maintain the purity of hard white wheat, otherwise, its value would be lost.

The only way was to ensure that producers only planted certified seed that was guaranteed to be hard white wheat, but certified seed was also more expensive. A recent study of the price spread between certified seed at retail farm stores and farmer-saved seed had found a differential of $3.51 per bushel or about $0.11 per bushel. Thus, producers would need to receive a premium of at least that amount to recoup their increased seed costs.

Other Issues

Costs of identity-preservation at the elevator also would increase. Another study found these costs to be under $0.02 per bushel for a typical country grain elevator. These would have to be passed along in the marketing channel.

Obviously, it took time to produce enough seed so those producers could begin planting the new hard white wheats. Least-cost, identity-preserved marketing channels were those that could provide enough volume to fill a processor's plant capacity. Mr. Terry Garvert, Cargill's manager of foodgrain market development for the Grain Division, frequently used the following analogy when talking to producers about the need to increase production of hard white wheat. He said, *"Critical mass is usually determined by the "rule of 300,000." A wheat yield of 50 bushels per acre planted on 6,000 acres yields 300,000 bushels of wheat or approximately 8,000 metric tons. This volume is approximately equal to one 100-unit car train or one hold in a Panamax vessel. Tripling 300,000 bushels equals an ocean going vessel and 12 times that (36 times 300,000 bushels) is an ocean going vessel every month for 12 months*."

One goal of Cargill's strategic intent, with respect to grain, was to create value for its international grain customers and its domestic flour customers. The international grain market was becoming more sophisticated as large central buying agencies in many countries were being dismantled and trade barriers were being reduced. Individual millers were beginning to purchase wheat based on its milling characteristics. For example, recent trade agreements such as the entry of China into the World Trade Organization required countries to purchase a certain percentage of their wheat outside the centralized buying agency. Thus, one way to create value was to develop wheats designed for specific end uses, produce them in identity-preserved marketing channels, and test them in a baking laboratory.

Cargill also was developing risk-management programs that would enable producers and other customers to better manage market price risk. One such program enabled producers to share overall gains from Cargill's hedging operations. Producers who had contracted wheat through Cargill AgHorizon's Average Plus (A+) contract for the 1999/2000 crop year received $0.11 more per bushel above the

average futures price during the pricing period. These programs helped provide price risk protection for producers who contracted with Cargill for one of its identity-preserved wheats.

Biotechnology Influences Wheat Value Chain

Cargill issued a position statement on biotechnology in December 1999 stating that it would continue to accept all crops developed under traditional breeding or genetic engineering programs. However, Cargill's oilseed plants would use only varieties that had been approved by the European Union (EU) and the United States (US), whereas its corn wet-milling plants would accept those varieties approved by the EU. Because the approved varieties were ones already being planted by producers, the statement did not drastically change any existing practices. Because there were no GM wheats at the present time, there was no need to issue any statement regarding wheat.

Genetic engineering enabled animal and plant breeders to better control exactly when and where a particular gene was expressed and the amount of the gene product. Many of these genes could not be observed through traditional breeding methods, such as natural mutations, cross breeding, and selection. Thus, breeders were able to develop new crop varieties whose genes were resistant to certain herbicides (Roundup Ready soybeans™) or pesticides (*Bt* corn). Many, but not all, of these new plants were "GM or enhanced" products. Many of these products enabled producers to lower their use of certain production inputs and increase yields, which meant rapid adoption by many producers. Potential improvements in wheat using genetic engineering would be better seed protein quality or uniform kernel size. Increasing the number of certain glutenin proteins would help strengthen dough for bakers. Modifications to the amount of starch contained in wheat were another possibility for wheat wet millers such as Cargill.

Genetically Modified Wheat

Availability of GM wheats were imminent. The *USDA Field Release Database* found that 21 release permits in the field test releases had been issued for wheat and another 136 for notifications for field test releases. The overwhelming majority were herbicide-tolerant or virus-resistant wheats. Initial test results indicated that a significant decrease would occur in weeds, which would increase yields per acre. Thus, GM wheats likely would be adopted by producers, if the costs of the seed were less than the sum of the revenue from increased yields and any cost savings from reduced crop inputs.

