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Research report

Factors influencing U.S. consumer support for genetic modification to prevent crop disease ☆

Katherine A. McComas [a,*], John C. Besley [b], Joseph Steinhardt [c]

[a] Department of Communication, Cornell University, Ithaca, NY 14853, USA
[b] Department of Advertising, Public Relations, and Retailing, Michigan State University, East Lansing, MI 48824, USA
[c] Department of Communication, Cornell University, Ithaca, NY 14853, USA

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ABSTRACT

This study examines support for the genetic modification (GM) of crops in the context of preventing "late blight," a devastating potato and tomato disease that caused the Irish Potato Famine in the 1850s and results in substantial crop loss today. We surveyed U.S. adults who do the primary grocery shopping in their household ($n = 859$). Half of the respondents were randomly assigned to read a vignette describing late blight before responding to questions about GM, whereas the other half read a vignette about generic crop disease before responding to questions. We also examine how the perceived fairness of decision makers relates to GM support and the perceived legitimacy of GM decision making. We found that disease specificity mattered less to support and legitimacy than the perceived fairness of decision makers. The perceived risks of GM to human and environmental health negatively related to GM support and legitimacy, whereas the perceived benefits (e.g. reduced threats to crops and a more secure food supply) positively related to support and legitimacy. Objective knowledge about GM had a small, negative relationship with legitimacy whereas self-assessed familiarity with GM had a positive relationship. Overall, the results offer additional confirmation of past findings from more localized settings that perceived fairness of decision makers matters to support for GM and underscore the importance of considering how risk managers' behaviors and actions are perceived alongside individuals' perceptions about the risks and benefits.

Introduction

In the body of work examining attitudes toward genetic modification (GM), perceived benefits have emerged as a key driver of public support (Flair-Flow, 2002; Frewer et al., 2013; Knight, 2005; Mather et al., 2012; Rodríguez-Entrena & Salazar-Ordóñez, 2013). Given that much of the discourse surrounding resistance to GM has focused on risk perceptions, some scholars have questioned whether opposition to GM is based not so much on concern about risks but a perceived lack of the benefits for the public (Batista & Oliveira, 2009; Gaskell et al., 2004). Underlying these questions are fundamental issues of fairness in terms of the allocation of risks versus benefits as well as who gets to decide such allocations, considerations that scholars of organizational justice would describe as distributive and procedural justice or fairness (Colquitt, Conlon, Wesson, Porter, & Ng, 2001; Tyler, 2000). This study extends this research into the realm of GM by investigating how the perceived fairness of decision makers relates to public support for GM and the perceived legitimacy of the decision making process surrounding its use.

Furthermore, because research suggests that the public does not judge all applications of GM as equally appropriate or ethical (Frewer, Howard, & Shepherd, 1997; Knight, 2006), this study examines support for GM used to reduce the threat of significant crop failure and economic costs due to crop disease. While some research suggests that people tend to be more supportive of GM in relation to reduction of crop disease (Frewer et al., 1997; Gaskell et al., 2004; Priest, 2000), the strength of this relationship has not been investigated while controlling for other variables influencing support. Finally, given that researchers have suggested that specificity of use may influence support (Frewer et al., 1997), this study tests whether casting the benefits in terms of reducing the risks of a particularly notorious crop disease having historical and modern resonance, *Phytophthora infestans*, more commonly known as "late blight," versus generic crop disease, might have a stronger relationship with support for GM.

Background

The challenges associated with fighting crop disease and late blight in particular offer an interesting context in which to extend current

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* Corresponding author.
E-mail address: kam19@cornell.edu (K.A. McComas).

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knowledge about public views about agricultural biotechnology. Late blight is an infectious crop disease that spreads easily from field to field due to the number of spores it produces. It can be particularly devastating to both home gardeners and commercial farmers as it can destroy an entire season's crop in a matter of days. In the 1850s, late blight swept through Europe, depleting potato supplies, and is blamed for the infamous Irish Potato Famine, which resulted in over one million deaths and a similar number of emigrations out of Ireland (Donnelly, 2001). For decades, late blight lay mostly dormant, but in the late 1980s, a new strain emerged as a worldwide problem due to the migration of exotic strains across continents (Fry & Goodwin, 1997; Song et al., 2003). In 2009, one of the largest outbreaks of late blight in recent history spread throughout much of the northeastern United States. The outbreak likely originated from tomato plants bought by home gardeners and spread quickly resulting in untold economic costs to farmers (Moskin, 2009a, 2009b).

Prevention of late blight can involve the use of fungicides for conventional growers or copper for organic farmers. Some have suggested that GM crops bred to resist the disease may provide a permanent solution that also reduces dependence on chemicals to manage the disease (Dixelius, Fagerstrom, & Sundstrom, 2012; Haverkort, Struik, Visser, & Jacobsen, 2009; Song et al., 2003). An attendant question, and a focal one of the current study, is whether using agricultural biotechnology to prevent the spread of late blight provides a compelling enough application to encourage people to support the technology (Haverkort et al., 2008). It is possible that late blight's association with the Irish Potato Famine and more recent outbreaks may increase the disease salience and thus lead to greater concern about the disease and support for the development of blight-resistant potatoes and tomatoes, a so-called "drastic times call for drastic measures" hypothesis. On the other hand, it may be that late blight does not conjure up enough concern to influence support for agricultural biotechnology beyond what people may already support in light of generic crop threats or other factors shown to influence views about agricultural biotechnology. For instance, one recent news article reported public opposition in Ireland to field trials of blight-resistant GM potatoes, citing concerns about risking the local area's reputation for local, organic, and artisanal foods (Higgins, 2013).

