The Science behind "Organic": Conflicts among Government Standards, Public Perceptions, and Scientific Findings

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Introduction

Organic food certification and labeling became a U.S. policy in 2002, following more than a decade of debate about what practices and materials to allow in organic production. The final ruling included a list of synthetic and natural substances allowed and not allowed in processes labeled as organic, a hierarchy of three labels for products with varying amounts of organic ingredients, and procedural and administrative instructions on obtaining certification. Essentially, a food product can be labeled and marketed as "organic" if at least 95% of its ingredients are produced without genetic modification, irradiation, biosolid fertilizer, or antibiotics. Although the USDA "makes no claims that organically produced food is safer or more nutritious than conventionally produced food," public perceptions of products with the organic label are generally that they are less harmful to human health and the environment than their unlabeled conventional counterparts. Scientific research performed on the safety, nutrition, and environmental impact of organic foods and practices have provided results that generally reflect these perceptions but also highlight conflicting and incomplete knowledge of the subject. In light of these findings, organic regulators might consider policies to promote consumers' access to current scientific information as well as more a more informative labeling scheme. The present organic labeling standards, having been developed from industry standards rather than science and public interests, fail to fairly inform

consumers as to how their food options reflect their concerns and values.

History of the Term "Organic"

Although agricultural practices have sustained human life for millennia, we have only recently developed a significant concern with the definitions of and differentiations between various agricultural methods. In the United States, the term "organic" has borne the brunt of these concerns, having been adopted, defined, and redefined by small groups of farmers as well as states and the federal government. This process has been affected by the economic interests of the organic industry and the health and environmental interests of consumers, and the current national standard definition of "organic" has not quelled discussions of its changing identity.

Bioethicists Peter Singer and Jim Mason highlight the recency of our interest in the particular term "organic," stating that "until the middle of the twentieth century, ['organic'] simply meant something living or derived from living matter" (2006, p. 198). Indeed, it was not until the 1942 publication of J.I. Rodale's *Organic Gardening* magazine that the term took on a specific definition relating to farming methods (particularly soil health in light of the post-war fertilizer boom) and eventually the foods they produced. Over the coming decades, the popularization of the term and the organic movement led to associations of farmers adopting "organic" in a broad sense (Singer & Mason, 2006, p. 198). For example, the International Federation of Organic Agriculture Movements (IFOAM), a large-scale umbrella organization for promoters of the movement, defined "organic agriculture" as:

> "an agricultural system that promotes environmentally, socially, and economically sound production of food, fiber, timber, etc. In this system, soil fertility is seen as the key to

> successful production. Working with the natural properties of plants, animals, and the landscape, organic farmers aim to optimize quality in all aspects of agriculture and the environment" (quoted. in Singer & Mason, 2006, p. 199).

However, such a general definition relying on subjective phrases like "sound production," "natural properties," and "optimize quality" still left the question of processes' and products' "organic" status largely up to a debatable values system.

By the 1970s and -80s, when consumers were beginning to find organic food among their produce options, the inconsistencies between promoters' definitions of "organic" started to become a concern. With over forty private and state-level certification systems in the United States, including the well-known Demeter Association and California Certified Organic Growers, there were variations in certification standards and labels. Without federal regulation, producers could even label their foods as organic without receiving certification (USDA Foreign Agricultural Service, 2001). As this system grew, it created confusion for consumers and resulted in lawsuits (Fedoroff, 2004, p. 248), which prompted interest in a centralized and enforced set of organic standards among consumers, producers, and the federal government.

The first party to take action was a body of representatives of the organic industry – the Organic Food Production Association of North America (OFPANA), which was established by IFOAM and would eventually become the Organic Trade Association. In 1988, OFPANA produced a set of guidelines on the ideals of organic farming, which were meant to direct but not define regional organic certification standards (DiMatteo & Gershuny, 2007, p. 255). OFPANA members created these guidelines based on an examination of "certification standards and programme information from every known certifier in the USA and Canada" (DiMatteo & Gershuny, 2007, p. 256). Although this nonprofit group's

methodology was thorough, it was not science-based or specific enough in its recommendations to serve as a set of national standards.

Federal Response to Calls for Labeling

The federal government began its venture into organic industry standards when Congress passed the Organic Food Production Act (OFPA) as part of the 1990 Farm Bill. OFPA's official purposes were to:

> "(1) establish national standards governing the marketing of certain agricultural products as organically produced products; (2) assure consumers that organically produced products meet a consistent standard; and (3) facilitate commerce in fresh and processed food that is organically produced" ("National Organic Program; Proposed Rule," 1997, p. 65850).

