



PROS AND CONS OF GMO FOODS

Mihaela PILA, Nicoleta STĂNCIUC,
Cristian Silviu SIMIONESCU, Silviu STANCIU



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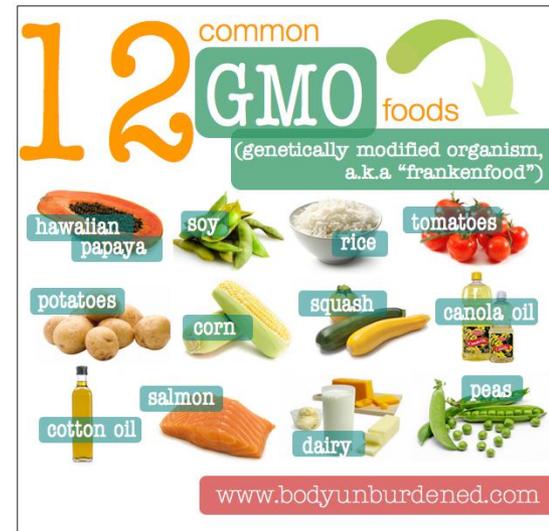
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Abstract

Genetically modified organisms (GMOs) are living organisms whose genes have been modified by bioengineering. There are many scientific discussions related to the risks or benefits associated with the consumption of these foods, on the health of consumers. The research proposes a review of opinions related to the consumption of GMO Foods, based on the scientific literature. Web of Science - Clarivate, SCOPUS, ResearchGate and Google Scholar were used for documentation. The research highlighted many concerns about possible impacts on human health and the environment, but also positive aspects related to improving global food production. European countries oppose genetically modified crops, but there are advocates of genetically modified crops who argue that they are necessary to improve global food production. It is impossible to anticipate all risks, especially in the long term. In addition to allergies, liver and reproductive problems, infant mortality, sterility, disease and death are common and linked to GMO consumption. In addition to allergies, liver and reproductive problems, infant mortality, sterility, disease and death are common and linked to GMO consumption. Insect resistance, higher yields, more economical to grow or food quality were listed as advantages. Global population growth, climate change, food security issues may consider GMOs as a solution for population nutrition.



PROS AND CONS OF GMO FOODS

GMO Foods

Tomato



Tomatoes have been genetically modified, but they are not being grown commercially at this time

Alfalfa



GMO alfalfa is contaminating non GMO alfalfa crops at a rapid rate

Cotton



At least half of cotton grown in the world is GMO

Rice



GMO rice has been approved but is not yet being used commercially

Wheat



Unapproved GMO has contaminated wheat fields, and we don't yet know the extent of it

Sweet Corn



More than 70 percent of corn grown in the United States has been genetically engineered

Sugar Beets



90% of Sugar Beets (used to make 50% of our sugar) are GMO

Summer Squash



Farmers don't like GMO squash but some experts say GM squash have blended with wild squash

