CHOICES
a publication of AAEA Agricultural & Applied Economics Association
www.ChoicesMagazine.org
2nd Quarter 2010, 25(2)

Social Equity and the Genetically Engineered Crops Controversy

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JEL Classification: Y80

Over a decade since the first genetically engineered (GE) crops were approved, an increasingly polarized debate regarding whether GE crops could promote agricultural sustainability shows no signs of ebbing. Proponents emphasize the potential of this technology to enhance agricultural production with the possibility of reducing the use of economically costly and environmentally detrimental inputs, as well as the potential to address challenges related to changing climatic conditions. Critics counter with concerns that include the risks associated with releasing novel life forms into the natural environment, the increasing concentration of economic power in the small number of firms that control important intellectual property, the possible continued decrease in farm numbers, and other ethical issues associated with manipulation and control of life forms. Proponents and critics alike employ the vocabulary of sustainability to frame their arguments, including concerns about the long-term well-being of humankind. They also often refer to the same scientific research to support their assertions. This suggests to us that the differing views over whether GE crops can contribute to agricultural sustainability have roots in the way sustainability is conceptualized and used to evaluate the impacts of GE crops.

A major contributing factor to the conflicting viewpoints is that proponents and critics alike generally ignore the social equity issues inherent in the concept of sustainability (Lacy, et al. 2009). When scholars do address social impacts, they tend to rely on simplistic assumptions about the social relations that enable or constrain the emergence of sustainable practices and ignore the salient social issues surrounding the development and diffusion of a technology (Ervin, Glenna, and Jussaume, 2010). This oversight is disappointing given that attention to social issues is widely considered to be an essential element in virtually all definitions of sustainability, although there are certainly differences in the social issues that are identified and how they are defined. The long history of social scientific research on the role of technology in processes of social change and adaptation further reveals the importance of recognizing the necessity to incorporate social equity in investigations of any technology's economic, social, political, and environmental impacts. Such assessments are necessary for identifying the potential risks and benefits associated with technology adoption, and thus to generate a holistic analysis of a technology's sustainability potential.

Our goal is to highlight the centrality of the social dimension of the concept of sustainability, with a particular emphasis on social equity. We utilize the definition of social equity offered by the World Bank in *World Development Report 2006: Equity and Development*, which states that "...individuals should have equal opportunities to pursue a life of their own choosing and be spared from extreme deprivation in outcomes." We examine social contexts that enable or constrain opportunities for various actors at multiple levels: agribusiness and industry, national and international policy makers, farmers and their local communities, and the university and academic scientists. We then identify key social innovations necessary for enabling GE crops to become part of a sustainable agricultural system.

Sustainability

The concept of sustainability had its origins in renewable natural resource management over a century ago. The concept has been embraced in recent years as part of a movement that seeks to advocate for development that moves beyond the simple goals of economic growth and incorporates concerns for environmental impacts and social welfare. The 1987 Brundtland Commission popularized sustainability on a global scale. However, many have pointed out that the concept remains vague and misunderstood.

The malleability of the concept of sustainability has been evident in debates surrounding agricultural sustainability. Research indicates that, during congressional hearings leading to the 1985 Food Security Act, at least four distinct definitions of sustainable agriculture emerged. Those definitions included sustaining the conventional agricultural system, sustaining small-farm livelihoods, sustaining the natural resource base of agriculture, and a hybrid approach that emphasized sustaining farm livelihoods and the natural environment (Glenna 1999).

Despite the vague and contested nature of efforts to apply the concept of sustainability to policy debates and to advocate for particular technologies, it is important to remember that conceptualizations of sustainability have long emphasized social, economic, and ecological factors in a holistic and integrated approach. Most definitions of sustainability, including the Brundtland Report, make explicit references to the importance of social equity. In fact, such concerns were codified into law in the 1990 Food, Agriculture, Conservation, and Trade Act. To be sustainable, according to the law, agriculture must:

- “satisfy human food and fiber needs;
- enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;

- sustain the economic viability of farm operations and enhance the quality of life for farmers and society as a whole."

This definition of sustainability emphasizes that economic, ecological, and social factors, including the quality of life for farmers and society as a whole, must be managed in an integrated fashion if the agrifood system is to be sustainable.

Unfortunately, the growing popularity of the use of the term sustainability has not contributed to a marked increase in thinking about change holistically and as a process. Thus, assessments of GE crops often focus on economic utility for actors such as farmers, consumers or firms, or impacts on specific environmental dimensions, such as water quality or beneficial pest populations. Such assessments often disregard interactions between the economic, environmental, and the social. More importantly for our paper, social concerns, including whether the costs and benefits of specific applications of GE technology are shared equitably across all classes of farmers and their communities, consumers and firms, are often left unaddressed altogether. An analytical focus exclusively on economic sustainability or environmental sustainability undermines the integrated perspective that thinking about sustainability is meant to encourage.

