Institute of Genetics and Cytology of the National Academy of Sciences of Belarus
National Co-ordination Biosafety Centre

Belarus Experience in Public Education and Awareness of Biosafety Issues

(10th Anniversary of the Cartagena Protocol on Biosafety)

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International Conference «Experience Sharing in Public Education and Awareness of Biosafety Issues»
Minsk, 1 October 2013

Introduction

The main task of the National Co-ordination Biosafety Centre (NCBC) is to provide the scientific information concerning the achievements in genetic engineering for Belarus citizens. The short description of the activity for the last four years is presented below to express NCBC aspiration to deliver as more information as possible concerning GMOs and the National Biosafety System as a tool for regulation of GMO market turn-over and GMO use in the food industry.

Interaction with the mass-media

Four press-conferences have been held at the National Press-Centre of the Republic of Belarus (2010, 2013) and during the scientific events organized by NCBC in 2011.

In 2010–2013 the NCBC personnel granted over 30 interviews, and all of them have been published in the central newspapers of the Republic of Belarus (“Soviet Belorussia–Belarus Today”, “Republic”, “Minsk Courier” and so on). NCBC specialists were invited by the local radio stations (“Radius FM”, “Radio Belarus” and other ones) and national and international TV channels (e.g., NIS TV “MIR”, Belarus Channels “Belarus-1”, “ONT”) for discussion of GMO problems and national regulation mechanisms of the genetic engineering activity. Information published by the Telegraph Agency BELTA has been disseminated through Internet.

Interaction with secondary schools and universities

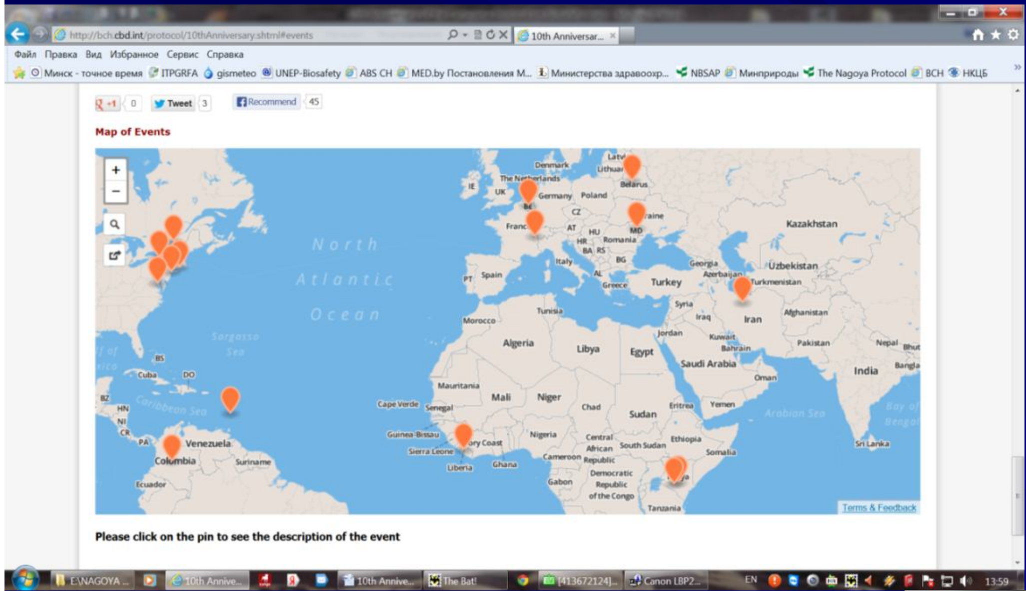
Dissemination of the objective information in regard to GMOs among school teachers, pupils and students is considered by us as a main way for education and enlightenment of all Belarus public. Three articles were published in 2011–2013 on scientific bases of GMO development and detection of the genetically modified ingredients in foodstuffs and feed, and real and mythical GMO effects on human health and the environment (the methodological journals for teachers “Biology: Education Problems” and “Biology & Chemistry”). NCBC personnel delivered several lectures on GMO and biosafety problems to university students and one lecture has been delivered to students of secondary schools at the National Health and Education Center for Children “Zubryonok” in 2010–2013.

NCBC book and tutorial publications (2004 – 2013)

Belarus experience sharing

An article on the Belarus experience of engaging and empowering the media to promote biosafety awareness was published in the international online journal «Biosafety Protocol News» (http://www.cbd.int/doc/newsletters/bpn/bpn-10-en.pdf).