Salmon



GMO salmon has not been approved by the FDA, but it will be very soon

Soy



More than 93% of soybeans the United States produces are genetically modified

For more information go to olmag.co/gmo-foods

Canola Oil



87% of canola grown commercially, and 80% of wild canola is GMO

Peas



Peas have been genetically modified but are not approved or available

Yeast



GMO yeast for wine has been approved

Hawaiian Papaya



Most Hawaiian papaya is GMO, even many organic crops are contaminated

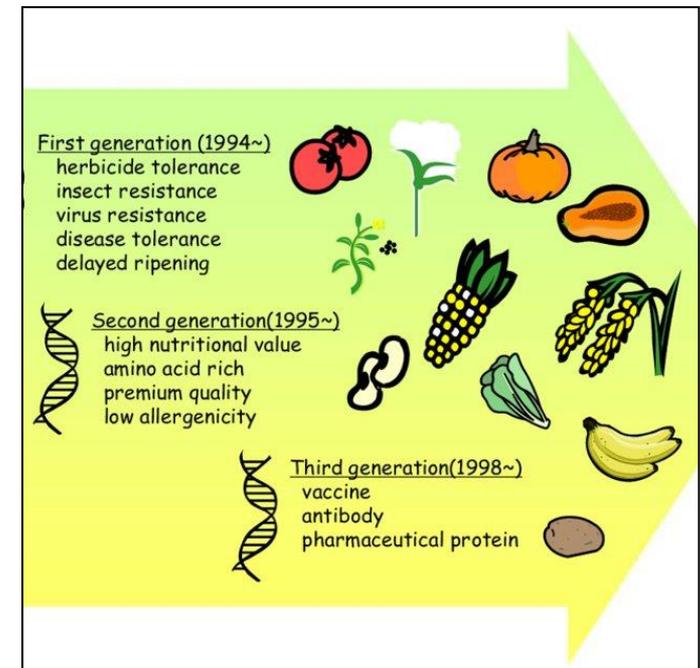
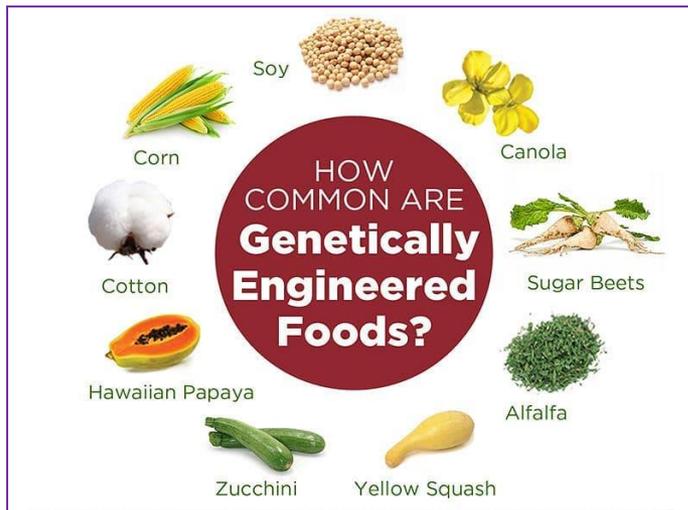
organic lifestyle
MAGAZINE

Genetically modified crops, also known as GM crops, are plants used in agriculture which have been modified by using genetic engineering methods. Other names commonly used for these crops are genetically modified organisms, or GMOs, and Biotechnology. The genetic modifications are done in order to create crop varieties with desirable traits, such as tolerance against herbicides and specific pests.

GMO's

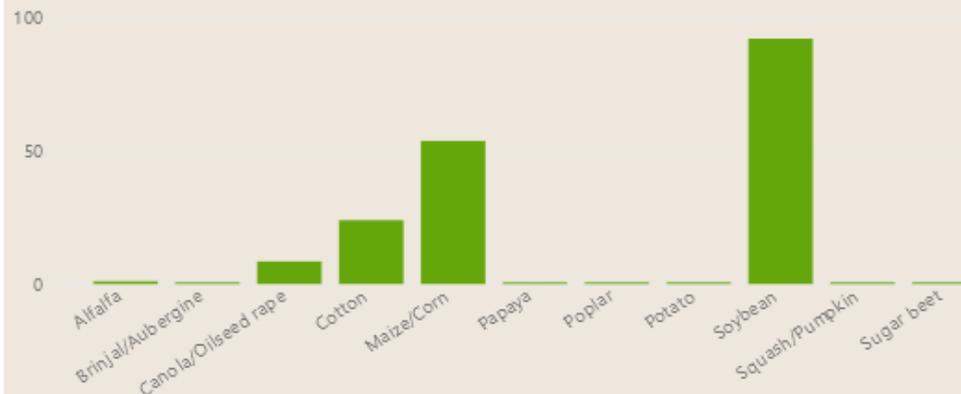
GMOs (genetically modified organisms) have been artificially manipulated through genetic engineering to express new traits

- organisms “in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination” (EC, 2001).
- first stages - products different as DNA/characteristics of the conventional mother organisms (from which they came).
- the current GM techniques make difficult the differentiation of the transgenic organisms from those which are conventional.
- difficulties in identification of transgenic organisms, the methods based on the authentication of DNA being inefficient.





Arable land used to farm specific GM plant (Mha) by GM plant - click to expand the chart



Note: Core data values are rounded to 2 d.p. Where values display as 0.00, total value is <0.0099

In the World....

