20 Jahre Grüne Gentechnik und Agrarökologie

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Eidgenössische Technische Hochschule ETH, Zürich, Schweiz
Institute für Integrative Biologie,
Gruppe Biosicherheit und Agrarökologie

Lösungsversprechen der Gentechnik

Grosse Ziele und Hoffnungen:

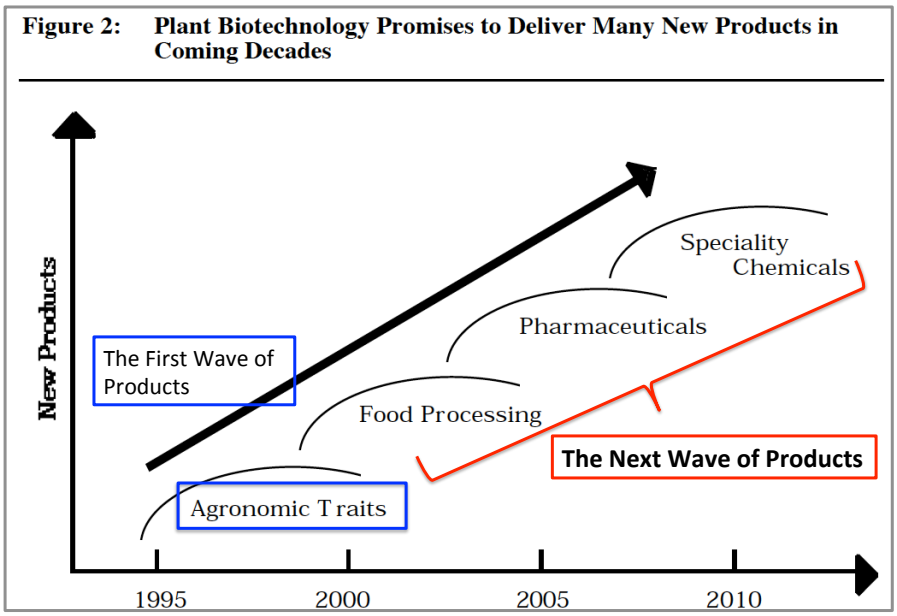
- Höhere Erträge
- Reduktion oder Abschaffung des Welthungers/ Armut
- Besserer Schutz der Gesundheit
- Schutz und Einsparung von Wasser
- Lösungsoptionen für Klimawandel
- Schutz der Biodiversität

http://d1jkwdgw723xjf.cloudfront.net/wp-content/uploads/2014/06/Annual-Report-2013.pdf

The Contributions of Plant Biotechnology to Agriculture in the Coming Decades, R. T. Fraley

Krattiger, A.F. and A. Rosemarin. **1994**. Biosafety for Sustainable Agriculture: Sharing Biotechnology Regulatory Experiences of the Western Hemisphere.

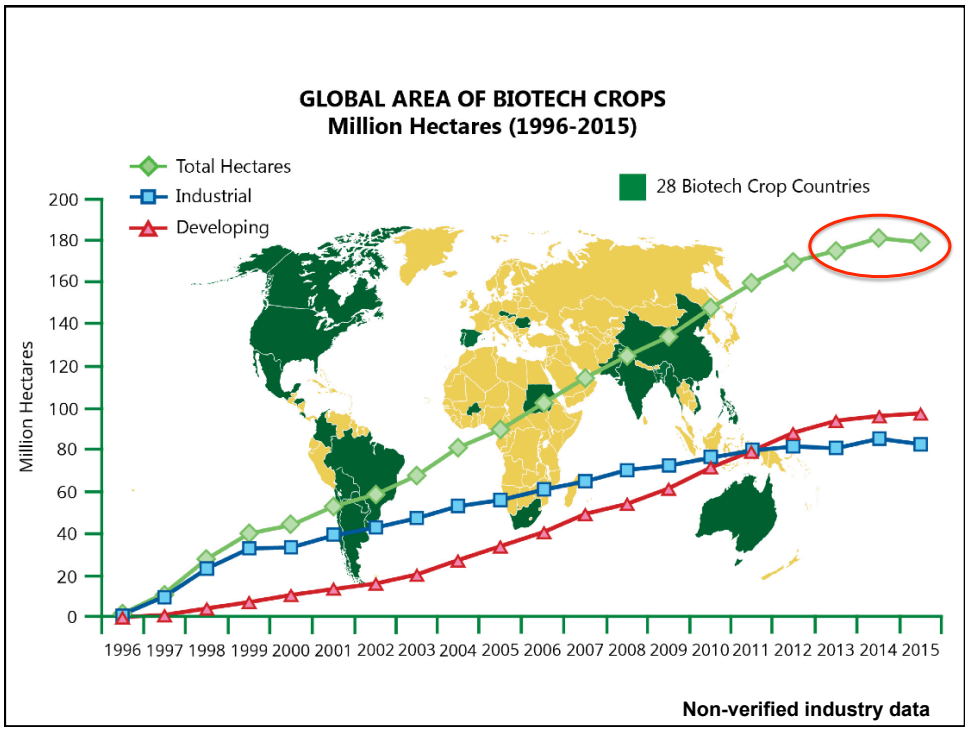
Figure 2: Plant Biotechnology Promises to Deliver Many New Products in Coming Decades