Among extant reviews that examine U.S. support of agricultural biotechnology (Besley & Shanahan, 2005; Blaine, Kamaldeen, & Powell, 2002; Nayga, Fisher, & Onyango, 2006; Shanahan, Scheufele, & Lee, 2001a; Wu, 2004), particularly relevant to the current study are reviews of public opinion surveys that have found that, on average, Americans tend to support GM and see more benefits than risks, although some concerns over safety and morality persist (Frewer et al., 2013; Priest, 2000; Shanahan, Scheufele, & Lee, 2001b). A number of standard demographics have been associated with U.S. support, including age, education, income, and political conservatism (Besley & Shanahan, 2005; Blizzard, 2003; Priest, 2001). Consistently, North Americans continue to show more positive evaluations of different GM applications than their European counterparts (Frewer et al., 2013).

Knowledge also persists as an important covariate (Hossain, Onyango, Schilling, Hallman, & Adelaja, 2003); however, it is often hard to separate from other factors with which it correlates, such as gender and decreased skepticism (Gaskell et al., 2004). Other studies have shown that knowledge has only indirect effects or no significant effects on support (Knight, 2005, 2007) In isolation, the relationship between scientific knowledge and support is sometimes weak and can be related both to GM support and opposition (Christoph, Bruhn, & Roosen, 2008). It may be that differences in measurement of knowledge account for some of the variance, with some studies using more of a self-assessed measure, akin to familiarity, and others more of an objective quiz-like measure (Knight, 2005). In general, the lack of a definitive relationship between knowledge and support suggests a need for further study.

As noted above, research also suggests that application influences GM support. Biomedical uses, for example, tend to be viewed more favorably than food uses (Bauer, 2002, 2005; Flair-Flow, 2002; Frewer et al., 2013; Hampel, Pfenning, & Peters, 2000; Knight, 2006; Savadori et al., 2004; Spence & Townsend, 2006). Recent European data continue to show that Europeans are generally negative about GM food, apparently driven by a perceived lack of benefits and persistent safety concerns (Gaskell et al., 2010, 2011). Ethical issues also persist (Frewer et al., 2013). Relatedly, European and U.S. data also suggest different and relatively more support for cisgenic (adding genes from the same species or plants that could be cross-bred using conventional practices) over transgenic production, perhaps due to less moral opposition (Gaskell et al., 2011; Knight, 2007, 2009). Studies have also shown more positive views toward GM when used for crop disease resistance versus food enhancement more generally (Anunda, Njoka, & Shauri, 2010; Frewer et al., 1997; Priest, 2000). For example, Anunda et al. (2010) found support for humanitarian uses of GM to increase food supply in Kenya.

Research also suggests that people's perceptions of risk managers relates to GM support. In particular, the perceived trustworthiness of risk managers has been a central component of much research on agricultural biotechnology (Frewer et al., 2013; Gutteling, Hanssen, van der Veer, & Seydel, 2006; Kikulwe, Wesseler, & Falck-Zepeda, 2011; Knight, 2006; Priest, Bonfadelli, & Rusanen, 2003; Siegrist, 2000). Research has generally shown a positive relationship between trust and support for biotechnology and a negative relationship between trust and risk perceptions (Brossard & Shanahan, 2003; Gaskell, Allum, & Stares, 2003; Knight, 2007).

Studies have generally measured trustworthiness by directly asking about how much respondents trust various societal actors. While insightful to a point, such research does not offer further insight into the ways in which trust may be lost or gained. The current research, in contrast, draws on work from social psychology on fairness that emphasizes trustworthiness as one component of the perceived fairness of decision-makers (Colquitt et al., 2001). In addition, the fairness literature emphasizes that, in many cases, the key aspect is not whether someone supports a decision but considers it legitimate. Legitimacy can be based on several aspects of fairness, including the distribution of benefits (distributive fairness) and the qualities of the decision making process (process-oriented fairness) (Tyler, 2011). Process-oriented aspects include whether people believe that they have a voice in the decision, would be treated with respect by authorities, and have access to timely and accurate information. Previous research in a community setting showed that the perceived fairness of local decision makers had a significant relationship with residents' concern about agricultural biotechnology (McComas, Besley, & Yang, 2008). The extent to which these relationships are present at a national scale is unknown.

In sum, public support for GM is shaped by myriad factors, including individual differences, such as age and gender; social aspects, like perceived decision maker trustworthiness and fairness; and contextual components, as in the application. The current study focuses primarily on the social and contextual factors, meaning the perceived fairness of decision makers and the prevention of crop disease, although we control for other important aspects such as knowledge, risk perception, and demographics in the model. To explore these relationships further, we pose two hypotheses and an exploratory research question.

H1: The perceived fairness (distributive and process-oriented) of decision makers will be positively associated with support for GM.

H2: The perceived fairness (distributive and process-oriented) of decision makers will be positively associated with the perceived legitimacy of the decision making process.