- 1.7 million hectares in 1996 /6 countries
- 181.5 million hectares in 2014/28 countries
- 179.7 million hectares in 2015/28 countries
- annual rate of increase of 3-4%.
- developing countries - adopt rapidly the GMO's
- 16.5 million little farms - 65 million people (ISAA, 2014)
- Bangladesh - approved the cultivation of the transgenic plants/2014
- 2015 Vietnam and Indonesia approved the commercialization of the GM crops obtained in 2014.
- more than 75% from the total of the GMO cultivated areas on a global scale

Top 10 Countries

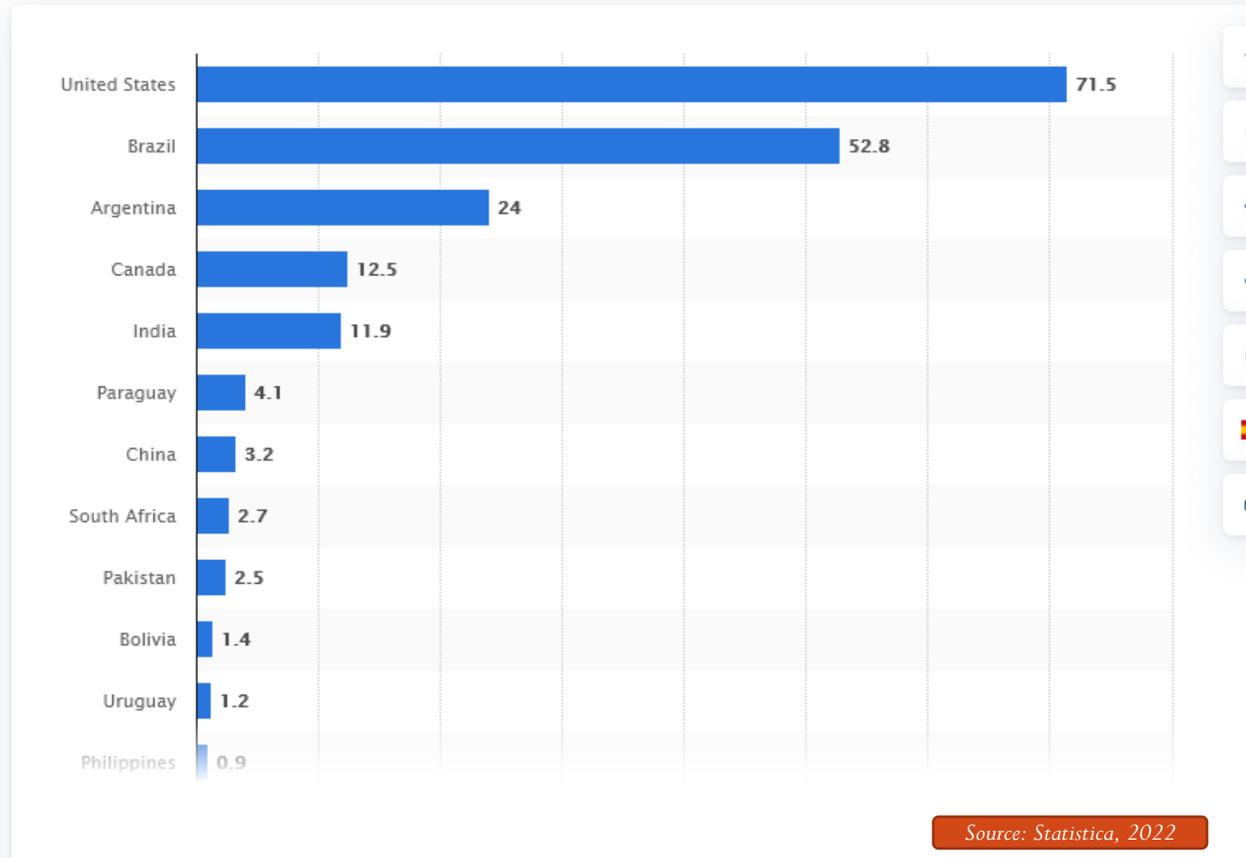
- **USA - 40,3%**,
- **Brazil -23,3%**
- **Argentina - 13,4%**
- **Romania - 0**

Country	Arable land used to farm GM plants (Mha) ▼	Available arable land (Mha)	% GM
USA	70,90	153,68	46,13
Brazil	44,20	71,88	61,49
Argentina	24,50	38,04	64,41
India	11,60	156,98	7,39
Canada	11,00	42,74	25,74
China	3,70	105,39	3,51
Paraguay	3,60	4,29	83,90
Pakistan	2,90	21,28	13,63
South Africa	2,30	12,02	19,13
Uruguay	1,40	1,77	79,20

