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GMO- TWO DECADES AFTER THE FIRST COMMERCIALISATION

Abstract

Regarding transgenic plants growth and food derived from genetically modified organisms (GMO) there is a large disagreement about its environmental and health adverse effects as well as about socio-economic implications. In the spirit of the general debate which is not slowing down, in this work we have analysed some indicators and consequences of the transgenic technology diffusion. Our work showed that biotechnology industry successfully recovered from 2008 recession, even the industry for the first time operated without losses, Also, it has been shown that the economic crisis contributed to the further strengthening of the monopoly power of the biggest companies. Bearing in mind, technological underdevelopment as well as fact that small companies collapsed during the crisis it is clear that Serbia cannot compete with multinationals at the biotech market.

***Key words**: transgenic plants, monopoly, recession*

JEL Classification: Q 18, G32, G10

ГМО- ДВЕ ДЕЦЕНИЈЕ НАКОН ПРВЕ КОМЕРЦИЈАЛИЗАЦИЈЕ

Апстракт

Постоји велико неслагање о економским, здравственим и друштвено-економским импликацијама узгоја трансгених биљака и хране проистекле од генетски модификованих организама (ГМО). У духу опште дебате, у овом раду смо анализирали одређене индикаторе и последице дифузије трансгене технологије. Показано је да се биотехнолошка индустрија успешно опоравила од рецесије, чак и да је по први пут пословала без губитака. Такође, показано је да је светска економска криза допринела даљем јачању монополских позиција највећих компанија. Имајући у виду технолошку неразвијеност, као и чињеницу да су мале компаније страдале у рецесији јасно је да Србија не може да конкурише мултинационалним компанијама на биотехнолошком тржишту.

***Кључне речи:** трансгене биљке, монопол, рецесија*

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Introduction

Although a food obtained from genetically modified (GM) plants is already involved in a food market chain, public debate on the issue is not slowing down. There is a large disagreement about environmental and health adverse effects as well as about socio-economic implications. The key areas of controversy related to GM food are: risk of harm from GM food, whether GM food should be labelled, the role of government regulators, the effect of GM crops on the environment, the impact of GM crops for farmers including farmers in developing countries, the role of GM crops in the feeding growing world population, and GM crops as a part of the agribusiness (Brankov Papic & Lovre, 2013a).

From the very beginning this technology was launched under the slogan of reducing the number of hungry people worldwide. Still, advocates of GM technology retain this slogan, saying what had happened before placement of this technology and what will happen in the coming decades. Their arguments are: "Global population, which was only 1.7 billion at the turn of the century in 1900, is now 7.2 billion, expected to climb to 9.6 billion by 2050, and will be close to 11 billion at the end of this century in 2100. Globally, 870 million people are currently chronically hungry and 2 billion are malnourished. To-date, biotech cotton in developing countries such as China, India, Pakistan, Myanmar, Burkina Faso and South Africa has already made a significant contribution to the income of 16.5 million small resource-poor farmers in 2014" (James, 2014). The relevant information to and how this technology has so far contributed to poverty reduction cannot be found in the existing literature. Their comments are generalized, promising, optimistic but not real. In accordance with the advice of public relations industry they frequently used terms such as: "transparency", "profit sharing", "dialogue", "help farmer", "has the potential", "it will contribute" and so on (Brankov Papic, 2013a, p. 50). For instance, multinational companies have not yet commercialized Golden Rice they're talking about more than a decade. Golden Rice has the potential to provide beta carotene fortified carbohydrate staple in order to combat vitamin A deficiency (VAD), the leading cause of childhood blindness and inability of the immune systems to combat disease. **WHO reports in 2009 and 2012 that 190 to 250 million preschool children worldwide are still affected by VAD annually (http://whqlibdoc.who.int/publications/2009/9789241598019_eng.pdf , http://www.iapb.org/vision-2020/what-is-avoidable-blindness/vitamin-A).**

On the other side, critics accuse multinational corporations the producers of GM crops of attempt to impose "food totalitarianism" on the world. "We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly nor economically beneficial to us. We do not believe that such companies or gene technologies will help our farmers to produce the food that is needed in the 21st century. On the contrary, we think it will destroy the diversity, the local knowledge and the sustainable agricultural systems that our farmers have developed for millennia, and that it will thus undermine our capacity to feed ourselves" (Statement signed by 24 delegates from 18 African countries to the United Nations Food and Agricultural Organization in 1998) (http://www.globalresearch.ca/lies-and-fabrications-the-propaganda-campaign-in-support-of-genetically-modified-crops-gmo/5433062?print=1).