10th Anniversary of the Cartagena Protocol on Biosafety
Map of the events



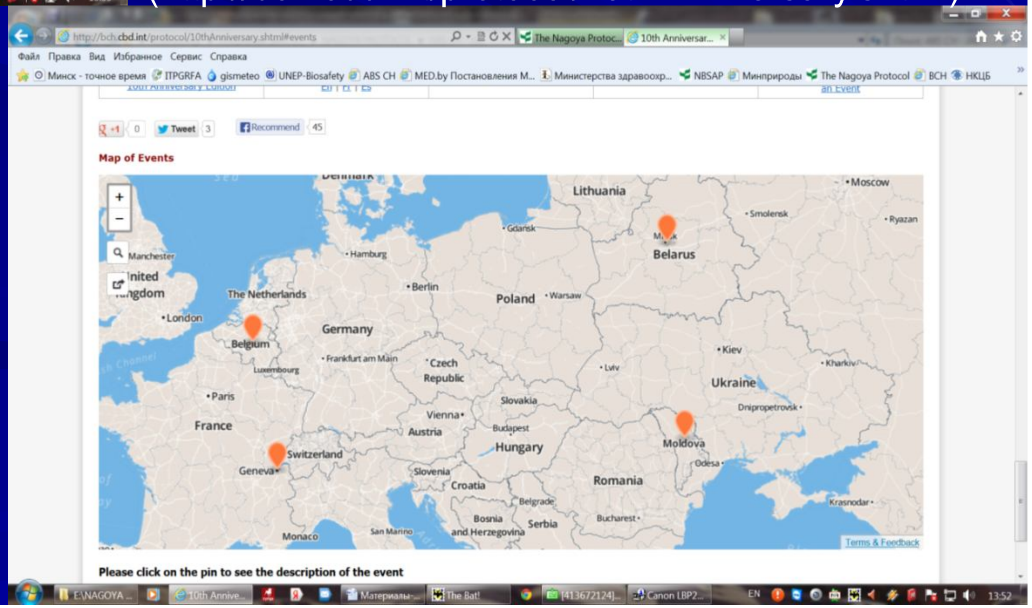
We prepared a video clip about the Belarusian experience in public awareness on biosafety issues at request of the Secretariat of the Convention on Biological Diversity (http://bch.cbd.int/protocol/10thAnniversary.shtml).


ВЕДЫ

На страже биобезопасности

UNEP

The newspaper «Vedy» (Knowledge) published an article "On Guard for Biosafety“ (September). An article “10th Anniversary of the Cartagena Protocol on Biosafety in Belarus” is prepared for October issue of the journal “Nauka i Innovatsii” (Science & Innovations”.



What do we tell the public about?

- How did the ”era of GMOs“ begin?
- Sharing the areas under GMOs.
- GMOs advantages and prosperity.
- Probable disadvantage effects of GMOs on human health and the environment.
- The negative effects of modern biotechnology, real and mythical.
- National biosafety system of Belarus.
- Belarusian research in the field of genetic engineering.
- GMO-containing product detection and labeling in Belarus, etc.

How did the ”era of GMOs“ begin?

First transgenic plants were developed by recombinant DNA technology in 1982 by scientists from the Institute of Plant Industry in Cologne (Germany) and the biotech company Monsanto (USA). Monsanto Company began to grow edible firstborn genetically engineered tomato "Flavr-Savra" on an industrial scale in 1994. Unlike their conventional varieties, it could be stored for months in a cool room in green, and in the warm became ripe. This is a useful feature due to cold resistance gene, introduced into tomato genome by genetic engineering from flounder.

Sharing the areas under GMOs

According to the International Service for the Acquisition of Agri-biotech Applications (ISAAA, http://www.isaaa.org), 2012 marked an unprecedented 100-fold increase in biotech crop hectarage from 1.7 million hectares in 1996 to 170.3 million hectares in 2012 (11.5% of the planet farmlands).

The five leading developing countries in biotech crops - China and India in Asia, Brazil and Argentina - in Latin America, and South Africa on the continent of Africa collectively occupy 78.2 million hectares (46% of global) and together represent ~40% of the global population of 7 billion.