Global Area of Biotech Crops in 2019

Agriculture > Farming

Area of genetically modified (GM) crops worldwide in 2019 (in million hectares)





BIOTECH SOYBEANS

FIRST COMMERCIAL PLANTING IN 1996

95.9 MILLION HECTARES
TOTAL AREA IN 2018

APPROVED FOR IMPORT IN
18 COUNTRIES

PLANTED BY FARMERS IN
9 COUNTRIES

USA BRAZIL ARGENTINA
PARAGUAY CANADA URUGUAY
BOLIVIA SOUTH AFRICA CHILE

38 APPROVED EVENTS IN
31 COUNTRIES

SOYBEANS **50%** OF THE WORLD'S
ACCOUNT FOR BIOTECH CROP AREA

USA IS THE WORLD'S TOP PRODUCER
OF SOYBEANS
BRAZIL IS THE TOP EXPORTER
OF SOYBEANS IN THE WORLD

78%
OF SOYBEAN GLOBAL
AREA OF 123.5 MILLION
HECTARES IN 2018
IS BIOTECH

For more, download: bit.ly/2018Soybeans



BIOTECH MAIZE

FIRST COMMERCIAL PLANTING IN 1996

58.9 MILLION HECTARES
TOTAL AREA IN 2018

APPROVED FOR IMPORT IN
15 COUNTRIES

PLANTED BY FARMERS IN
14 COUNTRIES

USA BRAZIL ARGENTINA CANADA PARAGUAY
SOUTH AFRICA URUGUAY PHILIPPINES SPAIN COLOMBIA
VIETNAM HONDURAS CHILE PORTUGAL

137 APPROVED EVENTS IN
35 COUNTRIES

MAIZE EVENT **NK603** RECEIVED **61 APPROVALS** FROM
28 COUNTRIES

30%
OF MAIZE GLOBAL
AREA OF 197.2 MILLION
HECTARES IN 2018
IS BIOTECH

For more, download: bit.ly/2018Maize



BIOTECH COTTON

FIRST COMMERCIAL PLANTING IN 1996

24.9 MILLION HECTARES
TOTAL AREA IN 2018

APPROVED FOR IMPORT IN
8 COUNTRIES

PLANTED BY FARMERS IN
15 COUNTRIES

USA BRAZIL ARGENTINA INDIA PARAGUAY
CHINA PAKISTAN SOUTH AFRICA AUSTRALIA MYANMAR
SUDAN MEXICO COLOMBIA COSTA RICA ESWATINI

