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Today's biotechnology and its issues

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Abstract

Environmental and food safety issues arise because some people think that biotechnology is ethically right, while others think it is wrong. These views are based on different predictions of the impacts of biotechnology. There are other similar issues in this regard. For example, what will be the impacts on present farmers in poor countries? How will biotechnology affect global trade? In time, these issues may disappear as we become more experienced with biotechnology and as scientists become better able to assure opponents that biotechnology provides benefits without any significant risks.

Keywords: Transgenic technology, GMO, LMO

Introduction

Increases in production and some of the ethical debate on crop biotechnology springs from the Green Revolution, a series of technology transfer initiatives including high-yield seeds, intensive irrigation techniques, herbicides, pesticides, mechanization, and petrochemical fertilizers to parts of the developing world. Some argue that the first green revolution occurred during 1840-1930 with the large transnational trade of nitrogen-rich fertilizers (Melillo 2012) ^[17]. Most commonly the green revolution is thought to have “begun in Mexico in the late 1950s, spread to Asia during the 1960s and 1970s, and continued in China in the 1980s and 1990s.” (Borlaug 2007) ^[2]. The revolution introduced new varieties and traits to crops, wheat and rice had their height reduced through the incorporation of specific genes, rice saw the incorporation of genes for photoperiod insensitivity and new varieties of wheat were selected for better adaptability to growing conditions and insensitivity (Davies 2003). Between 1960 and 2000 the proportion of hungry people in the world declined from 60% to 17%. The drawbacks of the Green Revolution are several. The increased use of fertilizers, herbicides and insecticides has led to environmental degradation and pollution (Murphy 2007) ^[18]. It is also generally accepted that The Green revolution benefited wealthier farmers who could afford fertilizers and new management methods although this is challenged by some (Fischer & Cordova 1998). Another challenge facing our agriculture is how to conduct it in a sustainable fashion. Today around 25 percent of global greenhouse gas emissions are directly caused by crop and animal production and forestry with deforestation having a severely negative impact on the climate while also being one of the greatest threats to biodiversity (FAO 2014) ^[10]. Over the past decade about 13 million hectares of forests have been converted to other land uses and mainly agriculture. Add that agriculture faces threats of water scarcity and pollution and loss of living resources and biodiversity. In order to meet the challenges of both productivity and sustainability agriculture needs reform.

Will crops developed using biotechnology save the world or trigger doomsday? From a quick glance at the debate on biotechnology and agriculture, one might get the impression that there are few possibilities in between—the debate has been characterized by a high degree of polarization (Van Haperen *et al.* 2012; cf. Gregorowius *et al.* 2012) ^[23, 13]. Those who believe in the potential of agricultural biotechnology usually refer to benefits in terms of increased yield, reduced environmental impact (Brookes and Barfoot 2008; Carpenter 2010; Mannion and Morse 2012) ^[4, 5, 16], improved farmer health (Kouser and Qaim 2011) and higher economic impacts for adopting farmers in developing countries (Finger *et al.* 2011) ^[11]. Critics of agricultural biotechnology question these benefits and raise concerns about potential risks, but they also tend to emphasize issues of social justice, for example because of dysfunctional institutions or regulatory regimes (Høyer Toft 2012), and other ethical considerations (Comstock 2000; Sandler 2004) ^[7, 20]. In many parts of the world there has been vocal opposition to the use of biotechnology in agriculture in general, and in particular to the use of genetically modified (GM) crops for food. Focus has to a large extent been on biotechnology as a risk to human health and the environment (Bauer 2005) ^[1], and it is not

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uncommon that this is combined with an argument to the effect that we know too little about the technology and that the unknowns might come back to haunt us (Smith 2007)^[21].

Crop biotechnology used in agriculture

Biotechnology' can sometimes be understood more narrowly and refer to genetic engineering that changes the genetic structure of an organism with genetic material from outside its species (transgenes). This is also known as transgenic modification and can be distinguished from intragenic modification where techniques are used to change the genetic structure by using genes from within the organism species (Myskja 2006)^[19]. If these techniques are used the product will be labeled as a GMO. Today many of the commercial products which are results of genetic modification are non-agricultural products, such as medicines and detergents. Some are industrial products used in food production, as for example GM yeast used for bakery and brewery (Dequin 2001)^[9]. Within agriculture large scale cultivation of GM crops began in the US in 1996 and have since expanded rapidly. Today GM crops cover about 11% of the worlds cultivated area with some crops being dominated by GM, for example 79% of the world soybean, 70% of all cotton, 32% of all maize and 24% of the oilseed rape (James 2013)^[14].

General Welfare and Sustainability

A central issue is whether the technology considers of the greatest good together with the concept of sustainability. While a technology can provide more food it should not be to the detriment of the environment or to human health or disrupt traditional behavioral systems. In like manner, it is an ethical issue if food that can provide more and better nutrition is not made available to those who need it most. Hence, not to use a technology that has potential to improve the quality of lives of people is also a moral issue. As an environmental issue, questions raised have to do with concerns regarding environmental protection, sustainable use of biodiversity, economic growth and social equity.

Distribution of Benefits and Burdens

A concern particularly in developing countries is the concept of just distribution. Questions have to do with whether the products produced by the technology will be able to provide for those who really need it and whether it will generate wealth for the society as a whole. A technology's ability to increase or decrease the gap between the rich and poor renders it an ethical issue. This includes allegations that products derived from modern biotechnology are being introduced by private companies that have an obligation to make profits. Also, whether a technology, while able to increase technical employment might eliminate subsistence labor as a result of replacing cultural operations. Other concerns include exploitation or control over genetic resources, consumers' choice and rights, and use of genetically modified animals. CAST (2005)^[8] suggests the need to institutionalize agricultural ethics. This involves a deliberate move to include some consideration of ethics in the actions, decisions, and policies that stakeholders in the food system create or support. Each stakeholder has to "accept the fact that that if ethical issues are going to be understood, and if ethical conflicts are going

to be resolved, it is our responsibility, within the limits of our place in the system, to understand and contribute."

Conclusion

Despite the diversity of ethical issues in agricultural biotechnology, there is a need to understand beliefs and doctrines as this allows coexistence within and across societies, and prevents social conflict. A technology's acceptance is based not only on technological soundness but also on how it is perceived to be socially, politically, and economically feasible from the viewpoint of disparate groups. An understanding of ethics helps determine what information is needed by society and how to deal with different opinions. A process of negotiation based on trust is essential to enable stakeholders to participate in debates and decision-making.

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