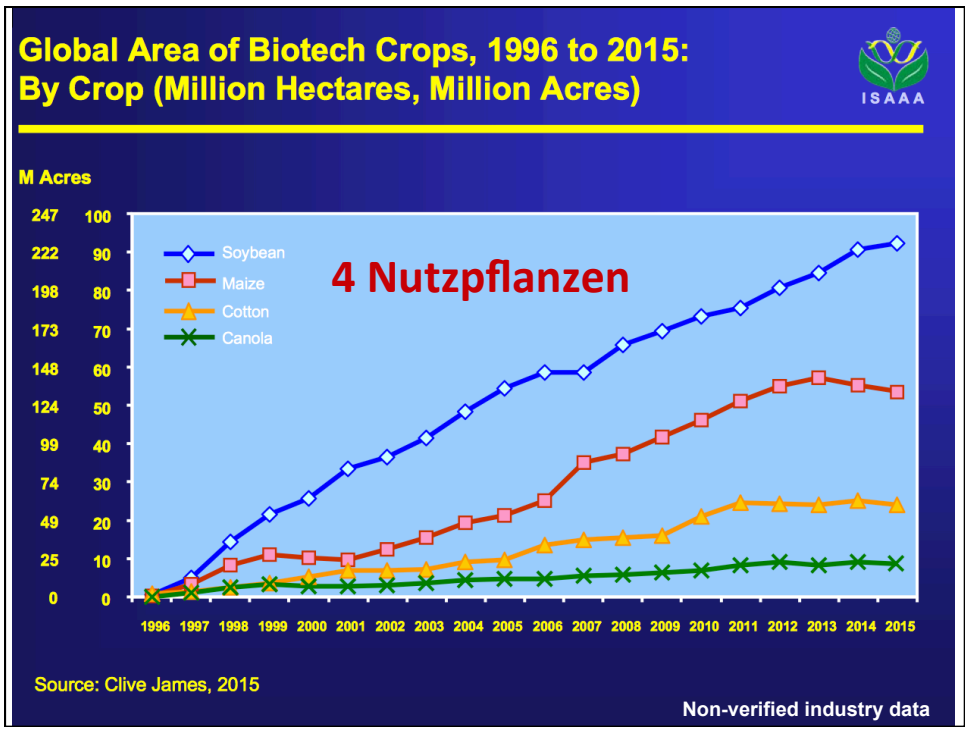


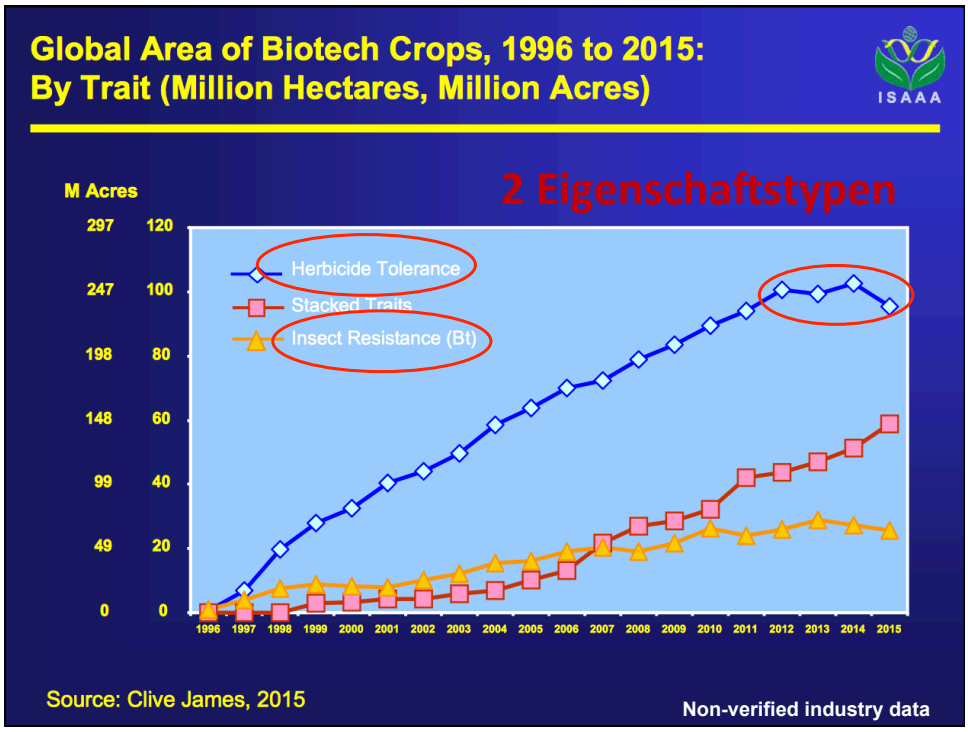
Ein Realitätscheck

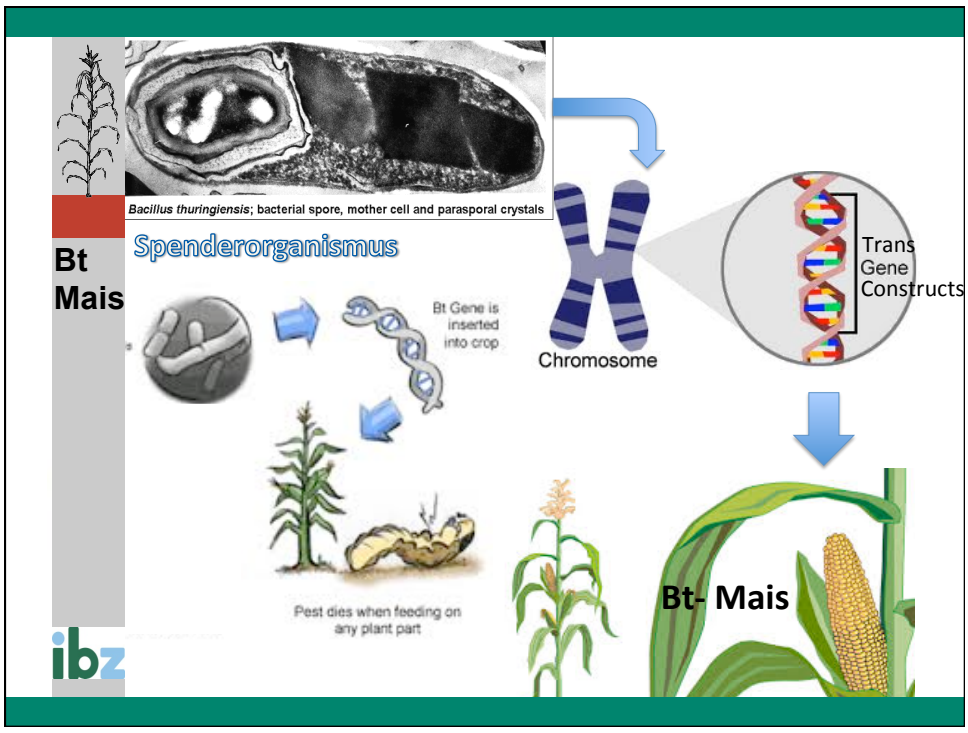
Aktuelle GV Nutzpflanzen im Anbau

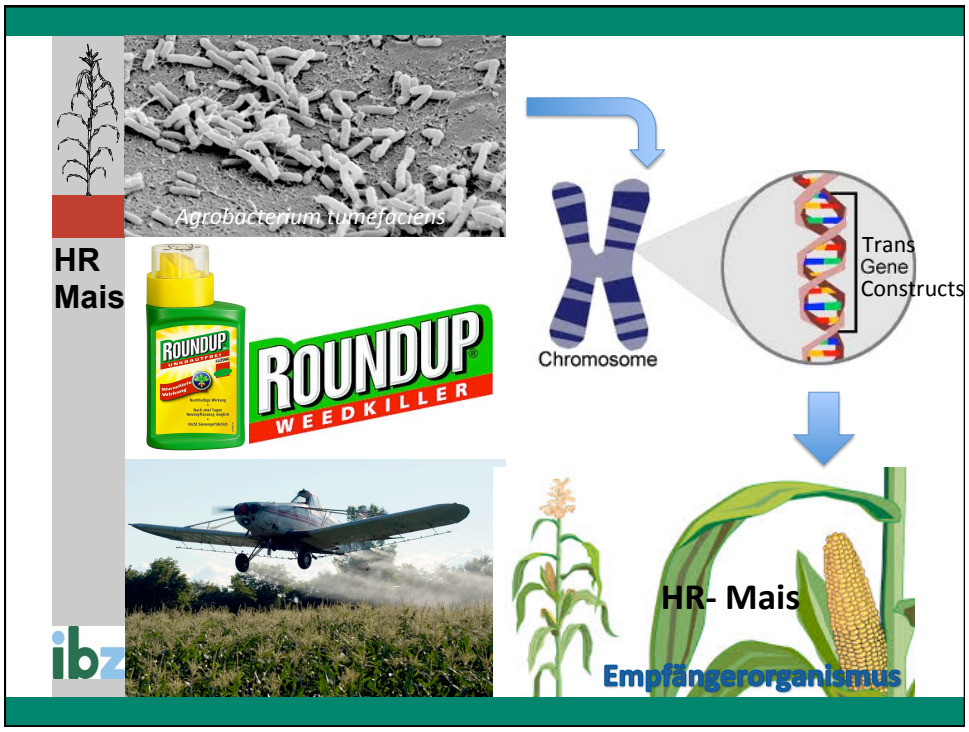
ibz

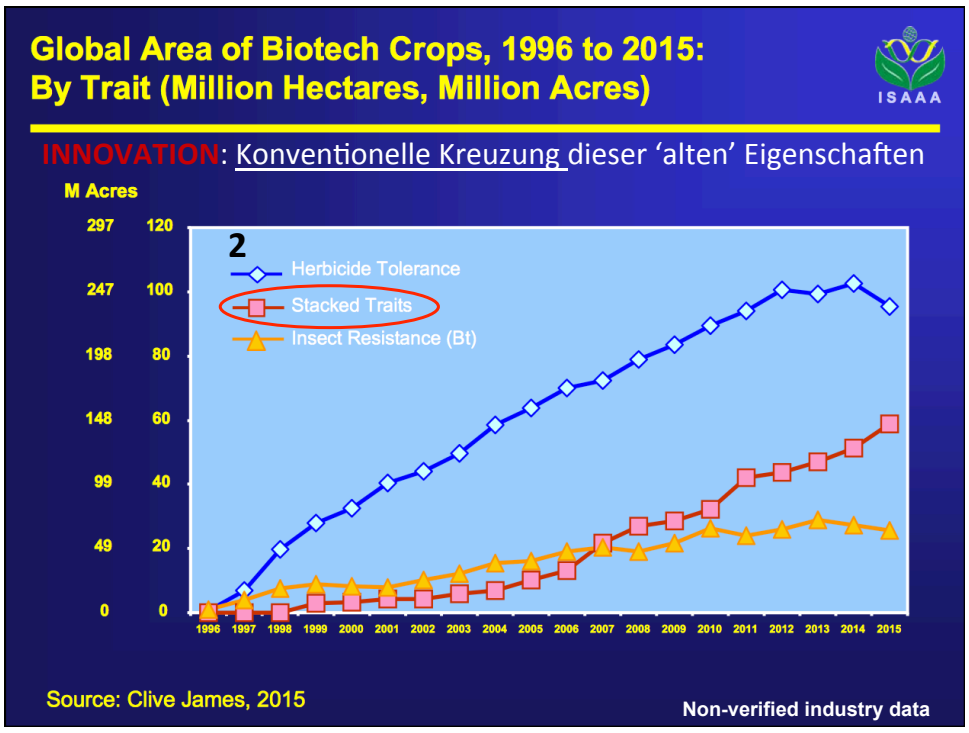

GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996-2015)
Total Hectares
Industrial
Developing
28 Biotech Crop Countries
Million Hectares
200
180
160
140
120
100
80
60
40
20
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Non-verified industry data

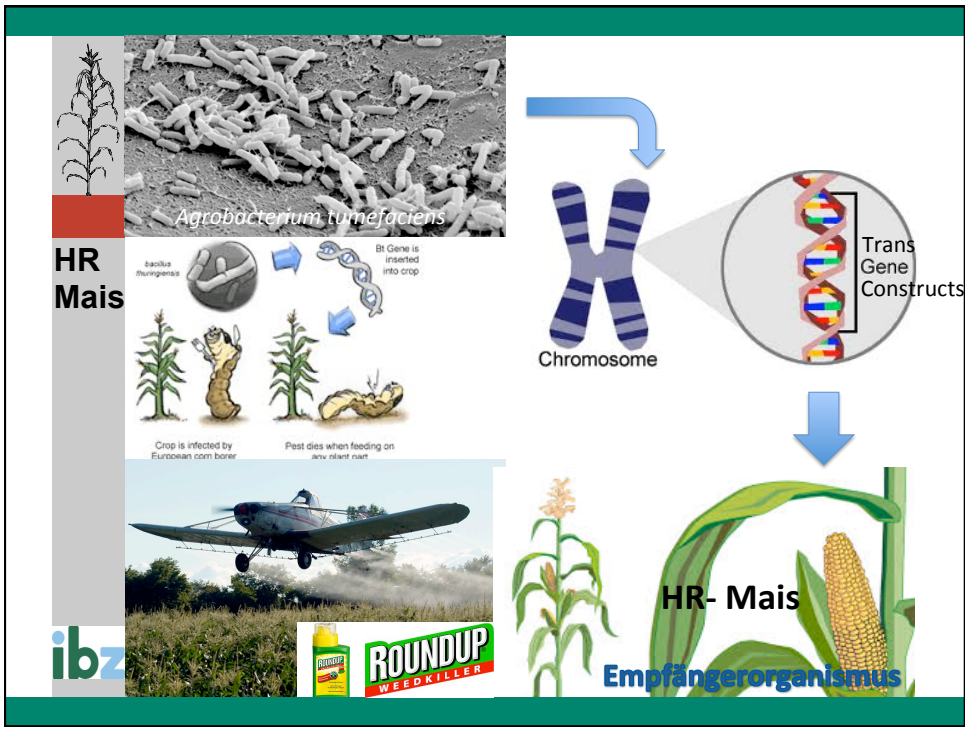

Global Area of Biotech Crops, 1996 to 2015:
By Crop (Million Hectares, Million Acres)
ISAAA
M Acres
247 100
222 90
198 80
173 70
148 60
124 50
99 40
74 30
49 20
25 10
0 0
Soybean
Maize
Cotton
Canola
4 Nutzpflanzen
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Source: Clive James, 2015
Non-verified industry data


Global Area of Biotech Crops, 1996 to 2015:
By Trait (Million Hectares, Million Acres)
ISAAA
M Acres
2 Eigenschaftstypen
297 120
247 100
198 80
148 60
99 40
49 20
0 0
Herbicide Tolerance
Stacked Traits
Insect Resistance (Bt)
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Source: Clive James, 2015
Non-verified industry data


Bacillus thuringiensis; bacterial spore, mother cell and parasporal crystals
Bt Mais