63 APPROVED EVENTS IN
27 COUNTRIES

INDIA IS TOP COTTON PRODUCER
IN THE WORLD

7.5 MILLION FARMERS
AND THEIR FAMILIES
IN INDIA HAVE ENJOYED THE
BENEFITS OF PLANTING BT COTTON

76%
OF COTTON GLOBAL
AREA OF 32.9 MILLION
HECTARES IN 2018
IS BIOTECH

For more, download: bit.ly/2018Cotton



BIOTECH CANOLA

FIRST COMMERCIAL PLANTING IN 1996

10.1 MILLION HECTARES
TOTAL AREA IN 2018

APPROVED FOR IMPORT IN
10 COUNTRIES

PLANTED BY FARMERS IN
4 COUNTRIES

USA CANADA AUSTRALIA CHILE

37 APPROVED EVENTS IN
15 COUNTRIES

95% BIOTECH CANOLA'S
ADOPTION RATE IN CANADA

CANADA PLANTED 8.7 MILLION HECTARES
BIOTECH CANOLA IN 2018

MOST OF BIOTECH CANOLA
PLANTED IN CANADA ARE **HERBICIDE TOLERANT**

CHILE GROWS BIOTECH CANOLA
FOR SEED EXPORT

29%
OF CANOLA GLOBAL
AREA OF 34.7 MILLION
HECTARES IN 2018
IS BIOTECH

For more, download: bit.ly/2018Canola



BIOTECH ALFALFA

FIRST COMMERCIAL PLANTING IN 2006

1.3 MILLION HECTARES
TOTAL AREA IN 2018

APPROVED FOR IMPORT IN
5 COUNTRIES

PLANTED BY FARMERS IN
2 COUNTRIES

USA CANADA

5 APPROVED EVENTS IN
10 COUNTRIES

CANADA PLANTED **HARVXTRA™**
ALFALFA | **USA** PLANTED
RR® & HARVXTRA™
ALFALFA

HARVXTRA™ ALFALFA
WAS FIRST PLANTED IN 2016

HIGH DEMAND FROM FARMERS
• CONTAINS LESS LIGNIN
• HIGHER DIGESTIBILITY
• OFFERS 15-20% YIELD INCREASE

BIOTECH ALFALFA ADOPTION RATES IN THE USA
AND CANADA IS LIKELY TO INCREASE AS MORE AND
MORE FARMERS REALIZE THE BENEFITS OF THE
TECHNOLOGY IN LIVESTOCK PRODUCTION AND FARM
MANAGEMENT.

For more, download: bit.ly/2018Alfalfa



TOP 5 BIOTECH CROPS IN THE WORLD

WWW.ISAAA.ORG

AN ISAAA INFOGRAPHIC BY CLEMENT DIONGLAY

SOURCES: ISAAA Brief 54 (bit.ly/ISAAABrief54)
ISAAA GM Approval Databases (bit.ly/GMApprovalDatabase)
ISAAA Pocket K No. 2 (bit.ly/PKN02)

NOTE: In these ISAAA resources, the European Union (EU = 28 countries) is counted as one (1) country.

www.facebook.com/isaaa.org/

www.instagram.com/isaaa_org/

www.twitter.com/isaaa_org

JUNE 2020

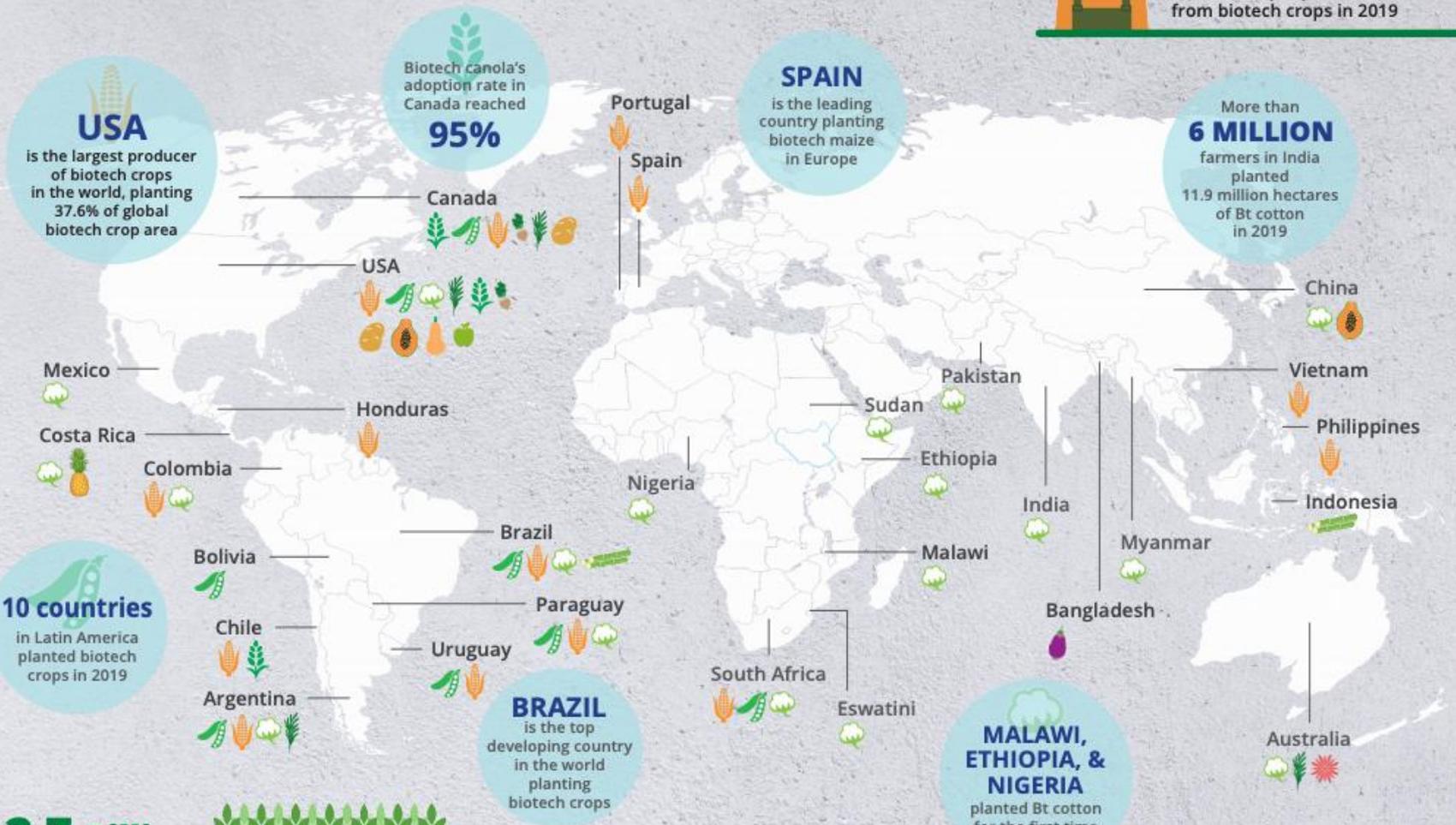
Do you know where biotech crops are grown?