To accomplish these goals, OFPA created the National Organic Program (NOP) as a part of the United States Department of Agriculture's Agricultural Marketing Service. The NOP was to be comprised of the Secretary of Agriculture and a National Organic Standards Board (NOSB) of advisors.

The NOSB's membership reflected an array of parties interested in the organic industry, but did not give much of a voice to the science community. Of the fourteen members the Secretary of Agriculture would first appoint in 1992, there would be four organic farmers, two organic processors, one organic retailer, three environmental and resource conservation experts, and three public and consumer representatives; but only one would be an "expert in the field of either toxicology, ecology, or biochemistry" ("National Organic Program; Proposed Rule," 1997, p. 65851). The composition of this policy advisory group reflects the pre-standards view of the organic labeling issue as primarily a concern of traditional

agricultural ideals and their relationship to mass marketing. Prioritization had clearly been given to the protection of food producers from competitors wanting to use low-standard organic labels, and to the protection of consumers from this potential fraud. The NOP did not consider the relevant science of "organics" – products' health and environmental effects – as the basis for consumers' concerns.

By 1994, the NOSB developed draft recommendations on the actions and allowances that constitute "organic" processes. The Board's original methodology was similar to that of OFPANA – reviewing "standards previously established by other organic organizations to determine for which subject areas position papers would be developed" ("National Organic Program; Proposed Rule," 1997, p. 65851). In their establishment of a National List of synthetic substances approved and not approved for use in organic-labeled products, the NOSB saw the value of a more scientific viewpoints and commissioned technical advisory panels to assess the risks of the 170 substances under consideration ("National Organic Program; Proposed Rule," 1997, p. 65851). The compilation of the NOSB's recommendations on labeling, accreditation of certifiers, organic production processes, insect and plant disease treatments, livestock health, synthetics substances, and other relevant issues were then reviewed by the USDA's Agricultural Marketing Service and Secretary of Agriculture before their publication in 1997.

Public Reactions

During the 1990s, public interest in the labeling of organic products had grown, and when these recommendations, known as the first Organic Rule, were published in the *Federal Register*, they elicited "an unprecedented volume [hundreds of thousands] of comments… most of them critical" (Fedoroff, 2004, p. 248). Some of the most controversial allowances included organic labels for genetically-modified organisms

(GMOs), as well as foods that included certain synthetic compounds. People expressed aversion to the ideas of using biosolids (treated sewage sludge) to fertilize and irradiation to kill insects on organic produce. Additionally, people were concerned by the idea that livestock that had been given antibiotics could still be "organic" (USDA Foreign Agricultural Service, 2001). The USDA responded to this public demand for precaution by revoking its allowance of many of the above risks (Kirschenmann, 1998). The final Organic Rule, published in 2000, prevents GMOs, biosolid fertilizers, irradiation, and antibiotics for livestock in any product receiving an organic label (Fedoroff, 2004, p. 250).

One publically-opposed proposal – the allowance of certain synthetic compounds – was maintained in the final Organic Rule as well as the resulting National Organic Program (NOP). Established in 2002, the USDA's NOP includes the nationwide standards for the definition of organic products found in the final Organic Rule as well as the criteria for the three levels of organic labeling. Products labeled "100% Organic" promise to be made fully from ingredients that meet those established standards, while products labeled simply "Organic" can only claim to be made from ninety-five percent organic ingredients. The other five percent, however, must allowed by the USDA's National List of Allowable and Prohibited Materials, as originally proposed by the NOSB and approved of by the NOSB's science advisors. The final label, "Made with Organic Ingredients," requires that seventy percent of the products ingredients meet organic standards (USDA Agricultural Marketing Service, 2008). This hierarchy, descriptions of which provide no scientific evidence for the 70-, 95-, and 100-percent threshold decisions, has allowed the national labeling program to include somewhat of a spectrum of approval within a specific set of standards.