Spenderorganismus
Bt Gene is inserted into crop
Chromosome
Trans Gene Constructs
Pest dies when feeding on any plant part
Bt- Mais
ibz


Agrobacterium tumefaciens
HR
Mais
ROUNDUP
WEEDKILLER
Chromosome
Trans
Gene
Constructs
HR- Mais
Empfängerorganismus
ibz


Global Area of Biotech Crops, 1996 to 2015:
By Trait (Million Hectares, Million Acres)
ISAAA
INNOVATION: Konventionelle Kreuzung dieser 'alten' Eigenschaften
M Acres
297 120
247 100
198 80
148 60
99 40
49 20
0 0
2
Herbicide Tolerance
Stacked Traits
Insect Resistance (Bt)
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Source: Clive James, 2015
Non-verified industry data



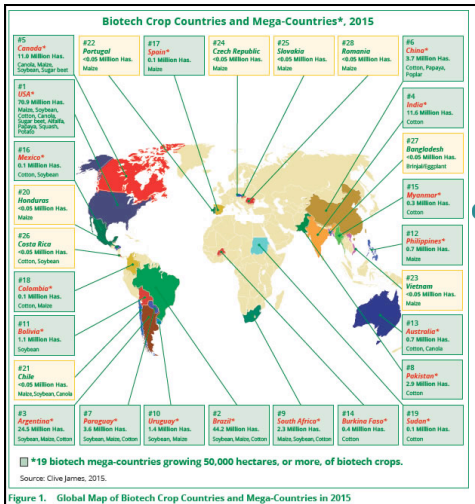
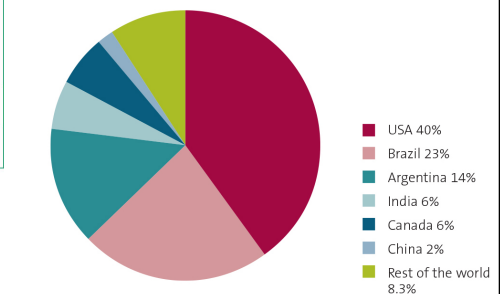


Figure 1. Global Map of Biotech Crop Countries and Mega-Countries in 2015

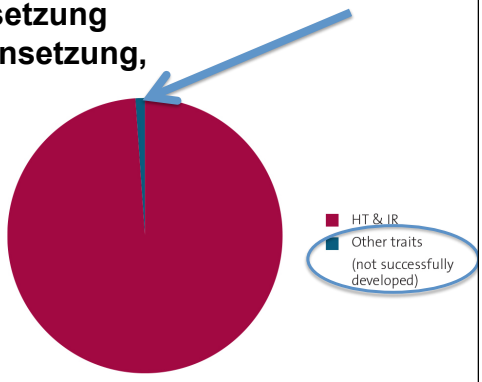
2 – 4 – 6 Formel
Seit den späten 1990s
bauen >90% an



Source: *Calculations based on ISAAA (2014). Special Brief 46 – 2013 Executive Summary, Global Status of Commercialised Biotech/GM Crops: 2013, http://www.isaaa.org/resources/publications/briefs/46/executivesummary/*

Andere Eigenschaften – zum Beispiel:

- Virusresistenz
- Veränderung Inhaltsstoffe
- (e.g. Stärkezusammensetzung – Amflora, Ölzusammensetzung, etc.)
- Standortanpassungen (Trockenheit, etc.)