More than 30 countries have planted biotech crops since 1996. See where they were grown in 2019.



17 MILLION

small, resource-poor farmers and their families totaling >65 million people benefited from biotech crops in 2019



2.7 Billion hectares of biotech crops planted since 1996



- Soybeans
- Alfalfa
- Eggplant
- Maize
- Papaya
- Sugarcane
- Cotton
- Squash
- Pineapple
- Canola
- Potato
- Safflower
- Sugar beets
- Apples

Source: ISAAA. 2019. Global Status of Commercialized Biotech/GM Crops in 2019. ISAAA Brief No. 55. ISAAA: Ithaca, NY.

For more information on biotech crops, visit www.isaaa.org



....and in Europe

- precaution on the cultivation /use of the transgenic plants.
- rigorous process of approval
- 58 GMO's authorized as food products (cotton, maize, modified microorganisms, oilseed rape, soybean, sugar beet) -2022
- 1998-2015 - 5 transgenic plants approved
- 2014 - BT corn / Monsanto
- Spain (116,306 hectares), Portugal (9,278 hectares), Czech Republic (3,052 hectares), Romania (217 hectares) and Slovakia (189 hectares) used GMO's crops (2016)
- 2016 - MON810 corn, genetically modified to produce an insecticide against the borer, was grown on 136,338 HA
- Austria, Bulgaria, Greece, Germany, Hungary, Italy, Luxembourg and Poland adopted measures of safeguarding
- 2022 Romania **0** hectares

MON810 corn - GMO

	2021	2022
Spain	96,606 ha	67,620 ha (-30%)
Portugal	4,321 ha	2,290 ha (-47%)
EU	100,927 ha	69,910 ha (-31%)

GMOs: EU decision-making process explained

GMOs for CULTIVATION

(under Regulation 1829/2003)

APPLICATION
TO A MEMBER STATE

Risk Assessment
by a Member State

GMOs for FOOD AND FEED

(under Regulation 1829/2003)