In the spirit of the general debate, in this work we have analysed some indicators and consequences of the GM technology diffusion.

Biotech crops diffusion

2014 was the 19th year of commercialisation of biotech crops, 1996-2014, when growth continued after remarkable 18 years increases. A record 181.5 million hectares of biotech crops were grown globally in 2014, at an annual growth rate of between 3 and 4%, up 6.3 million hectares from 175.2 million hectares in 2013. A 107-fold increase in GMO area from 1.7 million hectares in 1996 to 181.5 million hectares in 2014 makes its diffusion very impressive (Table 1).

Table 1.Global area of biotech crops 1996-2014

Year	***1996***	***1997***	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Area (million hectares)	1.7	11.0	27.8	39.9	44.2	52.6	58.7	67.7	81.0	90.0
Year	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***
Area (million hectares)	102.0	114.3	125.0	134.0	148.0	160.0	170.3	175.2	181.5	-

Source: James 2008, 2012, 2014

From the very beginning the U.S. are the absolute leader in the production. In the first year, 1996 U.S. accounted for more than 88% in the total production area. U.S. involvement has gradually decreased with the inclusion of other countries. In 2014, U.S. participation in the total area surface was around 40%. Today's area division is as follows: Latin American, Asian and African farmers collectively grew 96 million hectares or 53% of the global biotech hectares compared with industrial countries at 85 million hectares or 47%. In the long term, this trend is expected to continue despite different kind of resistance to the spread of this technology in developing countries. For example, **Bangladesh, one of the smaller and poorest countries in the world, approved and commercialized Bt brinjal in record time in 2014 because of** strong political will and support from the government, particularly from the Minister of Agriculture M.Chowdhury. Previously this crop has been rejected by India and Philippines citing lack of 'scientific certainty' on health and ecological safety. Giving in mind this a pivotal moment for GM technology in south Asia, important as an exemplary model for other small poor countries, the U.S supported this project through their agencies. Pilot scheme (US$ 600.000) owned and run by a Bangladesh Agricultural Research Institute (Bari) with support from USAID and Cornell University (http://www.theguardian.com/environment/2014/jun/05/gm-crop-bangladesh-bt-brinjal).

The greatest diversification of GMO production occurs in U.S. This country produces: maize, soybean, cotton, canola, sugarbeet, alfalfa, papaya and squash. China produces six different biotech crops: cotton, papaya, poplar, tomato, sweet pepper on 3.9 million hectares, while Canada produces four different GMOs: canola, maize, soybean,

sugar beet on the area of 11.6 million hectares. Brazil, Argentina and South Africa are producers of soybean, maize, cotton. Most other countries produce one or two crops. The most important GM crop is soybean, accounting for almost 50% of the total acreage. **GM soybean share** in the total soybean acreage is 100% in Argentina and Uruguay, 93% in the U.S., 92% in Brazil, 91% in Bolivia and 90% in Canada. The second most important GM crop is maize. Unlike GM soy that has built only one GM trait herbicide tolerance, GM maize are created to be tolerant to herbicides and/or resistant to insects. Global adoption rate for transgenic corn was 32% in 2013. 98% of corn originated from Canada is GMO. 90% of corn in U.S., 82% in Brazil and 80% in Argentina is obtained through genetic engineering

(http://www.gmocompass.org/eng/agri_biotechnology/gmo_planting/342.genetically_modified_soybean_global_area_under_cultivation.html).

In terms of trait the most widely used commercial GM traits are herbicide tolerance and insect resistance (Brankov Papic, 2013). Currently, two herbicide resistant cropping systems are common for soybean, maize, rapeseed, and cotton: *Roundup Ready* (active agent: glyphosate) and *Liberty Link* (active agent: glufosinate). Pest resistant transgenic plants, "Bt" plants produce Bt toxin on their own so they can defend themselves against specific types of insects. This means farmers no longer have to use chemical insecticides to control certain insect problems. Although at first glance these technologies are attractive, a reason for concern lies in the fact that the same multinationals produces GM crops and equivalent herbicides to which the plants are tolerant as well as held patent rights to these properties and technology (Brankov Papic, 2013).