Herbicide-resistant wheat would be available for Colorado producers in 2002. American Cyanamid had worked with land grant universities, public and private laboratories, and seed companies to develop wheat varieties tolerant to imidazolinone (commonly called IMI) herbicides. These herbicides provided contact

and residual control of weeds common to wheat production. The IMI wheat was not developed using genetic engineering (i.e., it was not GM), but researchers at Monsanto were developing a Roundup Ready wheat that also was herbicide resistant and was GM. Four land grant universities (Oregon State, Washington State, South Dakota State, and the University of Minnesota) signed agreements with Monsanto to develop a Roundup Ready hard spring wheat by 2003.

Two potential problems existed regarding consumer acceptance of these wheats. First, it was not clear whether IMI wheat would be viewed as GM wheat. The potential for customers to be confused over what was GM wheat and what was not was likely once these two products had been commercialized. Even though it would be 2004 before producers would be able to purchase seed to plant GM wheat (e.g., Roundup Ready wheat), a spokesperson for the leading wheat export market development association, US Wheat Associates, already had indicated that Egypt and Japan had stated that they did not want it.

Second, some scientists were worried that GM wheat (such as Roundup Ready wheat) would cross naturally with related species and produce a "super weed." Jointed goatgrass, a troublesome weed for producers, had a shared genome with wheat. It had four sets of chromosomes (compared to wheat's six), and two of them were from a parent species that it shared with wheat. Thus, a herbicide that killed jointed goatgrass also would kill wheat. If the herbicide-resistant gene was inserted into one of the shared genes, such a "super weed" might develop.

Labeling of Biotechnology

A recent lawsuit ruled in September 2000 that the government did not have to require labels, such as those required for food additives, for GM foods. However, the Food and Drug Administration did allow food manufacturers to voluntarily label their products, and a disclaimer likely would be added stating that there was no difference between GM and non-GM foods. Japan, Taiwan, South Korea, the EU, and Australia had announced plans to begin labeling of foods containing ingredients that contained GM food or feed grains. It was unclear what would happen in the US, but the recent recall of products that contained the only GM corn not approved for use in humans, Starlink genetics, had caused a disruption among food companies.

The demand for GM foods was still a niche market. For example, the price differential between the futures contract for Tokyo Grain Exchange's new GM soybean (of US origin) and that for its existing conventional soybean (of US origin) was not sufficient to recoup the costs of the identity-preserved system for the GM soybean.

Identity-Preserved Crop Production

The value chain of crop production to processing and on to consumers had undergone change. The government was mandating systems that could help measure and reduce food pathogens through intervention technologies. Cargill was one of the first companies to use steam pasteurization, which effectively reduced food pathogens in meat. But concern over safety was only part of the drive towards identity-preserved programs, or as Cargill called them, "a traceable chain of custody programs."

The need to develop marketing chains that would enable processors to fully utilize the benefits of GM crops also was driving the move towards identity-preserved crops. Such changes would mean the development of an identity-preserved grain-marketing channel. Cargill already had experience with such marketing channels. For example, food-grade white corn and yellow corn were handled separately through its InnovaSure™ program at Cargill elevators that supplied its Illinois Cereal Mills plant. Similarly, food-grade soybeans that had desired qualities for tofu also were handled separately. Similar programs also existed. All of these programs involved coordination with producers with respect to seed and delivery location. However, little wheat was contracted at the present time, and significant amounts were not even found in the latest figures complied by the USDA.

Identity-preserved marketing channels were more complicated than simply segregating crops during loading, unloading, storage, and transportation so as to avoid mixing the crops. Identity-preserved channels implied that producers used separate fields to avoid mixing pollen or seeds during planting and harvesting and cleaned equipment and on-farm storage units. Once the producer delivered the grain to an elevator, the manager also had to develop strict standards to maintain identity to the processor. This would add additional costs, because it would be difficult to develop rapid storage and unloading systems that could accept two or more types of grain simultaneously at harvest. Transportation of identity-preserved grains also posed problems, because the containers or rail cars would have to be sealed perfectly to avoid picking up any residue. If tolerances for GM material were as low as one percent, the costs could increase significantly.