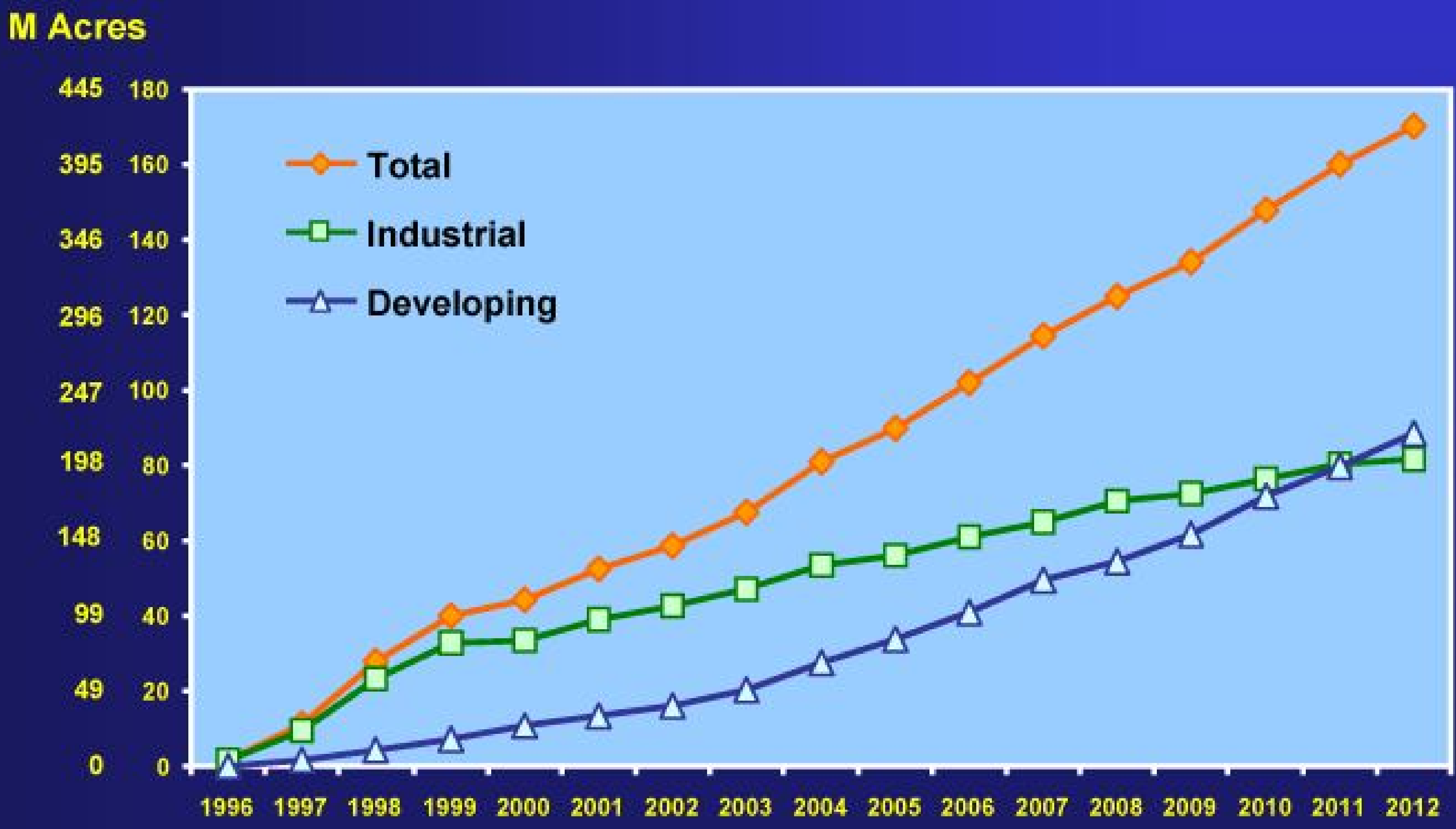


GMOs advantages and prosperity

From 1996 to 2011, biotech crops contributed to Food Security, Sustainability and Climate Change by:

- increasing crop production valued at US$ 98.2 billion;
- providing a better environment, by saving 473 million kg of pesticides;
- in 2011 alone reducing CO_2 emissions by 23.1 billion kg, equivalent to taking 10.2 million cars off the road;
- conserving biodiversity by saving 108.7 million hectares of land;
- and helped alleviate poverty by helping >15.0 million small farmers, and their families totalling >50 million.

Global Area of Biotech Crops, 1996 to 2012: Industrial and Developing Countries (M Has, M Acres)