Source: *Based on ISAAA Special Brief 44 (2012), http://www.isaaa.org/resources/publications/briefs/44/executivesummary/ and Nature Special Report, GMO Crops: Promise and Reality, http://www.nature.com/news/specials/gmcrops/index.html*

Der arktische Apfel – zugelassen Frühjahr 2015 - Nicht-bräunend

The Contributions of Plant Biotechnology to Agriculture in the Coming Decades, R. T. Fraley

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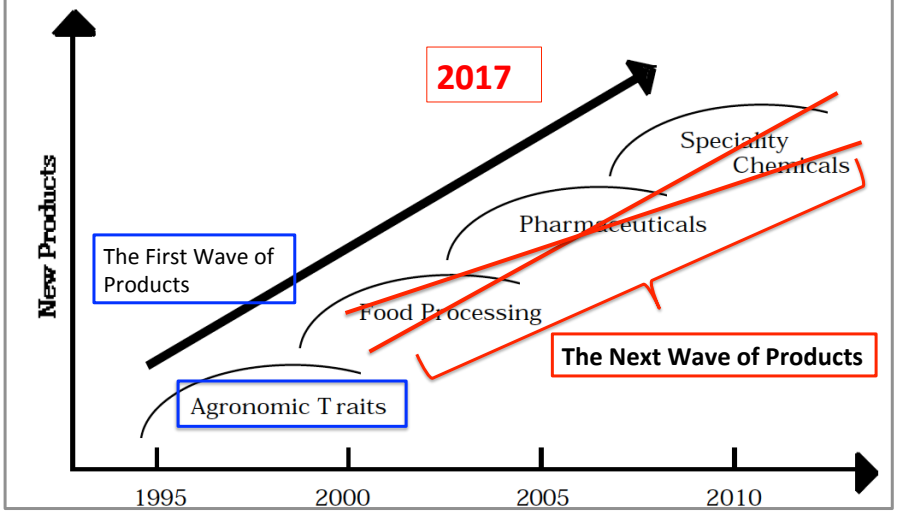
Figure 2: Plant Biotechnology Promises to Deliver Many New Products in Coming Decades



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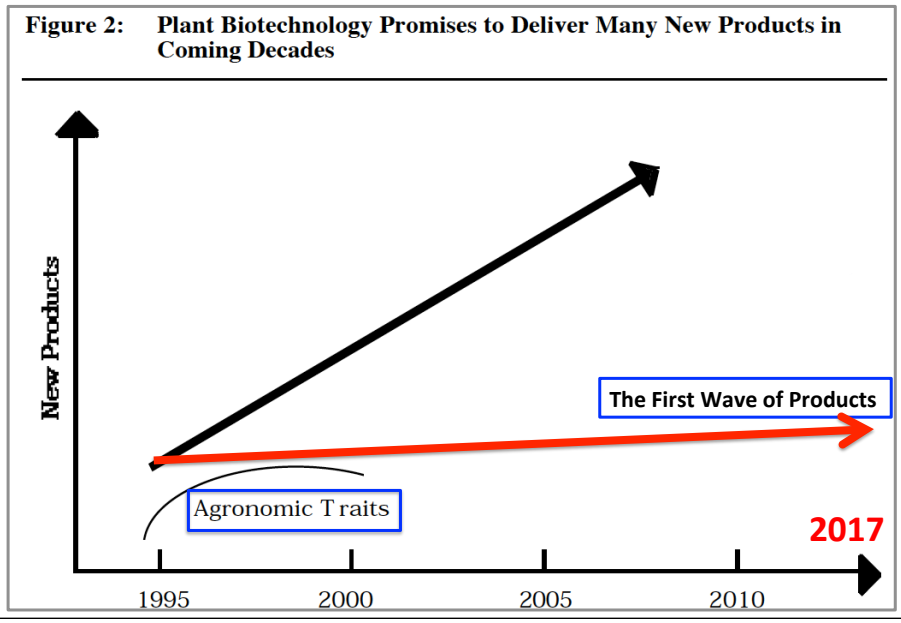


Risikoabschätzung

Risiken

Konkurrierende Narrativen

TYP I	TYP II
Ganzheitliche Nutzenvereinnahmung vs enge Risikoanalyse	Risikoanalyse wie Nutzenanalyse
KEIN PROBLEM	VIELE PROBLEME

Bt Pflanzen

Für den agrar-industriellen Anbau zur Rohstoffproduktion

ibz

Breiter ‘holistischer’ Nutzen – Gentechnik -relevant

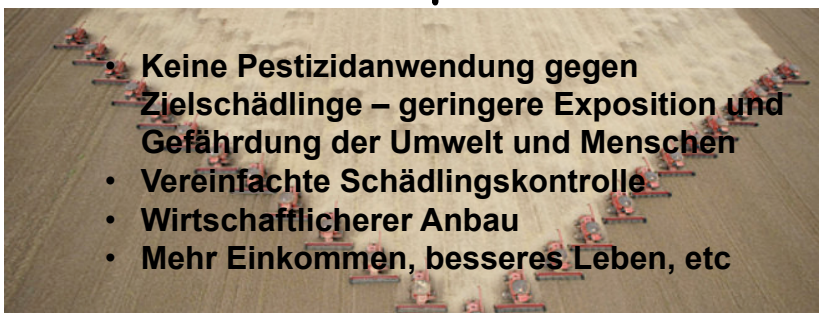
Insekten-resistente Pflanze

Bt Toxin

genuity VT DOUBLE PRO CORN

Reduzierter Pestizideinsatz

gegen Zielschädling



- **Keine Pestizidanwendung gegen Zielschädlinge – geringere Exposition und Gefährdung der Umwelt und Menschen**
- **Vereinfachte Schädlingskontrolle**
- **Wirtschaftlicherer Anbau**
- **Mehr Einkommen, besseres Leben, etc**

