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What Determines the Market Success of a Nanofood Innovation?

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Market Report	Yr Ago	4 Wks Ago	2/15/13
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	$129.15	$122.54	$122.94
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.. . . .	189.41	169.73	169.11
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	156.62	145.50	140.77
Choice Boxed Beef, 600-750 lb. Carcass.	189.04	192.68	183.07
Western Corn Belt Base Hog Price Carcass, Negotiated.	84.18	86.26	82.29
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean..	86.52	83.79	80.88
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct.	*	108.50	104.13
National Carcass Lamb Cutout, FOB.	384.36	294.80	285.82
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu..	6.16	7.84	7.28
Corn, No. 2, Yellow Nebraska City, bu..	*	7.38	7.16
Soybeans, No. 1, Yellow Nebraska City, bu..	*	14.34	14.25
Grain Sorghum, No. 2, Yellow Dorchester, cwt..	10.95	12.29	11.95
Oats, No. 2, Heavy Minneapolis, MN , bu.	3.48	3.90	4.08
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	137.50	247.50	*
Alfalfa, Large Rounds, Good Platte Valley, ton..	145.00	230.00	227.50
Grass Hay, Large Rounds, Good Nebraska, ton..	100.00	212.50	212.50
Dried Distillers Grains, 10% Moisture, Nebraska Average.	197.50	272.50	288.25
Wet Distillers Grains, 65-70% Moisture, Nebraska Average.	74.50	104.00	108.00
***No Market**			

If you are not quite sure what a nanofood is, you are not alone. The majority of the public in the United States is still uninformed about nanotechnology and its applications to the food sector. According to a commonly used definition, a nanofood is food that has been cultivated, produced, processed or packaged using nanotechnology techniques/tools or to which engineered nanomaterials have been added (Sekhon 2010).[1] Food nanotechnology has the potential to increase the supply, quality and safety of food. Applications include the use of nanosensors for monitoring crop growth, pest control and plant and animal diseases; additives and ingredients that enable changes in food texture, taste, processability and quality; and packaging material that release preservatives to extend food life and improve food safety by signaling whether food is contaminated or spoiled. While the potential benefits of food nanotechnology can be immense, its potential risks, which include the potential toxicity of nanoparticles, are not well understood.

Interestingly, research shows that despite lack of knowledge and understanding of nanotechnology, the public has, nevertheless, opinions as to its potential risks and benefits. While in the U.S. the public currently views the benefits of nanotechnology as outweighing potential risks, a large minority (44%) is unsure, which indicates that perceptions are malleable (Pidgeon et al. 2008; Satterfield et al. 2009). With advocates determined to not repeat the mistakes of biotechnology, it is clear that understanding the factors that determine the market acceptance of food nanotechnology and its potential impact on various interest

[1] Nanotechnology involves human-designed materials, devises or systems at the atomic or molecular level that have unique properties (chemical, physical, electrical or other) (Currall, et al. 2006).

groups can inform the design of effective policies and strategies for food nanotechnology innovations.

Research in the Department of Agricultural Economics at the University of Nebraska-Lincoln, funded by a grant from the U.S. Department of Agriculture under the Policy Research Centers Program, examines the determinants of the market acceptance and success of food nanotechnology innovations and the welfare effects of their introduction for the interest groups involved (i.e., consumers and suppliers of nanofoods and their conventional and organic counterparts), under different labeling regimes. The study accounts for (1) differences in consumer attitudes towards interventions in the production process, and (2) imperfect competition in the supply channels of interest, and identifies the exact conditions under which a food nanotechnology innovation will end up being (a) ineffective (i.e., not accepted in the market), (b) non-drastic (i.e., accepted and co-existent with its conventional and organic food counterparts), and (c) drastic (i.e., successful enough to drive its conventional food counterparts out of the market).

Research findings show that the market and welfare effects of the introduction of food nanotechnology innovations are case-specific and dependent on (a) consumer attitudes towards the use of nanotechnology in food production, (b) consumer valuation of the enhanced attributes of nanofood innovations, (c) the labeling regime governing food nanotechnology, (d) processor/retailer adoption costs, and (e) the degree of competition in processing/retailing.

Specifically, the study shows the following:

- High consumer valuations of the enhanced attributes of nanofoods (e.g., enhanced food quality and/or safety), can lead to drastic innovations even when consumers are averse to the use of nanotechnology in food production.
- The greater the adoption and labeling costs of nano-technology, the greater the likelihood that the nanofood innovation will be either non-drastic or ineffective.
- When consumers are very averse to food nanotechnology and/or segregation and labeling costs are high, the introduction of a labeling regime can be detrimental to the market acceptance and success of this new technology.
- The introduction of food nanotechnology causes a reduction in the prices of existing food alternatives (e.g., conventional and organic food products), with the price reductions being greater when adoption and labeling costs are low and competition among processors/retailers is more intense.
- Even when all consumers are averse to nanotechnology, the introduction of food nanotechnology innovations that offer enhanced food quality and/or food safety can be beneficial for all consumers.
- Producers of conventional and organic food products lose from the introduction of food nanotechnology.

The next steps in this research effort involve the empirical investigation of the factors identified above as key determinants of the market success of nanofood innovations. This will involve the study of U.S. consumer attitudes and willingness to pay for nanofood applications that improve food quality (e.g., ripeSense® packaging) and food safety (e.g., active packaging), as well as how attitudes and valuations are influenced by policy regimes (e.g., voluntary versus mandatory labeling), the source, nature and framing of information, cultural world views and governance philosophy, religiosity, trust in government, scientists and the food industry and demographic characteristics, to name a few. Stay tuned.

This article is based on the CAFIO-PRG working paper "The Market and Welfare Effects of Food Nanotechnology" by Van Tran, Konstantinos Giannakas and Emie Yiannaka.

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