Perceptions of Labels' Implications

Twelve years of debates at the federal level following decades of discussions among farmers resulted in a seemingly simple labeling scheme representing hundreds of pages of rules. For consumers, according to the president of organic producer Stonyfield, "the word 'organic' is now more credible than ever" (Hirshberg, 2009, p. 56). Conceptions of that credibility, however, may be misplaced. Despite common perceptions that organic products are safer and healthier than their conventional counterparts for humans and the environment, the USDA "'makes no claims that organically produced food is safer or more nutritious than conventionally produced food. Organic food differs from conventionally grown food in the way it is grown, handled and processed'" (quoted. in Nestle, 2009, p. 213). The Organic Rules were not based primarily on scientific research, but rather on debates over traditional definitions. More recent and applied research provides some insight into the environmental and health effects of organic-labeled products.

Research surveys frequently show that people perceive organic products to be healthier and less environmentally-damaging than items produced through conventional means. A 2002 literature review conducted by the Department of Food Science at the University of Otago in New Zealand notes that,

> "in the USA, consumers who considered organic foods to be better than conventional foods believed that the following characteristics… were important when they purchased organic foods: safety, freshness, general health benefits, nutritional value, effect on environment, flavor, and general product" (Bourn & Prescott, 2002, p. 2).

Further studies have concluded that consumers generally prioritize health concerns, such as pesticide residues, over

environmental concerns, such as carbon intensity or pollution, in their comparative judgment of organic and conventional foods (Bourn & Prescott, 2002, p. 2). These feelings are likely the results of media coverage of "food scares"; mad cow disease, *E. coli* outbreaks, and one particular 1989 media frenzy over Alar – a carcinogenic chemical used on conventional apple orchards – all inspired bouts of food awareness among Americans (Pollan, 2006, p. 152-153).

Although many food scares have resulted in rules to increase safety – the FDA banned the feeding of slaughter remnants to cows and the EPA banned the use of Alar (Pollan, 2006, p. 75, 153) – the original intent of the Organic Rule was to define the terms of "organic" rather than to provide organic products as safer options. In 2000, Secretary of Agriculture Dan Glickman stated, "The organic label is a marketing tool. It is not a statement about food safety. Nor is 'organic' a value judgment about nutrition or quality" (quoted. in Pollan, 2006, p. 179). Indeed, the Final Organic Rule cites not increases in health or safety but reductions in labeling fraud, administrative costs, and barriers to organic markets as its primary "benefit," and explains that food safety is out of its scope because foods qualified to be labeled "organic" may not necessarily modify their labels to include words like "healthy" or "pure," which are regulated separately ("National Organic Program; Final Rule," 2000, p. 80668, 80580). The document heavily references economic and legal research as opposed to scientific findings on safety issues of popular public concern. Nevertheless, consumers make these value judgments when they choose to pay for organic-labeled foods, believing they will be healthier or less environmentally-damaging than their conventional, lower-priced counterparts. The science explaining these value judgments, though somewhat new and unclear, could help consumers better understand what their "organic" purchases mean for their safety, nutritional, and environmental concerns.

Scientific Debates

Because the Organic Rule does not allow for the use of synthetic herbicides and most insecticides in organic-labeled ingredients, people tend to assume it is chemical-free and safe (Singer & Mason, 2006, p. 200). Most scientific research suggests this perception to be slightly optimistic, but not off-base. Often cited is a 2002 Consumers Union study of 90,000 samples of twenty fruits and vegetables, which found that 73% of conventionally-grown foods and 23% of organic foods contained pesticide residues (and the latter dropped to 13% - and the former dropped insignificantly – when long-lived banned chemicals like DDT, Dieldrin, and chlordane were excluded) (Baker et al., 2002). Differences in people's diets have been shown to produce measurable differences in these chemicals in their bodies. A 2002 University of Washington study of thirty-nine preschool-aged children divided among conventional and organic diets showed an average of six times the concentration of organophosphate pesticides in the urine of the conventionally-fed children (Curl et al., 2003). These results show that the official organic practice of agriculture without synthetic pesticides or herbicides do affect products and their consumers.

Some researchers, however, have called into question the assumption that these effects are beneficial or necessary to human health. According to geneticist Nina Fedoroff, Ph.D., "the question is whether the pesticide residues actually present on [conventional] foods in the supermarket are high enough to cause harm" (2004, p. 252). In a 1999 random sampling of 9,438 food products on the market, only 1.2% of fruits and vegetables were found to contain any chemicals at levels higher than their EPA tolerance levels as established by risk assessments (FDA, 1999). Perhaps the effects of reducing crops' chemical exposures to "organic" levels is insignificant to human health; little research has been done to determine the health effects of pesticide and herbicide exposure at levels

below those of observed adverse effects, and some chemicals involved in conventional processes do not yet have risk assessment-based thresholds (Singer & Mason, 2006, p. 204).

