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Public Perceptions of Genetically Engineered Nutraceuticals

Market Report	Year Ago	4 Wks Ago	10-28-16
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	138.14	100.21	104.04
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	220.29	143.09	133.80
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	200.83	141.27	138.71
Choice Boxed Beef, 600-750 lb. Carcass.	219.22	186.63	182.00
Western Corn Belt Base Hog Price Carcass, Negotiated	60.77	48.53	44.87
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	81.94	75.24	72.64
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	156.73	158.36	146.03
National Carcass Lamb Cutout FOB.	357.69	353.14	351.19
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	4.14	2.64	2.74
Corn, No. 2, Yellow Nebraska City, bu.	3.52	NA	NA
Soybeans, No. 1, Yellow Nebraska City, bu.	8.26	NA	NA
Grain Sorghum, No.2, Yellow Dorchester, cwt.	5.93	4.66	4.82
Oats, No. 2, Heavy Minneapolis, Mn, bu.	2.60	2.51	2.78
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	185.00	160.00	160.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	75.00	68.75	67.50
Grass Hay, Large Rounds, Good Nebraska, ton.	77.50	70.00	67.50
Dried Distillers Grains, 10% Moisture Nebraska Average.	112.50	112.50	108.00
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	49.50	40.50	41.75

*** No Market**

The 2016 World Food Prize was awarded in October to four scientists for their pioneering work on bio-fortification — a process of enhancing traditional foods with micronutrients, particularly vitamins and minerals, through conventional selective breeding or genetic engineering. Three of the laureates who work in African countries bred and championed the orange-fleshed sweet potatoes[1]. Although not native to the African continent, the orange-fleshed sweet potato is enhanced with beta-carotene to boost vitamin A content and combat vitamin A deficiency, a health challenge in many developing countries.

Despite their potential role in combating malnutrition and hunger, the introduction of genetically modified (GM) foods has been strongly contested since their commercialization in 1996. Attitudes toward GM foods have been influenced by whether they confer value to producers or consumers. While the introduction of first generation GM foods that conferred agronomic benefits to producers was initially met with strong consumer opposition (Giannakas and Yiannaka 2008), second generation, consumer-oriented GM products, which have enhanced

[1] The three laureates who developed the orange fleshed sweet potato are Drs. Maria Andrade, Jan Low and Robert Mwanga, all with the International Potato Center. Dr. Howarth Bouis, the fourth laureate is the founder of HarvestPlus at the International Food Policy Research Institute (IFPRI).

functional properties (e.g., bio-fortified GM foods), have been gaining acceptance by consumers (De Steur et al. 2015). Building on second generation GM foods, recently developed third generation GM food products claim to provide health and disease treatment benefits to consumers. *Nutraceuticals*, as such products are are called, are foods or parts of foods that provide medicinal or health benefits to consumers, including the prevention and treatment of diseases (Kalra 2003). Genetically engineered (GE) nutraceuticals thus include foods associated with increased health benefits and/or disease prevention (second generation GM food products), but also plants and animal products that could be used to create vaccines and drugs to treat or cure diseases (third generation GM products). Examples of GE nutraceuticals are rice that can be used for a cholera vaccine (Murnaghan 2012), GE bananas that can be used for a Hepatitis B vaccine (American Chemical Society 2007), and a GE version of the tobacco plant that could be used in a vaccine for the human papillomavirus (HPV) or cervical cancer. At present, Astellas Pharma in Japan is at the forefront of conducting clinical trials for a vaccine in rice against diarrheal diseases such as cholera (Taylor 2016).