Source: Clive James, 2012

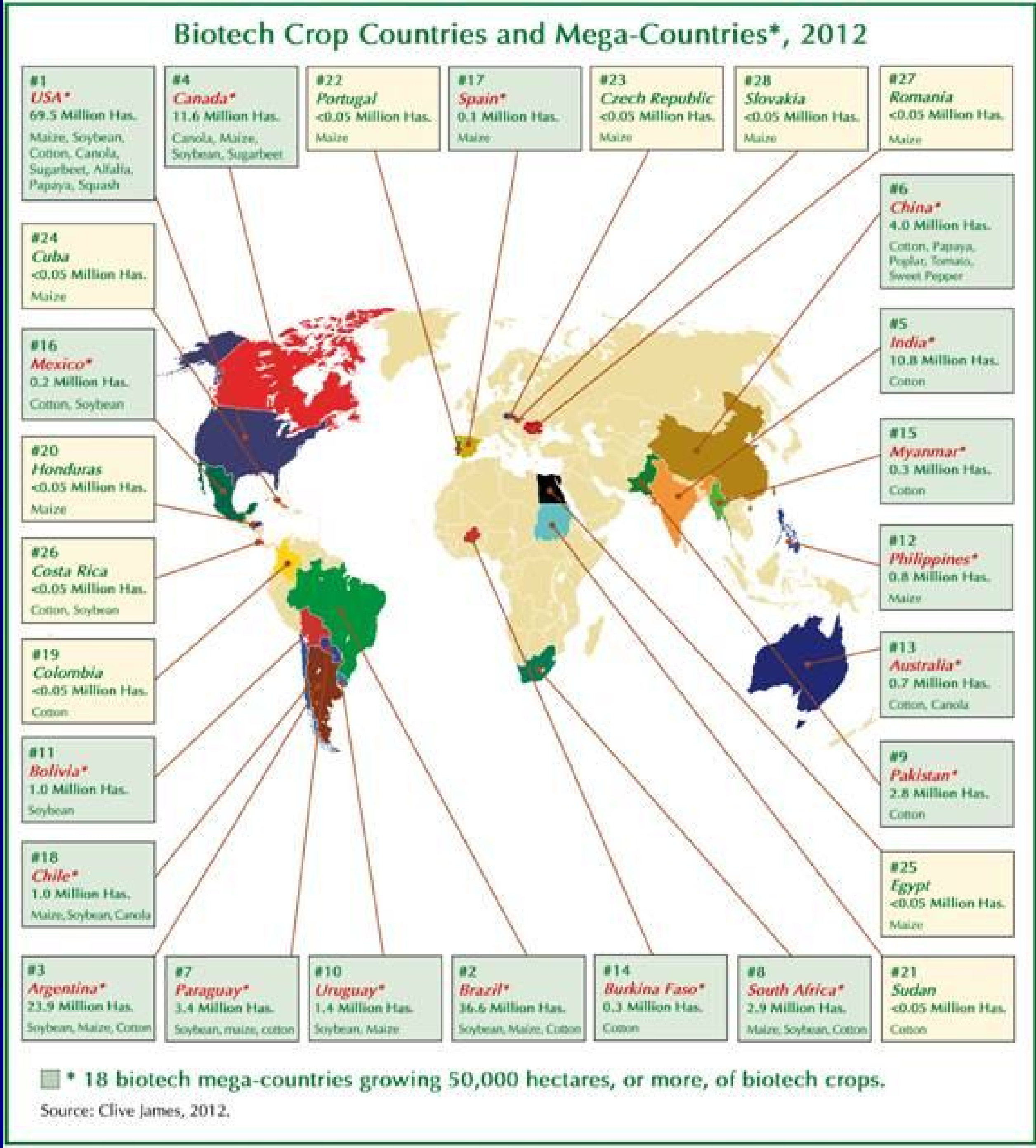


Figure 1. Global Map of Biotech Crop Countries and Mega-Countries in 2012

Table 1. Global Area of Biotech Crops in 2011: by Country (Million Hectares)**

Rank	Country	Area (million hectares)	Biotech Crops
1	USA*	69.0	Maize, soybean, cotton, canola, sugarbeet, alfalfa, papaya, squash
2	Brazil*	30.3	Soybean, maize, cotton
3	Argentina*	23.7	Soybean, maize, cotton
4	India*	10.6	Cotton
5	Canada*	10.4	Canola, maize, soybean, sugarbeet
6	China*	3.9	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay*	2.8	Soybean
8	Pakistan *	2.6	Cotton
9	South Africa*	2.3	Maize, soybean, cotton
10	Uruguay*	1.3	Soybean, maize
11	Bolivia*	0.9	Soybean
12	Australia*	0.7	Cotton, canola
13	Philippines*	0.6	Maize
14	Myanmar*	0.3	Cotton
15	Burkina Faso*	0.3	Cotton
16	Mexico*	0.2	Cotton, soybean
17	Spain*	0.1	Maize
18	Colombia	<0.1	Cotton
19	Chile	<0.1	Maize, soybean, canola
20	Honduras	<0.1	Maize
21	Portugal	<0.1	Maize
22	Czech Republic	<0.1	Maize
23	Poland	<0.1	Maize
24	Egypt	<0.1	Maize
25	Slovakia	<0.1	Maize
26	Romania	<0.1	Maize
27	Sweden	<0.1	Potato
28	Costa Rica	<0.1	Cotton, soybean
29	Germany	<0.1	Potato
	Total	160.0	

* 17 biotech mega-countries growing 50,000 hectares, or more, of biotech crops
** Rounded off to the nearest hundred thousand

Source: Clive James, 2011.

Table 1. Global Area of Biotech Crops in 2012: by Country (Million Hectares)**

Rank	Country	Area (million hectares)	Biotech Crops
1	USA*	69.5	Maize, soybean, cotton, canola, sugarbeet, alfalfa, papaya, squash
2	Brazil*	36.6	Soybean, maize, cotton
3	Argentina*	23.9	Soybean, maize, cotton
4	Canada*	11.6	Canola, maize, soybean, sugarbeet
5	India*	10.8	Cotton
6	China*	4.0	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay*	3.4	Soybean, maize, cotton
8	South Africa*	2.9	Maize, soybean, cotton
9	Pakistan*	2.8	Cotton
10	Uruguay*	1.4	Soybean, maize
11	Bolivia*	1.0	Soybean
12	Philippines*	0.8	Maize
13	Australia*	0.7	Cotton, canola
14	Burkina Faso*	0.3	Cotton
15	Myanmar*	0.3	Cotton
16	Mexico*	0.2	Cotton, soybean
17	Spain*	0.1	Maize
18	Chile*	<0.1	Maize, soybean, canola
19	Colombia	<0.1	Cotton
20	Honduras	<0.1	Maize
21	Sudan	<0.1	Cotton
22	Portugal	<0.1	Maize
23	Czech Republic	<0.1	Maize
24	Cuba	<0.1	Maize
25	Egypt	<0.1	Maize
26	Costa Rica	<0.1	Cotton, soybean
27	Romania	<0.1	Maize
28	Slovakia	<0.1	Maize
	Total	170.3	

* 18 biotech mega-countries growing 50,000 hectares, or more, of biotech crops
** Rounded off to the nearest hundred thousand

Source: Clive James, 2012.