Furthermore, there is some scientific evidence that processes that are not allowed for organic products may increase the safety of conventionally-produced foods. For example, Dr. Fedoroff notes that in the case of microbes like *Salmonella* and *E. coli*, which cause food poisoning and thousands of U.S. deaths per year, irradiation could significantly reduce risk (2004, p. 255). These microbes can come in contact with the food through manure, which many organic producers use as fertilizer. Although irradiation was originally allowed in the first draft of the Organic Rule, it was revoked following negative public comments with concerns about radioactivity. Dr. Fedoroff insists that this fear is unfounded at the levels of irradiation necessary for food, and that there are levels of irradiation "that [kill] harmful bacteria but [don't] heat the food enough to change its nutrition or taste" (2004, p. 256). The range of safety concerns in food production and consumption and the limited scientific data available make it difficult to justify organic or conventional foods as the "safer" choice.

The evidence that organic-labeled foods have higher nutritional quality than conventionally-grown foods is similarly unclear. One of the main challenges in studying this field is isolating the variables related to organic practices; genetics and environmental factors can significantly influence nutritional measurements like vitamin and mineral contents (Bourn & Prescott, 2002, p. 7). The University of Otago literature review cites studies that have "found no significant difference in the nutritional value [vitamins A, B_1, and C] of crops fertilized with manure-based composts compared with those treated with inorganic fertilizers" as well as ones that have found higher vitamin A and B levels in crops grown in manure than in chemically fertilized soil (Bourn & Prescott, 2002, p. 7).

Despite these overall conflicting findings, advocates of the nutritional benefits of organic foods have found increasing scientific support in research performed over the last decade. A 2003 study by University of California-Davis researchers found that fruits and vegetables grown by organic or sustainable (as distinct from Organic Rule-compliant) methods contained significantly higher amounts of vitamin C and polyphenols, the latter of which include antioxidants that combat cancer and microbial illness, than did those grown by conventional methods (Asami et al., 2003). Further studies have shown that these beneficial compounds are present in significantly higher concentrations in the bodies of people with organic diets than of those with conventional diets (Grinder-Pederson et al., 2003). Findings like these, however, have not been consistent enough to confirm an overall organic food nutritional benefit.

In addition to health and nutritional concerns, an increase in scientific and media attention to climate change has recently added sustainability and the environmentally-friendly agricultural practices to the public perceptions of the organic label. There is some evidence that organic farming is, in general, a less carbon intensive process than conventional farming due to its energy efficiency. The nonuse of synthetic fertilizers, which require significant amounts of energy to produce (Singer & Mason, 2006, p. 204), is one of the main reasons University of Essex researchers found that U.S. organic wheat production uses 68% of the amount of energy required for conventional U.S. wheat production (Pretty & Ball, 2001). Beyond efficiency, there has been research into the potential for organic farms to act as carbon sinks. The Rodale Institute, an organic farming education organization, completed a twenty-two-year field trial with which it concluded that "soil under organic agriculture management can accumulate about 1,000 pounds of carbon (3,500 pounds of carbon dioxide) per acre-foot of soil each year," and if all 160 million acres of corn and soybeans grown in the U.S. converted to these methods, "a

potential for 580 billion pounds of excess carbon dioxide per year can be sequestered" (Hepperley, 2004).

Organic methods have also been shown to contribute significantly to climate change due to some inefficiencies. An organic label does not guarantee a local producer, and transportation of organic items results in carbon output worldwide (Pollan, 2006, p. 183). Additionally, it is not just carbon, but also methane, that contributes to the greenhouse effect. A study funded by the British Department for Environment, Food and Rural Affairs noted that organic cows' high fiber diet of grass and hay increases their methane release compared to that of non-organic cows, whose feed usually contains more starch. Furthermore, because the rules for organic cow products forbid the use of bovine growth hormone, more organic cows are needed to produce the same amount of milk as non-organic cows, and thus more methane is produced (Shepherd et al., 2003). Studies have yet to show organic farming methods' net influence on climate change.

