Economic issues in agricultural biotechnology[1]

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Abstract

The integration of biotechnology in agricultural sector becomes increasingly debatable in several countries. While many countries have realized potential benefits from adopting biotechnology in crop breeding e.g. genetically engineering technology and undoubtedly produced and exported genetically modified (GM) commodities, other countries still oppose to GM products, especially GM food. The social and economic environments are key elements shaping country's agricultural biotechnology policies. This paper will discuss major economic issues related to agricultural biotechnology. The emphasis will be on inconsistencies of international regulations adopted by different countries such as Codex Alimentarius and Cartagena Protocol on Biosafety, which have resulted in several international trade disputes.

Introduction

Biotechnology covers a wide range of technologies and applications. In this paper, I will focus only on biotechnology applications in agricultural sector or green biotechnology. Although the applications of biotechnology in crop breeding include marker-assisted selection and tissue culture, this paper will address issues related to modern biotechnology, specifically genetic engineering technology. The issues of GM crops are global debates due to differences in public acceptance which resulted in different policies and regulations among countries.

The first commercialization of genetically modified (GM) commodities started in 1996. Fifteen years later, in 2010, 29 countries have adopted GM crops, accounted for over one billion hectares of production area. Among the non-adopted countries, 30 of them have approved the imports of GM crops. Four major adopted GM crops, in terms of production areas, are soybean, maize, cotton, and canola, respectively, and common GM traits are insect-resistant, herbicide-tolerant, and virus-resistant. The largest shares of planted GM crops to total crop production areas are soybean (81%), cotton (64%), maize (29%), and canola (23%) (James 2010). All countries in North American continent have adopted GM crops; whereas a vast majority of Middle East countries and Russia have not. Egypt, Burkina Faso, and South Africa are only three GM adopting countries in African continent. Similarly some countries in Europe and Asia have adopted GM crops while others have not. GM maize has been adopted in several European countries including Spain, Portugal, Chez Republic, Poland,

Slovakia, and Romania while Sweden and German recently adopted GM potatoes. Despite more challenges in food security issue, Asian countries including China, India, Pakistan and Myanmar adopted GM cotton, but no other GM food crops (except for China). Not only that these countries differ in their GM-related policies, but also their economic and social environments which may strongly influence the GM policies themselves.

Economic issues in agricultural biotechnology

Apart from scientific issues of biotechnology, there are numerous social and economic aspects that shape GM policies in each country. Economic interests are irrefutable one important factor influencing the GM policies. One of the most important policy questions is whether a country should adopt or not adopt GM crops. To answer this policy question, it is rather more complex than economic reason, but still a key motivation in addition to cultural and ethical reasons. In theory, ex-ante economic impact analysis will provide a prospect answer to a country's well-being from adopting GM crops. When a country's economic surplus (measured as the summation of consumer surplus, producer surplus, and government revenue) of adopting GM crop is greater than otherwise, it suggests GM adoption policies, and also vice versa. Frequently the economic justification of a country as a whole is different than those of a particular stakeholder, and the policy outcomes of many countries depend largely on those who have political authority.

Numerous studies show evidences of economic impacts from GM crops adoption on various stakeholders and on industry or country as a whole. A comprehensive review of literatures on economic impact of GM adoption can be found in Brookes & Barfoot (2005) and Smale et al. (2009). Main findings are that there are economic advantages for GM adopting farmers from yield improvement and cost reduction (e.g. reduced labor and herbicide use); nevertheless, not all farmers benefit from GM adoption depending on seed prices, farm practices, and severity of production problems. Consumer's preference and acceptance towards GM products, e.g. evaluated by their willingness-to-pay, will reflect their demands for GM products. Consumer's acceptance of GM products does vary by countries and by their demographics. As a result, the availability of GM products in the market will affect consumers differently depending on their demand. There are significant differences in GM perception and acceptance among countries, notably European countries and Japan are opposing to GM products while the US, China, and India are in favor of them (Gaskell 2000; Harrison et al. 2004; Smale et al. 2009).

A macro perspective on GM adoption covers broader impacts on the sector and impacts of international trade. A partial equilibrium or general equilibrium approach is generally used to analyze the macro impact of GM commodities. Readers could find plenty of references on

several studies on impacts on sectors and international trades from Smale et al. (2009). It is worth mentioning that every case is different depending on the size of the country (large vs small; a large country implies market power influencing world price), import or export commodity, food or non-food crops, domestic demand and supply elasticities, and the technology itself (e.g. yield advantages, seed price premium, factor cost saving).