Two new countries, Sudan (Bt cotton) and Cuba (Bt maize) planted biotech crops for the first time in 2012. Germany and Sweden could not plant the biotech potato, Amflora because it ceased to be marketed; Poland discontinued planting Bt maize because of regulation inconsistencies in the interpretation of the law on planting approval between the EU and Poland; the EU maintains that all necessary approvals are already in place for planting whereas Poland does not.

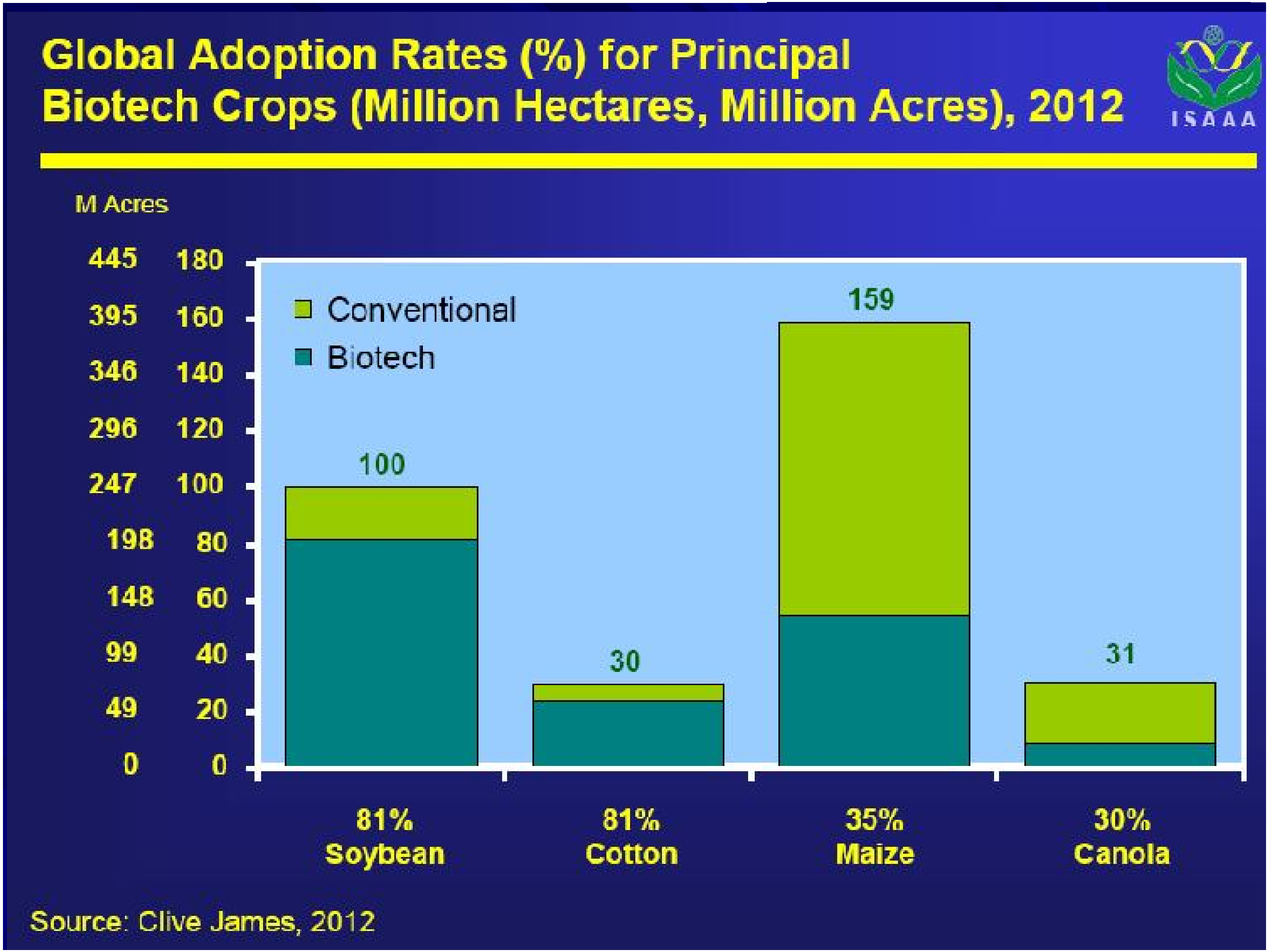
320 varieties developed from 25 transgenic plants are permitted to use