Perceptions of "organic" as environmentally beneficial extend to more traditional concerns of water quality, soil quality, and biodiversity. Most studies confirm perceived benefits in these areas due to organic methods' low use of chemicals. For example, synthetic fertilizers contribute significantly to nitrogen runoff into water systems, but organic methods must avoid such fertilizers (Singer & Mason, 2006, p. 203). In a thirty-seven year comparison of two adjacent wheat fields in Washington, one under organic management and the other conventional, the organic field maintained more nutrients and lost 75% less topsoil due to its higher content of organic matter as opposed to synthetic fertilizer (Reganold et al., 1987). Finally, organic practices have been found to promote biodiversity; a five-year British study of 180 farms found significantly more plant, spider, and bird species among the organic sites and noted that "the exclusion of synthetic pesticides and fertilisers from organic is a fundamental difference between systems" (quoted. in "Organic farms 'best

for wildlife'," 2005). Although the USDA terms of the organic label provide "no guarantee that a product comes from a farm in harmony with its environment" due to transportation needs and allowances for large-scale operations (Singer & Mason, 2006, p. 201), there seems to be general scientific agreement that most of the practices that qualify as "organic" result in environmental benefits.

The above scientific findings, which relate to public concerns about health and the environment, have little bearing on policy positions of the current industry-based organic labeling standards. The USDA maintains its "no claims" position that foods labeled as organic should not be thought to be any safer or more nutritious than those grown by conventional methods. The U.S. government has also not advocated for organic farming as an environmentally-beneficial (or detrimental) practice. As of 2003, the governments of the United Kingdom, France, and Sweden have taken similar neutral stances (UK Food Standards Agency 2003), showing that the public interest in the inconclusive scientific evidence on the implications of organic practices is being recognized internationally.

Scientific Limitations

Attempts to synthesize research on organic products' health and environmental impact have been limited by the variations in designs of these studies. The University of Otago meta-analysis on nutritional value notes that most previous studies had taken one of four approaches: chemical analyses, fertilizer effect studies, farm-based comparisons, and animal/human health effects studies. The authors found it impossible to compare findings across approaches, and challenging even to draw conclusions among studies within approaches due to variations in focus, technique, and results (Bourn & Prescott, 2002, p. 5-6). Presently, high costs and difficulties of conducting studies in this field likely contribute to these inconsistencies (Nestle, 2009, p. 213). Because this

research has only relatively recently been attempted for national- and global-scale questions of health and environmental impacts, scientists' techniques have not yet reached the strength necessary to interpret or overcome the conflicting findings that have led to unclear answers about the effects of organic foods.

Although scientific investigation of organic food quality is a relatively new field, the research has come from a variety of sources. Academics, advocacy groups, and organic retailers have published small- and mid-scale studies. Notably, the U.S. government has not conducted any large-scale comparison study of organic and conventional practices, although the British government has funded and run long-term studies. Much of the recent research on the qualities and effects of organic foods has been undertaken by non-U.S. entities, particularly the British government and universities worldwide. Questions about organic foods and practices are becoming international concerns and scientific endeavors because of their potential for health benefits and agricultural sustainability.

Advocacy and Politicization of Science

Following a half-century of philosophy-based debates about the holistic benefits of organic farming methods, the past decade has seen an upwelling of scientific research on the subject around the world. While many results of this research support the notion that organic products are good for human health and the environment, the findings are not unanimous and are difficult to compare. Moreover, the intent of such studies often conflicts with the U.S. policy on the "organic" definition and label, which does not purport to imply such benefits. Some parties have politicized the findings to advocate their philosophic stances on organic practices by taking advantage of the science's early state and unclear relationship with public policy. Debates continue about how the science and policy

should account for the holistic intentions of the original organic movement.

The incompleteness of the science addressing the health and environmental impacts of organic-labeled foods has allowed parties to stealthily advocate for their predetermined positions. Conflicting and unclear study results have provided evidence for and against the ideals of organic farming methods, sometimes even within the same studies. For example, the aforementioned Consumers Union finding that 23% of organic food samples contained traces of pesticides appeared in Peter Singer and Jim Mason's promotion of organic foods as well as Nina Fedoroff's criticism of the system. While Singer and Mason were able to say "only 23 percent of organically grown samples" contained residues (2006, p. 200), Fedoroff told readers that "23 percent of organic fruits and vegetables did contain traces of pesticides, including long-banned chemicals like DDT" (2004, p. 251). In using the available data to garner public support, advocates like Singer and Mason and Fedoroff have engaged in Roger Pielke's "politicization of science" by "looking to scientists to provide information that will help them to overcome or avoid politics" (Pielke, 2007, p. 35). Interest groups participating in the research, such as the Rodale Institute's study of an organic farm's carbon sequestration potential, also risk accusations of issue advocacy, because their published results consistently reflect their groups' missions despite conflicting findings in the field as a whole. In the absence of policy options currently relying on this research, these advocates' success can only be judged in their influence on public opinion. With the demand for certified products growing at an estimated ten percent annually (Millstone & Lang, 2003), advocates of the positive health and nutritional benefits of organic foods appear to be projecting a notion of scientific support onto consumers. In a field so historically rooted in philosophical positions and traditional practices, advocacy is to be expected, especially at this inconclusive stage in the science.