As noted in the National Research Council's 2010 report, *Impact of Genetically Engineered Crops on Farm Sustainability in the United States*, social issues associated with the development and dissemination of GE crops, including questions of equity, have been grossly understudied. And analyses of social, economic, and ecological interactions associated with GE crops have not been common. When efforts are made to integrate multiple concerns, the social and economic dimensions are often so oversimplified that the arguments do more to obscure than illuminate. For example, increasing yield is commonly presented as an unmitigated social benefit. What is often overlooked is how higher yields do not necessarily guarantee improved economic farm viability or decreased hunger. Increasing production in a context of chronic overproduction can lead to lower prices for farmers. And lower food prices do not necessarily benefit those who do not have the income to purchase food—a “lack of effective demand”.

A *New York Times* article, “India’s Poor Starve as Wheat Rots,” described how 350 million people in India went hungry as crops rotted in the field and as crops from past years sat untouched in granaries. Such occurrences have been common since the first modern famine, the Irish potato famine of the 1840s, when a fungus decimated the primary food source for the tenant farmers in Ireland. During the famine, Ireland continued to export foodstuffs. The problem, in other words, was not a lack of agricultural commodity production. The problem was a lack of social equity: the productive land was owned by a few who exploited poor tenant farmers to produce commodities for export while a free-market ideology paralyzed the political will to solve the problem. A similar problem continues today. Famines, hunger, and starvation are seldom caused by global, national, or even local shortages of agricultural commodities.

Social Equity and GE Crops

Highlighting the importance of social equity in assessing agricultural sustainability indicates how a systemic, integrated framework could yield a more robust understanding of the potential and the limitations of GE crops to become part of sustainable agriculture. The idea that there are inherent social aspects to technological development, both as “causes” and as “effects” has been well established. Technological diffusion has been associated with changes in social structure, social relations, patterns of work, and access to benefits and costs. A particularly important insight is that technological development and diffusion does not take place in social—or economic or environmental—vacuums. The now classic work of Hayami and Ruttan (1971) demonstrated how agricultural technology options vary by socio-economic contexts. Similarly, the positive and negative impacts associated with any particular technology are rarely uniform across time and space. And what any one group, including farmers, local community residents, and technology developers, may consider a personal or social benefit, another group may consider a personal or social harm.

In the case of GE crops, it is not surprising that most of the extant research and applications have focused on a narrow number of traits for crops such as corn, soybeans, and cotton that are the foundation for the industrial agricultural production system. It is surely not coincidental that one firm that has been most aggressive in developing GM seeds has focused on incorporating a trait that predisposes producers to using other inputs that the firm sells. It is also surely not coincidental that relatively little private sector research has been directed at applying GE to minor crops or to help farming systems adapt to changing or extreme climate conditions, because potential profits from minor or orphan crops are limited.

Although GE crop proponents do not completely ignore broad social impacts, they often address such issues only indirectly and without consideration for long-term consequences. For example, the National Research Council report referenced earlier notes that in the early stages of adoption, the use of GE corn and soybeans, along with the use of glyphosate, was associated with an increase in the use of no-till production systems. Therefore, proponents could point to farmers benefitting from reduced tillage expenses and less soil erosion. They could also list indirect benefits to the public, including improved water quality, due to the usage of a more benign chemical and reduced soil erosion. However, not all farmers are likely to share the benefits of GE crops. Large farms producing a few crops are more likely to benefit from GE crops than small, labor-intensive, and diverse farms because they are developed primarily to reduce input and labor costs within a mass-production system. A technology embedded in an agrifood system that favors a few mass-produced crops reduces the social benefits of agricultural biodiversity. Gene drift from GE crops is also a public harm because it is a type of pollution. Furthermore, the initial benefits to farmers and society of reduced tillage are likely to disappear with the spread of weeds that are glyphosate tolerant, a problem common to widespread adoption of technologies that provide pesticide and herbicide properties.

Similarly, evidence of private economic benefits, such as increased profits for agribusiness firms, is sometimes assumed to be a social benefit. Economic theory tells us that the benefits from farmer adoption of GE crops will be shared among farmers, the supply and marketing firms and the consumer. The proportions of the benefits going to the various parties are subject to determination through the markets and the parties' relative power. However, an explicit use of the concept of social equity challenges us to consider the broader distribution of economic benefits and costs. In the case of GE crops, economic benefits have become concentrated in a few firms that may have gained oligopolistic, or perhaps almost monopolistic, single firm control over crop seed markets. An analysis of change in patent ownership of GE crops between 1988 and 2008 indicates that mergers and joint ventures led to greater levels of concentration. According to an initial data analysis, multiple companies have intellectual property holdings of GE plants: 37 discrete owners of the 525 GE corn patents and 118 discrete owners of the 1013 GE non-corn patents. However, a closer analysis of changing ownership reveals that the top three firms in the GE corn category came to control 85.0% of the patents, and the top three firms in the GE non-corn category came to control 69.6% of patents. These findings indicate that there is substantial concentration of ownership of the intellectual property associated with GE crops (Glenna and Cahoy, 2009). For social equity questions related to GE dissemination to be addressed, research must address how the degree of concentration affects the portfolio of GE and non-GE cultivars available to farmers, as well as how such concentration might be reducing potential economic returns to farmers, which could affect the ability of farmers to pay higher wages to their employees.