- Soybean
- Corn
- Polish canola
- Argentine canola
- Cotton
- Tomatoes
- Potatoes
- Rice
- Sugar beet
- Flax
- Turneps
- Melons
- Beans
- Sweet pepper
- Tobacco
- Chicory
- Papaya
- Carnations
- Wheat
- Lucerne
- Creeping bentgrass
- Plum
- Sunflower
- Rose
- Poplar

Areas under the main transgenic crops in 2012 (http://www.isaaa.org)

- *Soybean:* **81.0 mln ha (47.6% of area under GM crops)**
- *Corn:* **55.6 mln ha (32.6%)**
- *Cotton:* **24.3 mln ha (14.3%)**
- *Canola:* **9.1 mln ha (5.3%)**

Total – 170.0 mln ha (99.8%)



Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares, Million Acres), 2012
ISAAA
M Acres
445
395
346
296
247
198
148
99
49
0
180
160
140
120
100
80
60
40
20
0
Conventional
Biotech
100
30
159
31
81% Soybean
81% Cotton
35% Maize
30% Canola
Source: Clive James, 2012

Varieties which were registered and approved for sale to the public and the food industry in the Russian Federation

- **Soybean** – line 40-3-2 tolerant to glyphosate, lines A 2704-12 and A 5547-127 resistant to glufosinate ammonium.
- **Potato** – varieties Russet Burbank Newleaf, Superior Newleaf, “Lugovskoy 1210 amk" and “Elizaveta 2904/1 kgs» resistant to the Colorado beetle.
- **Corn** − lines GA 21 и NK-603 tolerant to glyphosate, MON 810 resistant to corn borer, MON 863, resistant to pests (*Diabrotica* spp.), Bt-11 and T-25 resistant to glufosinate ammonium, MON 88017 and MIR 604 resistant to root beetle.
- **Sugar beet** – line H7-1 tolerant to glyphosate.

Yellow marked line of maize and soybean which displayed adverse effects in rats and mice.

Probable disadvantage effects of GMO on human health and the environment can be caused by

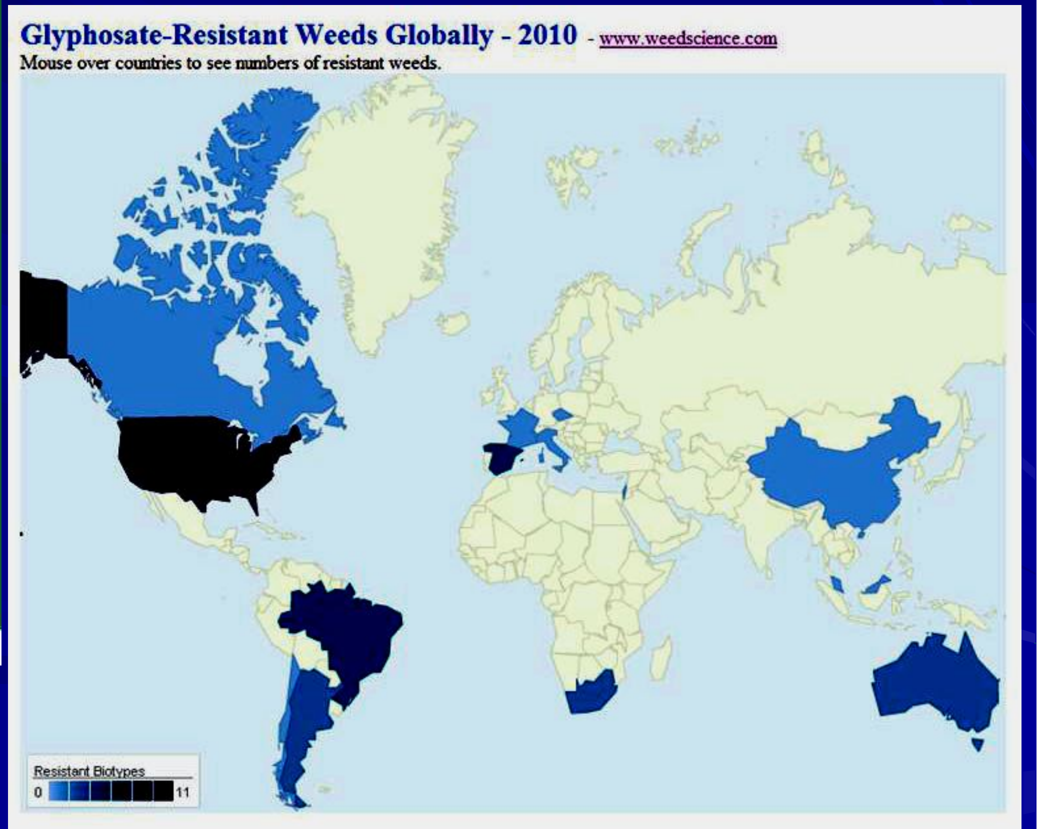
- The fact itself of the alien DNA insertion that can be fraught with:
  - change in the activities of some genes of the recipient organism;
  - the appearance of the possibility to transfer transgenes into other organisms.
- The syntheses of proteins – transgene products, new for the recipient organism, which can be toxic and/or allergenic for the other organism.