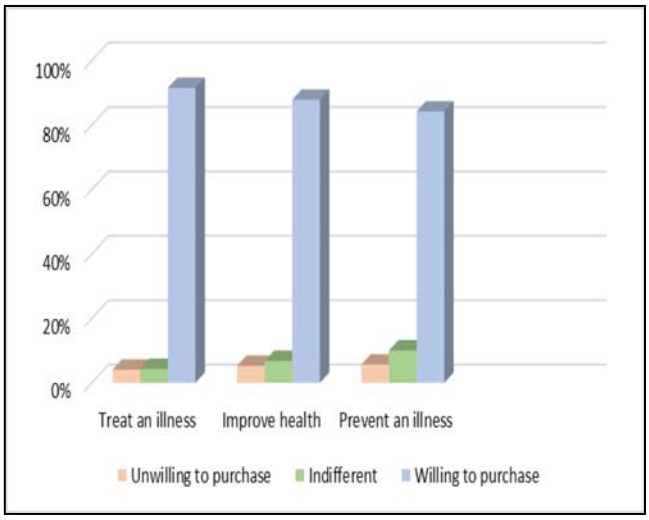
In the United States, the Food and Drug Administration (FDA) regulates nutraceuticals either as a dietary supplement or a food ingredient depending on how they are marketed by manufacturers (FDA 2016). The market for nutraceuticals is growing with an expanding global market valued at $165 billion in 2014 and projected to attain a staggering $278 billion by 2021 (Transparency Market Research 2016).

A study conducted by researchers in the Department of Agricultural Economics at the University of Nebraska-Lincoln (UNL) examined public attitudes and purchase intentions for GE nutraceuticals that either offer general health benefits or a treatment/cure for diseases. The study also examined how GE nutraceuticals are perceived with respect to their conventional and organic counterparts. An online survey that elicited responses related to views on GMOs, attitudes towards food labeling, preferences for genetically engineered nutraceuticals and demographic information was completed by 1,271 randomly selected students at UNL.

Survey results show that although the majority of respondents view GM food products favorably, they nevertheless express a strong preference for GM labeling. Faced with a choice between a GE nutraceutical with a disease treatment benefit and an organic food substitute with no such benefits, both sold at the same price, nearly half of all respondents indicated they would choose the GE nutraceutical, a quarter were indifferent between the two, while a quarter of respondents indicated a preference for the organic food product. When asked to consider a choice between a GE nutraceutical that offers general health benefits and its organic counterpart, both sold at the same price, respondents were evenly split with a third preferring the GE nutraceutical that offered general health benefits, a third were indifferent between the two, while the remainder one third preferred the organic food product.

In terms of purchase intentions, over 60% of respondents were equally willing to purchase GE nutraceuticals that offered treatment for diseases, versus GE nutraceuticals that offered general health benefits, such as disease prevention. A little more than a quarter of respondents were, however, more willing to purchase the GE nutraceuticals with the disease treatment benefit and were willing to pay an average price premium of 20% more for such products. Overall, the majority of respondents expressed willingness to purchase GE nutraceuticals developed to treat an illness, improve health and prevent diseases, as shown in Figure 1. However, price appeared to be a key determinant—less than a fifth of respondents would likely purchase GE nutraceuticals if they were more expensive than their conventional counterparts.

Figure 1. Purchase intention for GE nutraceuticals with different functionalities



Two methodological approaches were used to analyze the data. The multinomial logistic regression was used to analyze unordered dependent variables pertaining to preferences between GE nutraceuticals that offer general health benefits and treatment for diseases versus an organic food substitute that does not offer the same benefits. A tobit model was used to analyze factors that influenced respondents' willingness to pay a premium for GE nutraceuticals that offered treatment for diseases versus one that offered general health benefits, such as disease prevention. Empirical findings reveal that a number of respondent characteristics influence their preference for GE nutraceuticals. Specifically, respondents who paid greater attention to food production processes were 1.14 times less likely to purchase GE nutraceuticals that offered general health benefits, and instead had a 47% increase in their odds of purchasing an organic food product, relative to being indifferent between the two products. As expected, acceptance of the use of genetic modification in food production was associated with a greater acceptance of GE nutraceuticals. The partial odds of this group purchasing GE nutraceuticals that offered general health benefits and treatment against diseases increased by a factor of 1.98 and 1.65 times, respectively. Study results also indicate price sensitivity among respondents, including those more accepting of GM foods; not a surprising result given that our sample consists of college students. In light of the growing acceptance of bio-fortified GM foods, the above result suggests that GE nutraceuticals could further increase consumer acceptance and the market potential of GM foods.

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