Breite ‘holistische’ Risiken

Insekten-resistente Pflanze

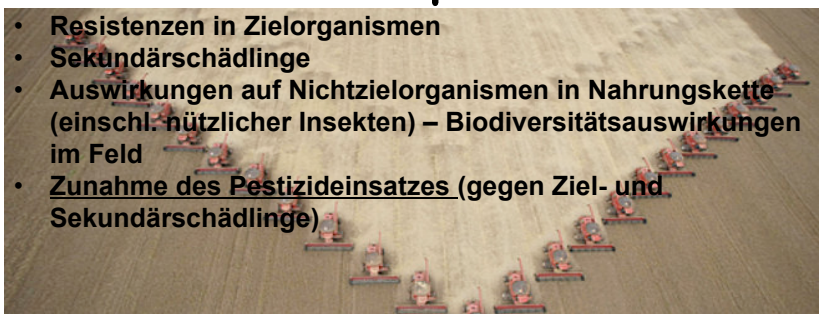
Bt Toxin

genuity VT DOUBLE PRO CORN

+

Erhöhter Pestizideinsatz

gegen Nicht-Zielschädlinge



- **Resistenzen in Zielorganismen**
- **Sekundärschädlinge**
- **Auswirkungen auf Nichtzielorganismen in Nahrungskette (einschl. nützlicher Insekten) – Biodiversitätsauswirkungen im Feld**
- **Zunahme des Pestizideinsatzes (gegen Ziel- und Sekundärschädlinge)**

Engen Risiken – nicht gentechnik -relevant

Insekten-resistente Pflanze

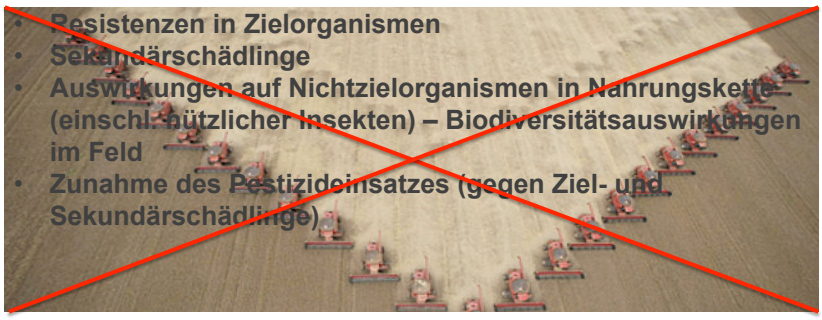
Bt Toxin

genuity VT DOUBLE PRO CORN

-

Erhöhter Pestizideinsatz

gegen Nicht-Zielschädlinge



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Herbizid-resistente Pflanzen

Für den agrar-industriellen Anbau zur Rohstoffproduktion

Breiter, 'holistischer' Nutzen - Gentechnik-relevant

Glyphosat-resistente GV Pflanze

Glyphosat-basierte Herbizide

- Pflugloser Anbau (Kostenersparnis)
  Kollateralnutzen:
  - Reduziertes Bodenerosionsrisiko
- Anwendung weniger schädlicher Herbizide
- Vereinfachtes Unkrautmanagement
- Wirtschaftlicherer Anbau

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"Herbicide-tolerant plants will have the **positive impact of shifting overall herbicide usage through substitution of more effective and environmentally acceptable products**."

"The commercial strategy behind engineering herbicide tolerance is to gain market share through a shift in herbicide use, **not to increase the overall use of herbicides as is popularly held by critics** (Goldburg et al., 1990)."

Breiter, 'holistischer' Risiken

Glyphosat-resistente GV Pflanze

\-

Glyphosat-basierte Herbizide

- **Resistenzen und Superunkräutern**
  ⟶ Anwendung alter, toxischerer Herbizide nötig
- **Rückstandsproblematik im Erntegut**
- **Umweltprobleme: reduzierte Aktivität der Bodenmikroben, reduzierte Mikronährstoff-verfügbarkeit, erhöhte Düngung nötig, massiv reduzierte Biodiversität**

Enge, ‘reduktionistische’ Risiken

Neue GV Pflanze

Einsatz Totalherbizid

Frühere Pestizidzulassung

- Resistenzen und Superunkräutern
  → Anwendung alter, toxischerer Herbizide nötig
- Rückstandsproblematik im Erntegut
- Umweltprobleme: reduzierte Aktivität der Bodenmikroben, reduzierte Mikronährstoff-verfügbarkeit, erhöhte Düngung nötig, massiv reduzierte Biodiversität

Enge, ‘reduktionistische’ Risiken

Neue GV Pflanze

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Umweltwirkungen

ibz

Ökologische Effekte:

Bt Pflanzen – produziert Insektengift aus *Bacillus thuringiensis:*

- **Neue oder Sekundär-Schädlinge**
- **Adverse Effekte auf Nützlinge**
- **Schädlingsresistenz**

ibz

TRANSGENIC PLANTS AND INSECTS

Western Bean Cutworm, *Striacosta albicosta* (Smith) (Lepidoptera: Noctuidae), as a Potential Pest of Transgenic Cry1Ab *Bacillus thuringiensis* Corn Hybrids in South Dakota

MICHAEL A. CATANGUI[1] AND ROBERT K. BERG

Department of Plant Science, South Dakota State University, Brookings, SD 57007–1096

Environ. Entomol. 35(5): 1439–1452 (2006)

2006

The western bean cutworm is an emerging or potential pest of transgenic Bt corn in South Dakota. … Untreated conventional corn hybrids were less infested with western bean cutworm larvae but more infested with European corn borer larvae.

…

Results from this study underscore the need to investigate other emerging or potential arthropod pests of transgenic *Bt* corn hybrids in addition to the western bean cutworm.

Offener Brief an Saatgut-Industrie :

"Over the next decade, the pest began to move deeper into the Midwest, eventually establishing itself as a threat to cornfields as far east as New York and Pennsylvania and as far north as Ontario." **Non/Target ⟹ Secondary pest (replacing others)**

"**WBC is now the PRIMARY Lepidopteran ear pest** in many parts of the Great Lakes region."
"We also **urge the industry to regard western bean as a primary, not a secondary, pest**."

Non/Target ⟹ Secondary pest (replacing others) ⟹ Primary pest

http://blogs.cornell.edu/ccefieldcropnews/2016/10/04/an-open-letter-to-the-seed-industry-regarding-the-efficacy-of-cry1f-bt-against-western-bean-cutworm-october-2016/ ; https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2016/10/05/herculex-trait-fails-western-bean-4?referrer=twitter#.V_pK2IHBh9g.twitter

Other predictable nontarget pests .....

nature International weekly journal of science

GM crop use makes minor pests major problem - Pesticide use rising as Chinese farmers fight insects thriving on transgenic crop.

Jane Qiu

Published online 13 May 2010 | Nature | doi:10.1038/news.2010.242

Wenig bis keine unabhängigen, wissenschaftlichen Publikationen.
Dagegen viele Medienberichte

Secondary pests reported from India

Punjab whitefly epidemic: We need a new ... - The Indian Express
indianexpress.com › Blogs ▾ Diese Seite übersetzen
15.10.2015 - A **whitefly** epidemic has devastated 60 per cent of the **Bt cotton** crop in Punjab and farmers have used 10-12 sprays, each costing Rs 3,200.

Whitefly lessons | The Indian Express
indianexpress.com › Opinion › Editorials ▾ Diese Seite übersetzen
23.10.2015 - Widespread damage to **cotton** from **whiteflies** in large parts of North **India** has led many to blame it on **Bt** gene technology. Environmental ...

Whitefly fear: Cotton acreage drops to 61-year low - Times of India
timesofindia.indiatimes.com › City › Chandigarh ▾ Diese Seite übersetzen
10.07.2016 - Fear of another attack of **whitefly** pest, which ravaged huge tracts of ... When a **BT Cotton** pod breaks the flying SHORTER LENGTH LINT gi.

Pest blights India's GM cotton crop, fuelling debate over risks | Reuters
www.reuters.com/.../us-**india-cotton-whitefly**-idUSKCN0S30QW... ▾ Diese Seite übersetzen
09.10.2015 - Two **Indian** states are suffering the first major pest infestation since the ... Damage from the **whitefly** attack on the **Bt cotton** variety in the states of ...