The negative effects of modern biotechnology

Figure 1. Global Map of Biotech Crop Countries and Mega-Countries in 2012

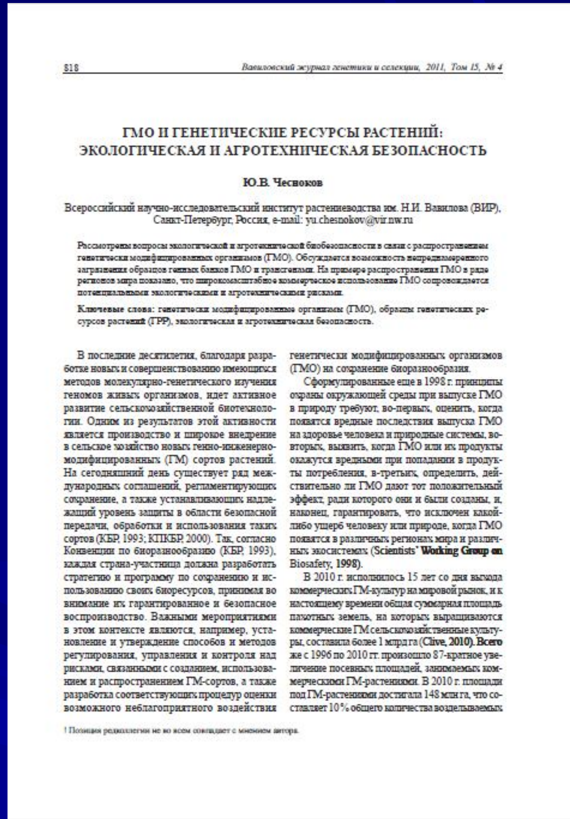
GMOs geography

Glyphosate-tolerant weeds geography



The negative effects of modern biotechnology

There is also a threat of reducing the genetic diversity of agricultural crops in general, and the danger of GM crops in developing countries that are centers of origin of crops. A recent review of U.V. Chesnokov in "Vavilov Journal of Genetics and Breeding" notes that in Japanese ports, unintentional release of GM canola was revealed. In Hawaii, 30 to 50% of surveyed papaya leaves and seeds have been genetically contaminated by GM counterparts. Similar data on the sink and soybeans were obtained in Romania. There are also cases of contamination of Gene Banks by transgenic lines (tomato in California, USA, soybeans and corn in Chile: in the first case, the samples were obtained by exchange from North Carolina, USA).



818 *Вавиловский журнал генетики и селекции, 2011, Том 15, № 4*

ГМО И ГЕНЕТИЧЕСКИЕ РЕСУРСЫ РАСТЕНИЙ: ЭКОЛОГИЧЕСКАЯ И АГРОТЕХНИЧЕСКАЯ БЕЗОПАСНОСТЬ

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Рассмотрены вопросы экологической и агротехнической биобезопасности в связи с распространением генетически модифицированных организмов (ГМО). Обсуждается возможность непреднамеренного загрязнения образцов генных банков ГМО и трансгенами. На примере распространения ГМО в ряде регионов мира показано, что широкомасштабное коммерческое использование ГМО сопровождается потенциальными экологическими и агротехническими рисками.

Ключевые слова: генетически модифицированные организмы (ГМО), образцы генетических ресурсов растений (ГРР), экологическая и агротехническая безопасность.

В последние десятилетия, благодаря разработке новых и совершенствованию имеющихся методов молекулярно-генетического изучения геномов живых организмов, идет активное развитие сельскохозяйственной биотехнологии. Одним из результатов этой активности является производство и широкое внедрение в сельское хозяйство новых генно-инженерно-модифицированных (ГМ) сортов растений. На сегодняшний день существует ряд международных соглашений, регламентирующих сохранение, а также устанавливающих надлежащий уровень защиты в области безопасной передачи, обработки и использования таких сортов (КБР, 1993; КПКБР, 2000). Так, согласно Конвенции по биоразнообразию (КБР, 1993), каждая страна-участница должна разработать стратегию и программу по сохранению и использованию своих биоресурсов, принимая во внимание их гарантированное и безопасное воспроизводство. Важными мероприятиями в этом контексте являются, например, установление и утверждение способов и методов регулирования, управления и контроля над рисками, связанными с созданием, использованием и распространением ГМ-сортов, а также разработка соответствующих процедур оценки возможного неблагоприятного воздействия генетически модифицированных организмов (ГМО) на сохранение биоразнообразия.

Сформулированные еще в 1998 г. принципы охраны окружающей среды при выпуске ГМО в природу требуют, во-первых, оценить, когда появятся вредные последствия выпуска ГМО на здоровье человека и природные системы, во-вторых, выявить, когда ГМО или их продукты окажутся вредными при попадании в продукты потребления, в-третьих, определить, действительно ли ГМО дают тот положительный эффект, ради которого они и были созданы, и, наконец, гарантировать, что исключен какой-либо ущерб человеку или природе, когда ГМО появятся в различных регионах мира и различных экосистемах (Scientists' Working Group on Biosafety, 1998).