Despite evidences of positive impacts of GM crop adoption, there are also several oppositions to GM technology; those include uncertain risks to human health, animals, and environment, unethical beliefs, and market consolidation of agricultural biotechnology. Howard (2009) found that there is a large degree of consolidation in GM seed market. There are six major life science companies that dominate in the GM seed market, namely Monsanto, Dupont, Syngenta, Bayer, Dow, and BASF. These six companies control 98% of GM market and 70% of pesticide market in 2000 (International Forum on Globalization 2010) will have a monopoly (oligopoly power to be precise) power to control the price and create high barrier to entry. Despite the monopolistic power in the seed market, it does not necessarily generate welfare loss, particularly when an improved technology generates higher yield benefits.

Other economic issues related to GM products involve the economic behaviors of stakeholders and the market of GM products such as R&D investment, intellectual property rights, market structures, market segregations, coexistence, labeling regulations, risk assessment, trade policy, food security, just to name a few.

Inconsistence of international regulations of GM products

Economic interests of a particular country mentioned above do vary, but what makes the issue of GM products more complex in the international context is the inconsistency of international regulations. GM regulations in many countries are driven by risk and benefit perceptions which are considerably different among countries. There are two main international trade frameworks in the context of GM commodity trade. The WTO framework is about scientific evidence which is not specific to biotechnology or GM products; whereas the Cartagena Protocol on Biosafety specifically targets at GM commodities on the socioeconomic and environmental considerations. These two frameworks appear to be inconsistent.

Trade agreements related to GM products under WTO framework include Sanitary and Phytosanitary Measures (SPS), Technical Barriers to Trade (TBT) and the General Agreement on Tariffs and Trade (GATT), and Trade-Related Aspects of Intellectual Property Rights (TRIPS). To provide international consistency in the assessment of GM products, in 2003 the Codex Alimentarius Commission (a joint program of WHO and the FAO) provides

food safety guidelines using the ‘substantial equivalence’ concept. The Codex assessment guidelines are based on scientific data such as chemicals, toxicological, and nutritional evaluations of the GM products and their conventional counterparts (Codex Alimentarius 2009). If GM food can be demonstrated to be substantially equivalent to existing food or food counterpart, it can be regarded as being as safe as its counterpart. Codex principles do not have a compulsory effect on national legislations, but are referred to and often used as a reference in the case of trade disputes (World Health Organization 2005).

On the other hand, the Cartagena Protocol on Biosafety entered into force in 2003 under the Convention on Biological Diversity. The main principle of Caragena Protocol is the ‘precautionary approach’ which establishes the right of a country to take into account socio-economic considerations arising from the impact of GM products on the conservation and sustainable use of biodiversity, especially with regard to the value of biodiversity to indigenous and local communities, and the lack of scientific evidences shall not prevent a country from taking a decision, as appropriate, with regard to the import of GM products in order to avoid or minimize such potential adverse effects (Zarrilli 2005).

Because the Cartagena Protocol and WTO agreements which commonly take Codex Alimentarius as a reference put emphasis on different grounds, the trade of GM products is likely to be arguable. If the WTO members involved in the dispute are both parties to the Cartagena Protocol, its provisions may be used as an instrument in interpreting WTO provisions, or as the applicable law. However, it will be up to the WTO panels to decide how much legal weight they wish to give to the provisions of the Protocol. If only one disputing member is a party to the Cartagena Protocol, the protocol could not be used as applicable law, but it may still play a role as proof of certain factual circumstances or as an instrument to interpret WTO treaty terms (Zarrilli 2005).

Noticeably major producers and traders of GM commodities such as Argentina, Australia, Canada, Chile, the US and Uruguay do not ratify to Cartagena Protocol while GM opposing countries such as the EU, Japan, South Korea, and most developing countries do.

There have been four GM trade disputes filed for WTO consultation. First was the import restriction of canned tuna fish in soybean oil from Thailand to Egypt in 2000. The other three cases were technical trade barriers (TBTs) against biotechnology products complained by Argentina, Canada, and the US against the EU in 2003. WTO found the EU inconsistent to sanitary and phytosanitary standards (SPS) in the case between the US and the EU, and resulted in the authorization to retaliate in 2008. The cases complained by Canada and Argentina were later terminated due to mutual agreements (World Trade Organization 2011).

Conclusion

Economic interest plays an important role in shaping a country's policies and regulations on GM products. Stakeholders in the GM market generally have diverge interests. While a country decide on its appropriate GM policies, the policy outcomes frequently favor some parties, but not the others. The inconclusive international agreements on GM products further create disputes among trading partners of different socioeconomic backgrounds. It is hoped that the existence of GM products in the world market will generate its utmost benefits to those who may need them without creating conflicts among countries.

Notes

1. Prepared for the 10th Annual IAS-STS Conference, Graz, Austria. 2-3 May 2011.

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