Incorporating social dimensions to holistic analyses of GE crop dissemination would lead, for example, to analyses that move beyond the scale of adoption of GE technology in the United States and globally and into the realm of who does and does not adopt the technology, what technological goals farmers have, and whether patterns of adoption mask real or potential conflicts between adopter and nonadopters. A study of Washington state wheat growers revealed that while just over 45% of wheat farmers were highly interested in herbicide-resistant wheat, even more farmers (55%) were highly interested in specialty wheat varieties that could secure premium prices in Asian markets. In addition, a substantial number of farmers (28%), who were predominantly smaller farmers, were highly interested in perennial wheat varieties. Many farmers also expressed concerns about technology agreements they would be required to sign to plant GE wheat (Glenna, Jussaume, and Dawson, in press). These findings point to a diversity of farmer needs and interests often ignored in technology assessments that lack a social equity dimension.

In the case of GE technology, the United Nations Food and Agriculture Organization recently raised concerns that minor crops often produced by small and developing country farmers, are being neglected at the expense of research on major crops. This concern is growing as research shows that university research profiles are increasingly moving in the direction of the private sector by focusing on major crops and major traits (Welsh and Glenna, 2006).

Moving towards Social Equity

New technologies rarely alter foundational social and economic structures. Rather, existing social and economic structures help to explain much of the distribution of environmental, social, and economics risks and benefits from new technologies. In the case of GE crops, the application of the technology in the existing social context has yielded environmental benefits that may or may not continue. The rapid spread of herbicide-resistant weeds can be linked to the broad geographical adoption of GE corn and soybeans that were engineered with a single major trait within the socio-economic context of a mass production framework. The lack of diverse management strategies, including different GE options, which contributed to the rapid emergence of weed resistance, was hardly surprising in the context of U.S. corn and soybean production. Achieving the promise of GE technology for sustainable agriculture is dependent on the adoption of a more flexible and holistic approach to the development, distribution, and use of GE technology, which in turn needs to be based on holistic analysis of technology development. The future economic viability of GE technology, as well as its potential to contribute to positive environmental outcomes, will depend on understanding and addressing the socio-economic structures and variety of farm management methods present in contemporary agriculture.

The proponents of GE technology have been far too sanguine in their predictions about the promise of the technology. Although apocalyptic predictions regarding environmental and economic disasters by some opponents of GE crops have so far not been manifested, we argue that the development and adoption of GE technology has taken place in the context of an agricultural system that is economically and socially inequitable, and this has important implications for the future. Research is needed that focuses on reforming inequitable policies and practices to improve the likelihood that GE applications would contribute to a more sustainable agriculture. As part of such a process, we make the following three suggestions.

First, all relevant stakeholders from multiple levels of the agrifood system, including farmers of different classes and sizes, consumers and citizens, and agribusinesses, should be involved in a collaborative process to ensure that a diverse representation of interests and values guide the GE technology research, development, and application process. One model that might serve as a prototype is participatory plant breeding. Examples already exist of how including farmers in breeding activities and field trials can guide research agendas to become directed at using up-to-date technological approaches for solving problems that farmers face in diverse environments, rather than breeding for mass production in homogenous environments (Mendum and Glenna 2010). Such a process addresses a broader cross-section of farmer interests, promotes agricultural biodiversity, and contributes to addressing challenges that a range of farmers face.

Second, scientific breakthroughs need to be combined with experiential knowledge to overcome the limits of reductionism. As GE crop research has been focused primarily on solving problems associated with a mass-production system, GE crop researchers generally have not been widely viewed as contributing to sustainable agriculture, although there are notable exceptions. A greater focus on social equity may help to break down barriers between GE researchers and sustainable agriculture groups.

Third, GE research needs to shift from a focus on private goods to a focus that includes an emphasis on public goods. This may be achieved with intellectual property and research funding reforms. Novel intellectual property institutions could be altered to promote public researchers' access to proprietary material. Furthermore, it should be recognized that the private sector lacks adequate incentives to focus on public goods research. Public support for public research institutions must be directed at the generation and distribution of minor crops and other non-proprietary agronomic knowledge if GE crops are to generate broader social benefits.

For More Information

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