В 2010 г. исполнилось 15 лет со дня выхода коммерческих ГМ-культур на мировой рынок, и к настоящему времени общая суммарная площадь пахотных земель, на которых выращиваются коммерческие ГМ сельскохозяйственные культуры, составила более 1 млрд га (Clive, 2010). Всего же с 1996 по 2010 гг. произошло 87-кратное увеличение посевных площадей, занимаемых коммерческими ГМ-растениями. В 2010 г. площади под ГМ-растениями достигала 148 млн га, что составляет 10 % общего количества возделываемых

[1] Позиция редколлегии не во всем совпадает с мнением автора.

The negative impact of Bt-corn pollen

- The negative impact of Bt-corn pollen on larvae of butterflies was found in 52% of the laboratory (11 species) and 21% of field (4 species) experiments.
- The negative impact of pollen was found in all three test lines Bt11, Bt176, MON810.
- LD50 from 13 to 36 grains of Bt176 pollen.
- Character disorders: decreased survival, worse nutrition, reduction of the size and weight of larvae, pupae, adults, increase in the total development time, behavioral change.
- No studies were carried out in the generation.

The GMOs danger to mammals

For the first time negative effects of GMOs on mammals were noted by British biochemist Arpad Pusztai, a Hungarian-born (The Rowett Institute, Aberdeen, Scotland). He studied the effect of genetically modified potatoes with snowdrop lectin gene built (a natural insecticide, safe for mammals) in rats and found painful changes in their body, dysfunction of some organs and immunity disorders. He announced his conclusions about the harmful effects of transgenic food on health in a popular TV show (August 10, 1998). Telecast roused a keen response, A. Pusztai was fired from the institute, as he himself says, in connection with his statement.

The GMOs danger to mammals

- GM-soybean 40-3-2 (*I.V. Ermakova*, Russia, 2007)
- GM-maize NK603×MON810 (*A. Velimirov, C. Binter , J. Zentek*, Austria, 2008)
- GM-maize MON863 (*G.-E. Séralini, D. Cellier, J. de Vendomois*, France, 2007)
- GM-maize MON810 (*A. Kilic, M.T. Akay,* Turkey, 2008; *A. Finamore et al.*, Italy, 2008)
- GM-maize NK603 (*G.-E. Séralini et al.*, France, 2012)

A List of food raw materials and foodstuffs, which were tested for availability of genetically modified components (GMC)

- **Soybean and all products from it.**
- **Corn and all products from it.**
- **Food additives, containing soybean and (or) corn products.**
- **Baby food produced by using soybean and (or) corn products.**

When baby food contains GMOs, such products cannot be used for children!

A list of laboratories accredited for GMO detection in Belarus

Ministry of Public Health

1. Republican Centre for Hygiene, Epidemiology and Public Health
2. Republican Scientific and Practical Centre for Hygiene
3. Minsk City Centre for Hygiene and Epidemiology
4. Brest Regional Centre for Hygiene, Epidemiology and Public Health
5. Gomel Regional Centre for Hygiene, Epidemiology and Public Health
6. Grodno Regional Centre for Hygiene, Epidemiology and Public Health
7. Mogilev Regional Centre for Hygiene, Epidemiology and Public Health
8. Vitebsk Regional Centre for Hygiene, Epidemiology and Public Health

State Committee for Standardization

9. Belarusian State Institute for Metrology
10. Brest Centre for Standardization, Metrology and Certification
11. Gomel Centre for Standardization, Metrology and Certification
12. Grodno Centre for Standardization, Metrology and Certification
13. Mogilev Centre for Standardization, Metrology and Certification
14. Vitebsk Centre for Standardization, Metrology and Certification

National Academy of Sciences

15. Institute of Genetics and Cytology, NAS of Belarus
16. Scientific and Practical Centre for Food, NAS of Belarus

Ministry of Agriculture and Food

17. Belarusian State Veterinary Centre
18. Central Research Laboratory of Bakeries

Data on testing foodstuffs for GMC content in LDGMO (2006–2013)

Year	Number of tests		Percent of positive results, %
	Total	Positive (soybean – S, corn – C)	
2006	**312**	**6S**	**1.92**
2007	**1746**	**16 (15S+1C)**	**0.92**
2008	**3166**	**58 (47S+11C)**	**1.83**
2009	**3482**	**41 (37S+4C)**	**1.18**
2010	**3427**	**9 (7S+2C)**	**0.26**
2011	**2803**	**6S**	**0.21**
2012	**3291**	**4 (3S+1C)**	**0.13**
To 24.09.2013	**2024**	**25 (24S+1C)**	**1.22**
Total	**20301**	**165 (145S+20C)**	**0.82**

GMO? No! But:

they should be under our strict control!