Cross-order and cross-phylum activity of *Bacillus thuringiensis* pesticidal proteins

Kees van Frankenhuyzen*

Great Lakes Forestry Centre, Canadian Forest Service, Natural Resources Canada, 1219 Queen Street East, Sault Ste. Marie, Ontario P6A 2E5, Canada

Journal of Invertebrate Pathology 114 (2013) 76–85

Cross activities reported for 27 proteins affecting 69 taxa

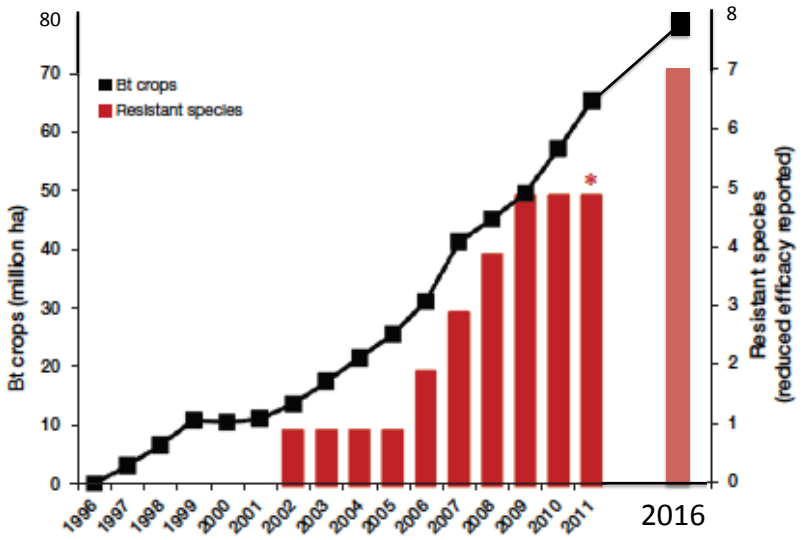
Kreuzaktivität für 27 (Bt) Proteine auf 69 (Insekten) taxa berichtet

13 cross-activities are in the low-toxicity range (10–1000 µg/ml), 12 in the medium – (0.10–10 µg/ml) and two in the high-toxicity range (0.01–0.10 µg/ml).

Wissenschaftliche Publikationen zu Effekte von Bt Toxinen und Bt Pflanzen auf Nichtzielorganismen

Nontarget organisms	Effects	Publications
Terrestrial insects		
Tetranychus urticae and *Phytoseiulus persimilis*	Behavior: prey preference	Zemkova Rovenska et al. 2005,
Chrysoperla carnea & apids	Behavior: prey preference	Meier and Hilbeck 2001
Harmonia axyridis	Abundance in field, adult life span	Stephens et al. 2012
Henosepilachna vigintioctomaculata	Survival	Song et al. 2012
Adalia bipunctata	Survival	Schmidt et al. 2009, Hilbeck et al. 2012
Cheilomenes sexmaculatus	Survival, adult emergence	Dhillon and Sharma 2009
Propylea japonica	Development, behavior	Zhang et al. 2006a,b,c
Coleomegilla maculata	Development time	Moser et al. 2008
Chrysoperla carnea	Survival	Hilbeck et al. 1998a,b, 1999
Eisenia fetida	growth, reproduction, enzyme acticitiy	Shu et al. (2015)
Lumbricus terrestris (earthworm)	Weight, growth	Zwahlen et al. 2003
Dung beetles	Community composition	Campos and Hernandez (2015)
Aquatic insects		
Daphnia magna	Sexual maturation, egg production	Bohn et al. (2008, 2010)
Crane flies	Growth	Jensen et al. 2010
Chironomidae		Prihoda & Coats 2008
Lepidostoma liba and *Helicopsyche borealis*	Growth, survival	Rosi-Marshall et al. (2007), Chambers et al. (2010)
Aquatic insects - litter feeders	Community composition	Axelsson et al. (2011
Others		
Cantareus aspersus (Snail)	Growth rates	Kramarz et al. 2009
Cray fish		Linn and Moore 2014

INSEKTEN RESISTENZ EVOLUTION GEGEN BT PFLANZEN



http://www.entsoc.org/sites/default/files/files/EntSocAmerica_PolicyStatement_ IRMGeneticallyModifiedCrops.pdf

Bt

Bt-resistente Schädlinge

Lösungsoption à la Industrie:

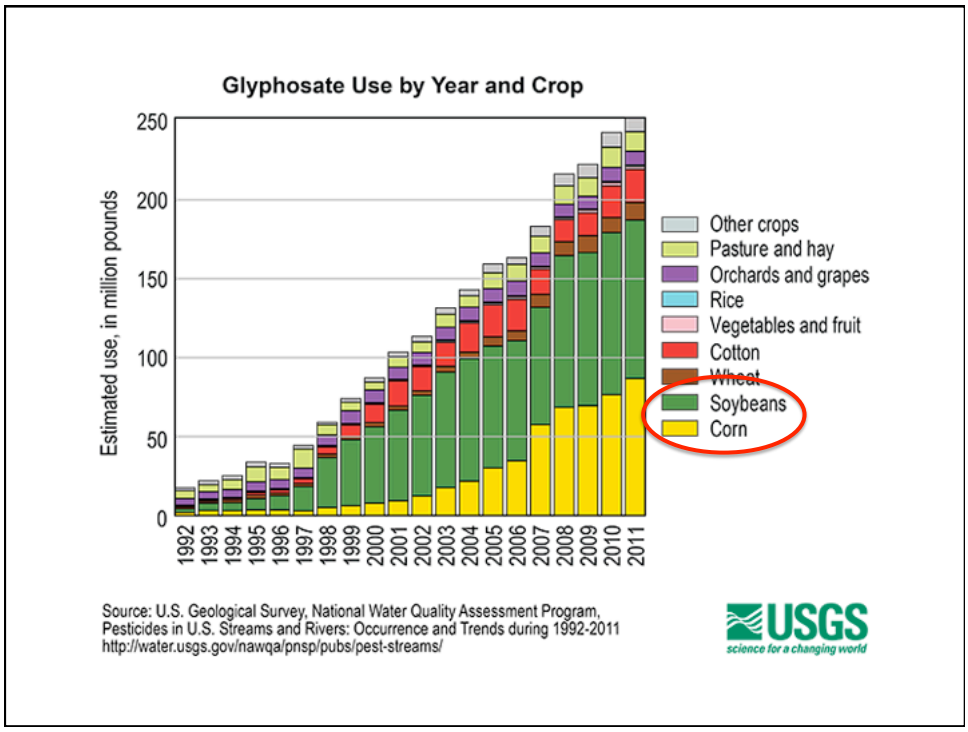
Applikation von **Endosulfan** auf ein Bt Maisfeld gegen resistenten Zielschädling *B. fusca* (2. Applikation – Januar 2010, Vaalhart, South Africa)