Biotech Transnational Corporations

Transnational agrochemical companies have been transformed through buying of seed companies, (at the beginning in industrial countries and, afterwards, through buying in developing countries) into leading edge "life science" companies like Du Pont, Syngenta, Aventis (nowadays known as Bayer CropScienece), Monsanto and Dow. The adaptation of agreement on all aspects of trade in services and intellectual property (TRIPS) on the Uruguay Round, which is mandatory for all World Trade Organization (WTO) members to protect patents of biotech discoveries (products and processes) and plant varieties, for the first time assumes legal measures in protection of intellectual property giving strong stimulus to private sector investments into the biotechnology. The result: five transnational corporations are in possession of 71% agricultural biotechnological patents worldwide. Monsanto is the major owner of GM soya bean, GM cotton and canola gen which is resistant to glifosat herbicide, Bayer CropScience possesses patent over all GM plants which have Bt toxin insecticide and Syngenta has the exclusive license on Golden Rice. Monsanto is the most important biotech company, which crated almost all crops placed in to the market worldwide resistant to glifosat herbicide with Roundup Ready trade mark and the majority of Bt crops (New Leaf, Bollgard, Yieldgard) (Brankov Papic& Lovre, 2008). In 2007, glyphosate was the most used herbicide in the US agricultural sector, 82,000 to 84,000 tonnes applied (http://www.epa.gov/opp00001/pestsales/).

The private sector has so far developed all GM crops, except crops in China who have developed by national research centers (Brankov Papic & Lovre, 2011). Companies

protect their own market position binding farmers by contract on an annual level for all and each seed supply, in reference they forbid them to keep the seed and lead each contract breaker right into the court (Brankov Papic & Lovre, 2010).

The special danger lies in fact that the majority of GM crops are controlled by several great companies. It seems that these transnational corporations don't gather monopole based profits in the absence of competition and effective regulative there are no guaranties that it will not happen in the future (FAO, 2004). In that sense we have analysed financial and economic performances of the biotech industry.

Financial and economic performances

Like the rest of the global economy, the biotech industry in the late 2008, faced with the global economic crisis. The crises had surprised many market players, especially hit main capital sources for biotech industry- investment banks and hedge funds. As a consequence of this turbulences available capital in the USA and Europe was dramatically reduced compared to 2007, from 29.5 billion to 15.9 billion US$ (by 38.7% in the USA and 66.2% in Europe). As presented in Table 2 biotech industry successfully restore investor confidence in the following years. Except for differences between U.S. and Europe in the size of capital raised (4 to 5 times less in Europe), there are also significant differences in its structure. For example, in the USA in the last observed year IPOs accounted for 12.9% in the total capital, while in Europe almost 3 times less (4.5%). Significance of follow-on and other sources and debt is quite similar in both regions. Venture capital participation is higher in Europe than in USA. The fall of US biotech companies from 2011 was driven by a decline in debt financing (from 19.8 billion to US$10.3 billion in 2013). Contrary, in Europe in the same period debt financing increased by 6 times, thanks to certain transaction among other transaction done by relocation of Jazz Pharmaceuticals headquarters from the US to Ireland in January 2012.

Table 2. Capital raised in North America and Europe by year (US$m)

	US											
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013***
IPOs	456	448	1.565	697	1.133	1.241	6	697	1.097	814	765	3.264
Follow-on and other	1.603	4.262	6.264	5.362	7.594	5.709	3.228	7.226	4.136	4.846	6.620	7.401
Debt	4.553	6.558	4.395	5.602	7.951	8.877	5.626	4.916	11.504	19.773	11.768	10.277
Venture	1.979	2.756	3.244	3.839	3.856	5.932	4.458	4.664	4.406	4.245	4.126	4.311
Total	8.590	14.054	15.469	15.499	20.534	21.759	13.317	17.503	21.144	29.678	23.279	25.253
	Europe											
IPOs	136	36	454	995	853	1.021	111	143	219	43	40	254
Follow-on and other	126	1.769	2.196	1.587	3.141	4.600	872	1.892	1.792.	1.134	948	1.541
Debt	63	39	24	100	279	319	108	654	396	393	1.934	2.446
Venture	1.259	1.064	1.860	1.776	1.872	1.821	1.531	1.091	1.371	1.321	1.243	1.474
Total	1.585	2.908	4.534	4.459	6.146	7.761	2.622	3.779	3.778	2.891	4.164	5.715

Source: Ernst&Young (2013), *Ernst&Young (2014)

From the early beginning the biotech industry has consistently delivered double-digit revenue growth. This trend has changed for the first time in 2007 when a new safety-related warning occurs. Similarly, R&D expenditures declined by 21% in 2009 and have never reached fast growth as it has (Table 3). As a response to a recession, biotech industry has reduced cash burn, laid off more than 10.000 employees, has closed non-profit companies, formed new strategic companies as well as offered secondary shares (Brankov Papic & Lovre, 2010). Thanks to these measures the industry for the first time operated without losses, — from a US$1.8 billion net loss in 2008 to a US$3.7 billion net profit in 2009. In the last observed year, 2013, the biotechnology industry gained 4.3 billion net income.