APPLICATION
TO A MEMBER STATE


Risk Assessment
Member States may
comment on
the application

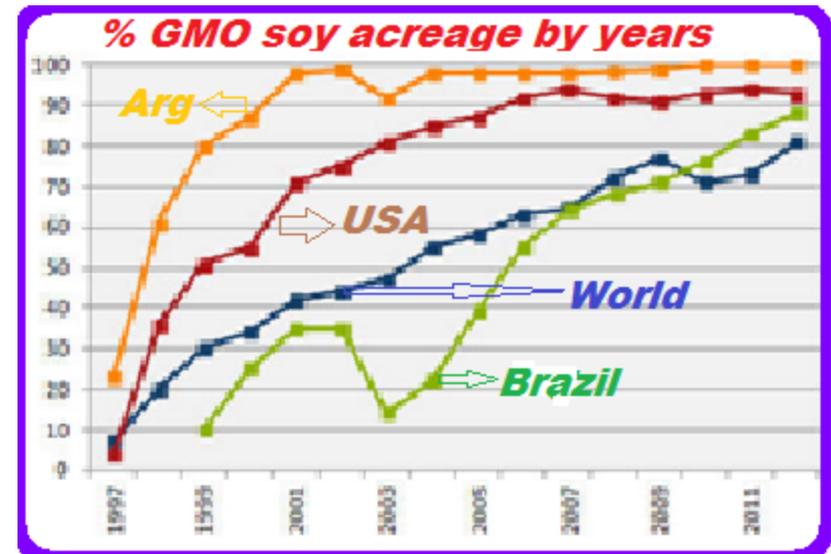
EFSA'S OPINION



GM soya crops in Romania

1998 – 2007 in Romania, 14 varieties of transgenic soya approved for cultivation

	2004	2005	2006
GM Soybean cultivated area (ha)	5523	87600	137275.5
GM Soybean plant varieties <i>Glycine max. (L.) Merrill</i>	AG160, DKB94, PR92B, S148, PKB	PR92B, S148, S099	DKB94, PR92B, S148



Economic analysis of using GM HT soybeans in Romania (€/ha)

(Source Brookes 2005)

	Farms smaller than 5000 ha		Farms larger than 5000 ha	
	Conventional	GM HT	Conventional	GM HT
Seed	45 (40–50)	Not applicable	40.5 (27–54)	Not applicable
Herbicide	152 (124–180)	Not applicable	109.5 (91–128)	Not applicable
Total cost of seed and herbicide	197 (164–230)	141.5 (135–148)	150 (118–182)	110
Cost of spraying	12 (9–15)	6	10.5 (9–12)	6
Total	209 (173–245)	147.5 (141–154)	160.5 (127–194)	116

PRO GMO's

- Insect resistance – reduce pesticide use and make crops resistant to their natural predators.
- Herbicide tolerance – decrease amount of tillage (turning soil to prepare for seeding) because of better and more flexible weed control; this reduces carbon emissions.
- Disease resistance – improve crops' ability to resist pathogens.
- Enhance nutrition – give crops more nutrient-dense properties.
- GM technology has reduced chemical pesticide use by 37% and soil erosion by 93%. It has also increased crop yields by 22% and farmer profits by 68%.
- More than 90 government bodies globally review and approve GMOs

An example of a GE crop is Golden Rice. It's a type of rice engineered to produce beta-carotene, which it doesn't naturally do.

Beta-carotene is a precursor to vitamin A and its deficiency is one of the leading causes of preventable night blindness in the world. Vitamin A deficiency is common in many developing countries.

Increasing nutrient density in foods can improve quality of life and even save lives around the globe.

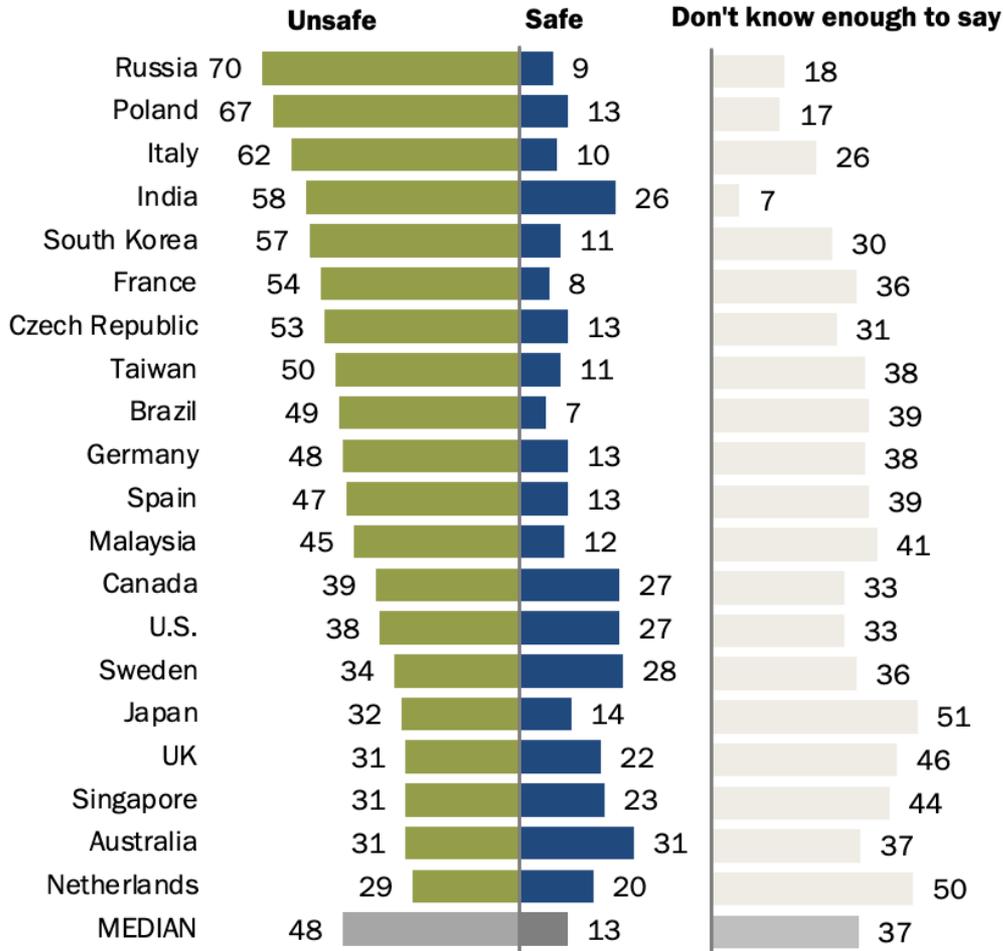
Fewer pesticides; Often cost less; May have more nutrients