Also at work on organic product science are the academic and government-funded researchers who have primarily filled the role of science arbiters. In addressing topics like the presence of pesticides and nutrients in foods, these researchers have taken on questions of public concern. As Pielke contends, many of their conclusions attempt "to remain above the political fray" by presenting conflicting findings and avoiding specific policy recommendations (2007, p. 16). For example, the Washington study on soil erosion concluded simply that "in the long term, the organic farming system was more effective than the conventional farming system in reducing soil erosion, and, therefore, in maintaining soil productivity" as opposed to implying a net benefit to U.S. agriculture if policies increased organic practices (Reganold et al., 1987, p. 370). The lack of policy-based science in this field may be a result of the public's general acceptance of the organic labeling rules due to the historical and current advocacy for organic practices.

Complicating the debate over the organic label are notions of social welfare in the organic ideal. In the original IFOAM definition of "organic agriculture," "socially and economically sound production" was noted as a priority alongside environmental concerns (quoted. in Singer & Mason, 2006, p. 199). The organic industry deemphasized its social goals beginning in 1988, when OFPANA decided to remove labor standards from its organic label guidelines because "the organic label could not be used to redress every problem in the food system, and enforcement would present major obstacles" (DiMatteo & Gershuny, 2007, p. 256). Small farmers have accused the final Organic Rule of taking a similar stance, citing their use of phrases like "grown without chemicals" or "free of antibiotics" to promote their products; they avoid the word "organic" because of the cost and administrative time necessary to obtain official certification (Fromartz, 2002). The high costs of organic-labeled products compared to their conventional counterparts have also raised concerns about

social justice. Presently, the potential benefits of organic products are inaccessible for poor consumers, whose financial means constrain them to the cheaper conventional options. If consumption of fruits and vegetables were to decrease among the poor due to the price increases associated with the organic label, these people would face undue health burdens because of their economic status (Fedoroff, 2004, p. 254). These issues reflect the argument that the NOSB did not sufficiently consider social and economic implications when creating the terms of organic certification.

Conclusions and Policy Recommendations

Ultimately, it is difficult to conceive of a policy solution to the conflicting health, safety, and environmental implications of the organic label and the debate over how that label should reflect the philosophical organic ideal. Although scientists can and should continue to search for a comprehensive understanding of how organic products differ from conventional ones, the common questions of public interest – health and environmental effects – are trans-scientific and therefore preclude clear policy answers from science. Notions of concerns like "safety" and "impact" are socially-constructed and value-based, as are the discussions of social responsibility in agricultural practices, so even the most thorough risk assessments would not be able to overcome people's differing views of these notions to suggest a unanimously-approved organic policy. Nevertheless, scientific research continues to increase our understanding of food products' effects on human and environmental health, and the public continues to seek a labeling scheme that presents these findings.

The most important course of action at this time is to promote a clearer understanding of the organic label and the most recent scientific findings among the public. The organic certification label does not clearly communicate the USDA

position of neutrality on the potential health or environmental effects of the product, nor does it explain the differences between the "100% Organic," "Organic," and "Made with Organic Ingredients" labels. With increasing media attention being placed on "food scares" and the benefits of "environmentally-friendly" daily living decisions, it is not surprising that consumers assume that the USDA organic label signifies a wise choice for their health and the planet. Additionally, the most readily-available information on this subject currently comes from publications by issue advocates, while the science arbiters' more comprehensive findings remain among the like-minded minority in academic journals. Because of this information imbalance, many consumers are making uninformed decisions, despite notions to the contrary. To correct for this miscommunication, policymakers could consider alternatives to the presentation of information – whether through amendments to product labeling regulations or systems of public access to the developing science. As concerns regarding health and the environment grow in light of research and advocacy, the public deserves to be able to understand how their food options reflect existing scientific knowledge and their values.

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