Identity-preserved crop production was the first step in the development of an "auditable" food-marketing channel and might even involve the use of ISO 9000 or 14000 protocols. Cargill had knowledge of such systems because its Sunny Fresh Foods business became the first food company to receive the prestigious Malcolm Baldrige National Quality Award in 1999.

Increased focus on milling and baking quality was another reason for identity-preserved marketing channels. Some contracting through identity-preserved channels was being done for wheat with traits that were desirable for milling and baking. For example, Con Agra contracted wheat varieties with producers in Colorado. General Mills and Nabisco contracted specific varieties of hard and soft wheats in Montana, Idaho, and other states, and General Mills had eight different

identity-preserved channels for wheat. Similarly, General Mills knew that some flakes in a box of Wheaties were flat, and some were curled. Consumers preferred the curled flake, because it retained its crispness longer when milk was added. This characteristic was a result of the wheat used to produce the flakes.

Challenges and Opportunities

It was difficult to get a clear picture with respect to the current rhetoric over GM crops. After all, it started as a trade issue due to the EU's rapidly increasing yields of coarse grains. Limiting corn imports through failure to approve certain *Bt* corn varieties would likely force EU livestock producers to use coarse grains as livestock feed, which also would reduce EU exports and reduce their existing budgetary outlays to support these exports. The recent entrance of Spain and Portugal (both large former importers of US corn) into the EU provided a large market for EU-produced coarse grains.
Cargill believed that the Sanitary and Phytosanitary (SPS) measures and the Technical Barriers to Trade (TBT) agreements fully covered the regulatory approval processes for GM products, and science was an appropriate basis for governmental trade restrictions. It was apparent that trade complications arising from attempts to regulate biotechnology needed to be considered by trade officials. The World Trade Organization was the forum for reviewing the trade-related aspects of the activities conducted in the other forums.

One challenge was how to maintain and improve Cargill's image with its customers and other consumers. The success of any value-creation strategy relied heavily upon trust. Wheat was an important commodity in world trade markets and an integral ingredient in many different food products. The introduction of IMI wheats and Roundup Ready wheats would likely confuse customers who were not sophisticated enough to know why one herbicide-tolerant wheat was GM and another (IMI wheat) was not. Cargill's status and reputation in the world grain markets could help provide leadership in much the same way that its position statement on biotechnology (e.g., it would continue to purchase all corn and soybeans that had been accepted by the EU, whether they were GM or not) in December 1999 had "settled the grain markets."

A second challenge was how to best compete in a world wheat environment that was rapidly becoming more sophisticated. Goertzen Seed Research developed hard red wheat varieties suitable for some milling purposes, but it did not have any quality hard white wheats, thus, Cargill would use the public varieties being developed by universities. A key concern was that if the hard white wheats being introduced in Kansas and other states were not handled through an identity-preserved marketing channel, all the milling benefits would be lost. It also was important that consumers knew that hard white wheat was not GM (Exhibit 3).

Exhibit 3. Summary of New Wheat Types Available to Producers in the Next Five Years

		Genetically Modified? Yes	No
Advantages	Increased output (better nutrition, milling properties)		Hard white wheat
	Reduced inputs (herbicide-tolerant)	Roundup Ready wheat	IMI-wheat

Opportunities included the abilities to create value through identity-preserved marketing channels using new hard white wheat varieties and to develop better relationships with producers who provided the foundation for the success of any such programs. Risk management services, marketing contracts, and joint ventures were three steps in building that relationship within the context of Cargill's strategic intent. Clearly, Cargill's global leadership would be needed to help meet these challenges and take advantage of the opportunities in the wheat value chain. Warren Staley and Cargill had much to think about in the next year.

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