Position of the academics

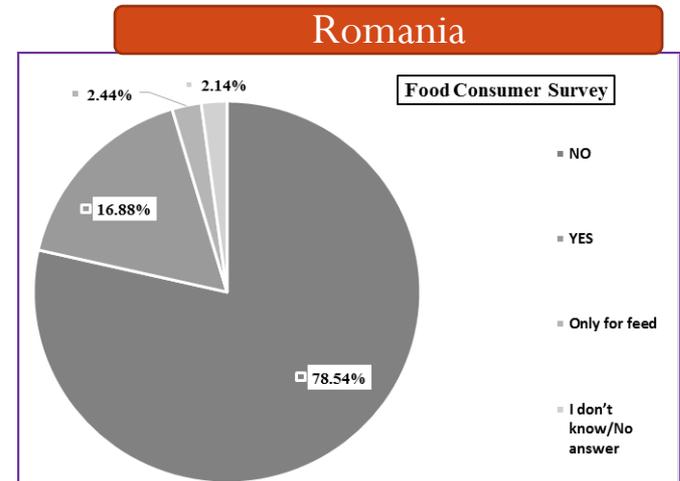
- Romania has:
 - Natural conditions favorable for use GMO's crops
 - Agriculture potential between 500,000 and 1,000,000 hectares for soybean
 - 400,000 to for intern consumption / potential of export of 500,000-2,000,000 to/year,
 - biodiesel fuel manufacture based on the soya oil,
 - reduction of the pollution
 - additional incomes for
 - the impact of the cultivation of transgenic soya over - the absence of the harmful effects over the diversity of the population of weeds, insects or microorganisms from the soil, which should be associated to these crops

Widespread skepticism about the safety of genetically modified foods

% who say genetically modified foods are generally ___ to eat



Note: Respondents who did not give an answer are not shown.
 Source: International Science Survey 2019-2020. Q20.
 "Science and Scientists Held in High Esteem Across Global Publics"



CONS GMO's

- **Changes in the interaction between plant and biotic environment:**
 - Persistence and invasiveness;
 - Selective advantages or disadvantages;
 - Transfer of genes;
 - Interactions with target organisms (e.g. induction of resistance in pests to which plants are resistant);
 - Interactions with non-target organisms (e.g. effects on bees and other non-pest insects, with consequences to biodiversity);
 - Interactions with the soil ecosystem with consequent biogeochemical effects.
- **Changes in the interaction between plant and abiotic environment:**
 - Alterations in Greenhouse Gas Emissions;
 - Variations in sensitivity to climatic effects;
 - Modifications in sensitivity to soil abiotic factors (salinity, minerals ...).
- **Harm to human or animal health:**
 - Toxicological effects;
 - Allergenicity;
 - Changes in nutritional value;
 - Transfer of antibiotic resistance.

**Allergic reactions; Increase antibiotic resistance,
Interaction GMO - environment**

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