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Can Genetically Engineered Nutraceuticals Win Back Skeptical Consumers?

Karoline Kastanek
University of Nebraska-Lincoln

Emie Yiannaka
University of Nebraska-Lincoln

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Market Report	Yr Ago	4 Wks Ago	11/14/08
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight	$93.15	$88.82	$91.76
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	118.26	108.57	107.72
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	113.24	105.70	102.85
Choice Boxed Beef, 600-750 lb. Carcass	143.50	147.45	155.68
Western Corn Belt Base Hog Price Carcass, Negotiated	45.91	60.69	51.73
Feeder Pigs, National Direct 50 lbs, FOB	34.81	41.90	54.45
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean	59.15	65.99	57.28
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct	91.00	93.25	97.62
National Carcass Lamb Cutout, FOB	266.75	265.89	265.39
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu	7.00	5.00	5.16
Corn, No. 2, Yellow Omaha, bu	3.64	3.93	3.75
Soybeans, No. 1, Yellow Omaha, bu	10.06	8.54	8.83
Grain Sorghum, No. 2, Yellow Dorchester, cwt	6.59	5.32	4.91
Oats, No. 2, Heavy Minneapolis, MN , bu	2.79	*	2.10
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton	135.00	190.00	202.50
Alfalfa, Large Rounds, Good Platte Valley, ton	87.50	77.50	77.50
Grass Hay, Large Rounds, Premium Nebraska, ton	*	85.00	75.00
Dried Distillers Grains, 10% Moisture, Nebraska Average	138.50	146.00	138.50
Wet Distillers Grains, 65-70% Moisture, Nebraska Average	45.00	54.00	48.00

***No Market**

The unexpected (to many) consumer resistance to the first generation genetically modified (GM) food products that focused on producers, and aimed at increasing yields, hurt the prospects of the agricultural biotechnology sector. As a response and in an effort to win back skeptical consumers, agricultural biotechnology firms started working on food products with functional properties desirable to consumers, that are commonly known as second generation GM products. Food products in this category include vitamin A enriched rice and maize (golden rice and golden maize), high protein wheat, and high oleic soybean oil, to name a few. Recently, a new generation of genetically engineered foods, referred to as genetically engineered nutraceuticals has emerged, attracting a lot of attention and stirring up additional controversy. While many of the second generation, consumer oriented GM food products can be viewed as genetically engineered nutraceuticals, this latter category is much broader.

The term nutraceuticals, a combination of the words "nutrition" and "pharmaceutical," was quoted by Dr. Stephen DeFelice in 1989, who defined them as foods *or parts of foods* that provided medicinal or health benefits to consumers, including the prevention and treatment of diseases (Kalra 2003). The Nutraceuticals Institute references nutraceuticals as phytochemicals or functional foods that are natural, bioactive chemical compounds that have health promoting, disease preventing or medicinal properties (The Nutraceuticals Institute 2006). Recently, the boundaries of what constitutes a nutraceutical have expanded to include genetically engineered nutraceuticals which are designed, according to the firms introducing them, for the purpose of creating inexpensive alternative pharmaceuticals, fighting disease in developing countries and improving consumer health through common foods such as fruits and vegetables. Thus, genetically engineered nutraceuticals include foods which the direct consumption of is associated with increased health benefits and/or

disease prevention (second generation GM food products), but also foods, plants and animal products that will be used to create vaccines and drugs that could treat or cure a disease (third generation GM products).

Examples of research currently conducted in this area include research on genetically engineered bananas that could be used for a Hepatitis B vaccine (Cosby 2007), genetically engineered rice that will be used for a cholera vaccine (Natarajan 2007), a genetically engineered chicory plant to produce an anti-malaria medicine – the plant is native to Africa where the medicine is mostly needed (Plant Research International 2007), and a genetically engineered version of the tobacco plant that could be used in a vaccine for the human papillomavirus (HPV) or cervical cancer (Perry 2007). The development of other vaccines derived from genetically modified mushrooms (EurekAlert 2007), algae (Bowen 2007) and livestock (Svoboda 2007) is also under way.

While most of these products are still in the development stage, there are some that are closer to being commercialized. A study conducted in Kansas tested a rice variety genetically engineered to produce anti-diarrhea medicine for children. The gene modified in the rice has properties copied from a specific protein found in human breast milk. The production of this protein will aid in the fight against diarrhea in young children, which is currently the second leading cause of infant and small child mortality (Haarlander 2007). Ventria Bioscience plans to launch this as an over-the-counter product by the end of the year (Downing 2008). Another genetically engineered nutraceutical that is close to its commercialization stage is insulin production from dairy cow milk. This project is being conducted in Argentina and the process involves the cloning of dairy cows for insulin mass production where the insulin, derived from a human gene and inserted in the bovine embryo before being implanted into the mother cow, will be released with the cow's milk. Scientists are hoping to have this insulin on the market within the next couple of years (Popper 2007).

The forthcoming commercialization of genetically engineered nutraceuticals is occurring at a time when governments around the globe are becoming more accepting of genetic modification. While the U.S. and Canada have historically been supportive of the production and consumption of genetically engineered foods, countries in the European Union, Australia, China and India, that traditionally opposed genetic modification, have been slowly starting to accept certain GM products. Brazil approved commercial sales of Syngenta's transgenetic corn in June (Danby 2008), although in the past there had been violent protests against GM production. Likewise, in South Africa farmers have been increasing production of genetically engineered crops, by as much as 30 percent from 2006 to 2007; in 2007 approximately 57 percent of the total maize acreage was planted to genetically modified maize (*Conversations about Plant Biotechnology,* 2008).

Along with excitement about the market potential of this new generation of GM products, there has also been resistance and skepticism from those opposed to genetic modification. A case in point involves strict regulations and restrictions in England that recently forced scientists working on genetically modified pig organs that could be used for human organ transplant procedures, to move their research from England to the U.S. (Sample 2007).

Whether consumers will embrace genetically engineered nutraceuticals remains to be seen. On the one hand, as the biotech sector would certainly hope, the use of genetic modification for nutritional and medicinal purposes, coupled with the persistence of high food prices in national and international food markets, could make consumers more accepting of genetically modified food products. On the other hand, the use of agricultural products in competing uses may be viewed as contributing to high food prices and thus may not be welcome; this has certainly been the case with agricultural crops used in biofuel production.

A second year Undergraduate Creative Activities and Research Experience (UCARE) research project that is currently underway in the Department of Agricultural Economics at the University of Nebraska–Lincoln, and will be completed by June 2009, involves the development of a survey that will be used to gather information and shed light into consumer perceptions of genetically engineered food products; consumer familiarity with, and attitudes towards genetically engineered nutraceuticals; and the potential effect of these new products on consumer attitudes towards genetic modification. Survey participants will be University of Nebraska–Lincoln students and consumers in the Lincoln, Nebraska area and survey results will be published in a second year UCARE research report.

Note: The article is based on Karoline Kastanek's first year UCARE project "The Market Effects of Genetically Engineered Nutraceuticals" conducted in the Department of Agricultural Economics at the University of Nebraska-Lincoln.

Karoline Kastanek, Undergraduate Student
Dept. of Agricultural Economics
University of Nebraska-Lincoln
Karoline2006@yahoo.com

Emie Yiannaka, (402) 472-2047
Associate Professor
Dept. of Agricultural Economics
University of Nebraska-Lincoln
yiannaka2@unl.edu

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