Table 3. Growth in established biotechnology centres (US$b)

Public company data	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Revenues	80.3	86.8	79.1	84.6	83.1	89.8	98.8
R&D expense	26.9	28.7	22.6	22.8	24.0	25.3	29.1
Net income (loss)	(3.1)	(1.8)	3.7	4.7	3.8	5.2	4.3
Number of employees	-	186.820	176.210	178.750	161.560	165.190	178.850
Number of public companies	815	700	622	622	610	598	616

Source: Ernst&Young (2009), Ernst&Young (2014)

Despite the recession, financial performance of the most important biotech agricultural company, Monsanto (http://www.monsanto.com/investors/pages/financial-highlights.aspx) indicate a stable and constant growth. The company net sales has increased two times during the period 2007-2014, from 8.3 billion to 15.9 US$ billion a year. Also, net income has increased almost 3 times, from 993 million to 2.7 billion $US. Net sales increased US$994 million in fiscal year 2014 from 11 percent of net sales in fiscal year 2014 from fiscal year 2013. Their Seeds and Genomics segment net sales increased by $400 million, while Agricultural Productivity segment increased by $594 million (http://www.monsanto.com/investors/documents/annual%20report/2014/2014_monsanto_annualreport.pdf).

Global values of transgenic seeds were nearly US$ 15.7 billion in 2014. The same value goes to biotech crops which represents 22% of the US$ 72.3% global crop protection market and 35% of the global seed market (http://www.marketsandmarkets.com/Market-Reports/transgenic-seeds-market-63068971.html).

Serbia- current position and way forward

As a result of the Biotech Law adopted in June 2009, Serbia does not produce GMO crops and there is no biotechnology varieties permitted for imports to Serbia. The current law regulates only conditions for the contained use, research activities, and field trials of biotech products under the strict control of the state. There is a strict and detailed application process for obtaining a permit for transgenic research (Brankov Papic, 2013). There are no economic motives for producing this food in Serbia. Serbia's rural

areas are featured of traditional farming, and 55% population live in this area. Major players in seed production are two semi-state owned institutes controlling over 60% of the country maize seed market (Van Berkum & Bogdanov, 2012). But, Serbia is under constant pressure from the international community to amend the Law on GMOs. It is a condition to join as a member the World Trade Organization (WTO). Serbian politicians are sending mixed signals on this issue.

In the meantime, the anti-GMO campaign in Serbia included a large number of organizations and individuals, but two are the leading: Green and Dveri Movements. On May 2013, Serbia was one of 40 countries that have organized protest against Monsanto. The rallies are organized by "March Against Monsantno" movement, and it is estimated that about 200,000 activists was participated the massive campaign which includes 6 continents, 40 nations, and at least 48 U.S. countries. In Serbia, the protest was held in Belgrade on the Main Square, Novi Sad on the Square of Freedom and in Nis on the Square of King Milan. Acknowledged university professors spoke about the negative effects of GMO seeds, food for the health of people as well as the Serbian economy, specifically. So far, 122 municipalities in Serbia have made "a declaration against GMOs," which is the local government declared its territory for GMO-free zones, including cultivation, import and trade.

In this way the Serbian public had declared about GMOs, but pressures do not abate. Because of that it can be anticipated- Serbia will adopt amendments to the GMO Law. In that case the fight against GMO should continue by establishing a proper system of food chain control with proper labelling. Also, movement activities to combat GMOs should continue so as not to allow citizens to sink into passivity.

Conclusion

Despite resistance and recession transgenic technology continues to spread. A 107-fold increase in GMO area from 1.7 million hectares in 1996 to 181.5 million hectares in 2014 makes its diffusion very impressive. Biotech crops today represent 22% of the global crop protection market and 35% of the global seed market value. Thanks to appropriate measures biotech industry as a whole came out of the minuses and continued financial strengthening. The industry profit rose from a US$1.8 billion net loss in 2008 to a US$3.7 billion net profit in 2009. In the last observed year, 2013, the biotechnology industry gained 4.3 billion net incomes.

Serbia is at a crossroads decisions amend the law on GMOs, as required by the international community or not. There is a strong public rejection of GMOs expressed in the signing of a declaration. Apart from majority will economically speaking Serbia significantly lags behind advanced transgenic technology and does not have the capacity to function in a patented world. That's why must find a way to resist pressure from the international community. In this sense all the activities of anti GMO campaign are most welcome.

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