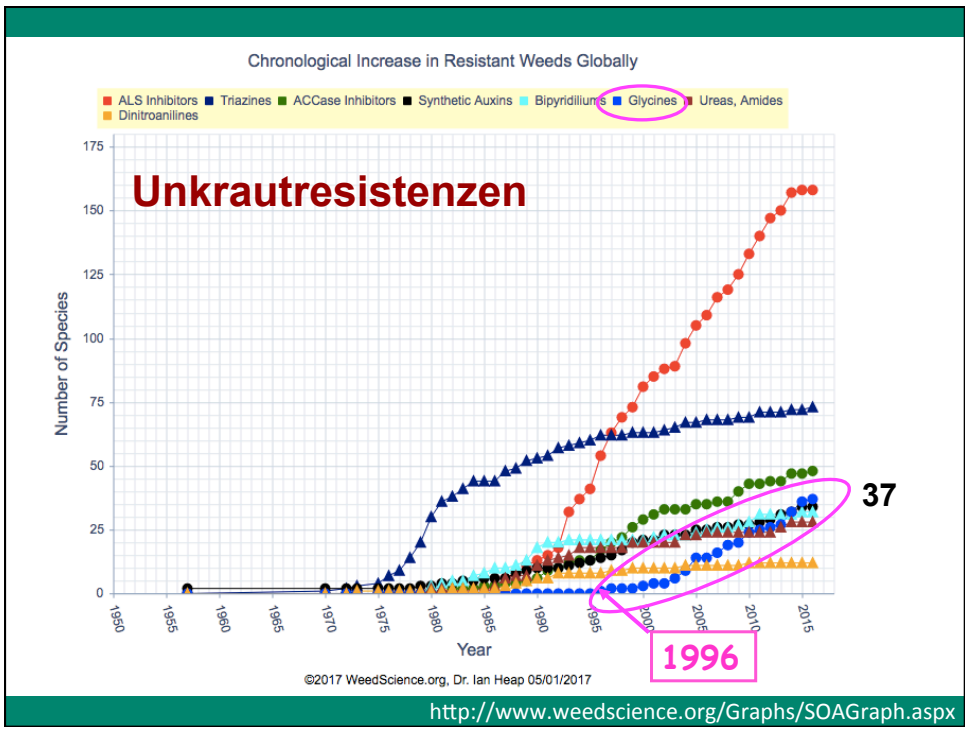
Ökologische Effekte:

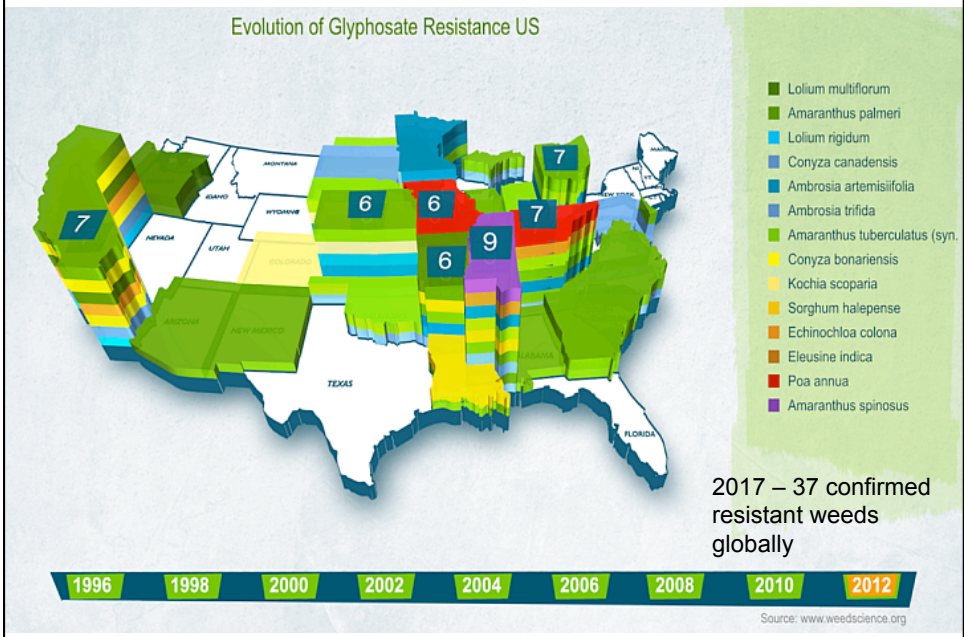
HR Pflanzen – resistent gegen Totalherbizide

Adverse Effekte durch Herbizideinsatz

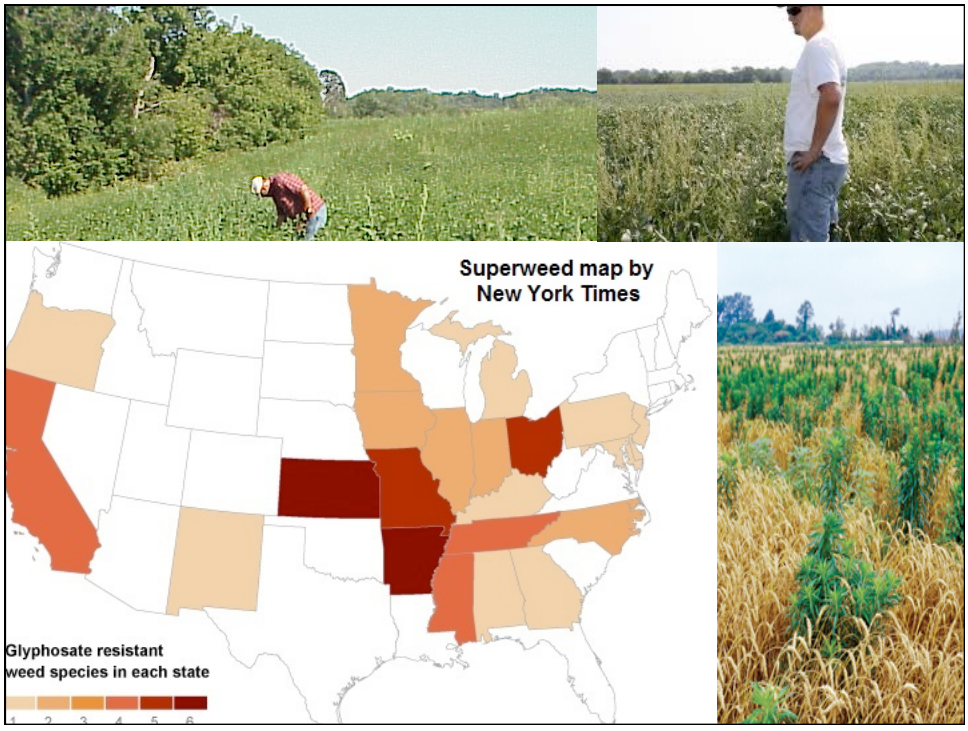
- Resistenzen und Superunkräutern
  → Anwendung alter, toxischerer Herbizide nötig
- Rückstandsproblematik im Erntegut
- Umweltprobleme: reduzierte Aktivität der Bodenmikroben, reduzierte Mikronährstoff-verfügbarkeit, erhöhte Düngung nötig, massiv reduzierte Biodiversität


Glyphosate Use by Year and Crop
Estimated use, in million pounds
250
200
150
100
50
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Other crops
Pasture and hay
Orchards and grapes
Rice
Vegetables and fruit
Cotton
Wheat
Soybeans
Corn
Source: U.S. Geological Survey, National Water Quality Assessment Program,
Pesticides in U.S. Streams and Rivers: Occurrence and Trends during 1992-2011
http://water.usgs.gov/nawqa/pnsp/pubs/pest-streams/
USGS
science for a changing world


Chronological Increase in Resistant Weeds Globally
ALS Inhibitors
Triazines
ACCase Inhibitors
Synthetic Auxins
Bipyridiliums
Glycines
Ureas, Amides
Dinitroanilines
Unkrautresistenzen
Number of Species
175
150
125
100
75
50
25
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
37
1996
©2017 WeedScience.org, Dr. Ian Heap 05/01/2017
http://www.weedscience.org/Graphs/SOAGraph.aspx



http://cornandsoybeandigest.com/respect-rotation



Probleme

1) Grenzwerte für Glyphosatrückstände werden überschritten

LÖSUNG – ad-hoc:

Anhebung des Grenzwerts per politischem/regulatorischem Entscheid

EU seit 2002: erhöhte ADI* auf 0.3mg Glyphosate pro kg Körpergewicht pro Tag (von 0.1mg, bzw. Nachweisgrenze**) - 20 kg Kind – **6 mg** Glyphosat pro Tag

FAO seit 2004: erhöhte ADI auf 1 mg/kg/day:
20 kg Kind – **20 mg** Glyphosat pro Tag

**COUNCIL DIRECTIVE of 24 July 1986 on the fixing of maximum levels for pesticide residues in and on cereals (86/362/EEC) - http://publications.europa.eu/resource/cellar/34582525-ea75-417e-8fc5-399fcb7e1dda.0004.01/DOC_1

*Acceptable Daily Intake – Akzeptable tägliche Einnahme

Year ADI was set for each food/feed	Crop	Increase of international MRL (from – to)	(multiple)
1997 [14]	Soybeans	5 - 20mg/kg	(x4)
	Soybean fodder	20 - 200mg/kg	(x10)
1999 [15]	Cotton seed	0.5 - 10 mg/kg	(x20)
	Maize grain	0.1 - 1 mg/kg	(x10)
	sorghum	0.1 - 20 mg/kg	(x200)
2006 [16]	Cotton seed	10 - 40 mg/kg	(x4)
	(EU MRL remains 10 mg/kg)		
	Maize grain	1 - 5 mg kg	(x5)
	(EU MRL remains 1 mg/kg)		
	Barley straw and fodder	None - 400 mg/kg	
	Grass hay	50 - 500 mg/kg	(x10)
2012 [17]	Lentils	0.1 - 5 mg/kg	(x50)
	(EU MRL increased to 10 mg/kg)		
	Sweetcorn	0.1- 3 mg/kg	(x 30)
	Sugar beet	1 - 20 mg/kg	(x20)

MRL = Maximum residue level (maximale Rückstandskonzentration)

https://www.foeeurope.org/sites/default/files/press_releases/foee_4_human_contamination_glyphosate.pdf

EXPOSITION – gemessen am Feld in Argentinien

Table: Overview of results (numbers in bold exceed MRL of 20 mg/kg)

	Residue (mg/kg), June 2013			Residues (mg/kg), Sept. 2013		
#	Glyphosate (acid)	AMPA	Glyphosate (Sum)	Glyphosate (acid)	AMPA	Glyphosate (Sum)
M1	5,3	<0,05	<5,34			
M2	7,4	6	16,54	1,4	10	16,63
M3	11,6	<0,05	<11,67	7,5	46	**77,54**
M4	22,5	18,1	**50,06**			
M5	18,8	13,7	**39,66**			
M6	11	13,2	**31,10**	12	12	**30,27**
M7	19,4	22,6	**53,81**			
M8	11,3	23,6	**47,23**			
M9	25,8	47	**97,36**	16,2	52,5	**96,14**
M10	14,3	<0,05	<14,38			
M11	23,9	33,8	**75,36**	4	46,5	**74,80**

AMPA has a molecular weight of 111,04, Glyphosate has a molecular weight of 169,07, the AMPA residues were thus calculated with a factor of 1,52 for generate a Glyphosate equivalent. (Glyphosate acid + (AMPA*1,52)` =Glyphosate (sum)). Moisture of the samples was around 6 percent.

Testbiotech report: www.testbiotech.de/en/node/926

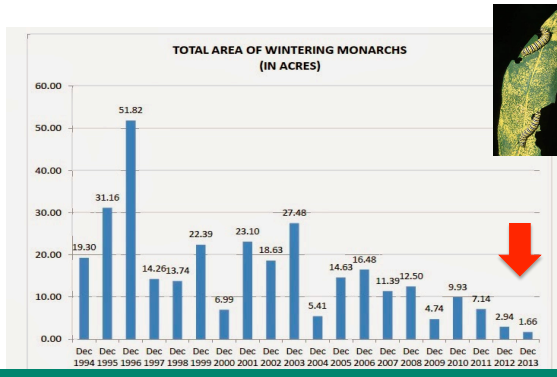
Umweltprobleme – Grosse *Biodiversitätsverluste* -

Beispiel: MONARCH Schmetterling in USA

***2014* – Monarch vom Aussterben bedroht**

*"The main cause of the monarch butterfly's decline is **the loss of milkweed** — its food — in its U.S. breeding grounds, a new study has found. That all but confirms that the **spread of genetically modified crops** is **indirectly killing the monarch**."**

HR und Bt gestapelte Maissorten + HR Sojabohnen



*http://www.cbc.ca/news/technology/monarch-butterfly-decline-linked-to-spread-of-gm-crops-1.2665131

Glyphosate-basierte Herbizide reduzieren die Aktivität und Reproduktion von Regenwürmer ….

Mailin Gaupp-Berghausen, **Martin Hofer**, **Boris Rewald** & **Johann G. Zaller**
Scientific Reports **5**, Article number: 12886 (2015) doi:10.1038/srep12886

We demonstrate, that ….. **Reproduction of the soil dwellers was reduced by 56%** within three months after herbicide application.

Herbicide application led to **increased soil concentrations of nitrate by 1592% and phosphate by 127%**, pointing to potential risks for nutrient leaching into streams, lakes, or groundwater aquifers.

These sizeable herbicide-induced **impacts on agroecosystems are particularly worrisome because these herbicides have been globally used for decades**.

http://www.nature.com/articles/srep12886

EXPOSITION

Contents lists available at ScienceDirect

Reproductive Toxicology

journal homepage: www.elsevier.com/locate/reprotox

Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada

Aziz Aris [a,b,c,*], Samuel Leblanc [c]

[a] Department of Obstetrics and Gynecology, University of Sherbrooke Hospital Centre, Sherbrooke, Quebec, Canada
[b] Clinical Research Centre of Sherbrooke University Hospital Centre, Sherbrooke, Quebec, Canada
[c] Faculty of Medicine and Health Sciences, University of Sherbrooke, Sherbrooke, Quebec, Canada

Serum 3-MPPA and CryAb1 toxin were detected in PW, their fetuses and NPW. This is the first study to reveal the presence of circulating PAGMF in women with and without pregnancy, paving the way for a new field in reproductive toxicology including nutrition and utero-placental toxicities.

Rückstände von Roundup (3-MPPA) und Bt Toxinen (Cry1Ab) wurden in schwangeren und nicht schwangeren Frauen und im Fötus gefunden.

ARTICLE INFO

Article history:
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EXPOSITION

Environmental & Analytical Toxicology

Krüger et al., J Environ Anal Toxicol 2013, 3:5
http://dx.doi.org/10.4172/2161-0525.1000186

Research Article Open Access

Field Investigations of Glyphosate in Urine of Danish Dairy Cows

Monika Krüger[1], Wieland Schrödl[1], Jürgen Neuhaus[1] and Awad Ali Shehata[1,2,3]*

[1]Institute of Bacteriology and Mycology, Veterinary Faculty, University of Leipzig, An den Tierkliniken 29, D-04103 Leipzig, Germany
[2]Avian and Rabbit Diseases Department, Faculty of Veterinary Medicine, Minoufiya University, Egypt
[3]Albrecht Daniel Thaer-Institute of Agronomy, University Leipzig, Leipzig, Germany

Abstract

In the present study, thirty dairy cows from each of eight Danish dairy farms were investigated for excretion of glyphosate in urine. Blood serum parameters indicative of cytotoxicity as alkaline phosphatase (AP), glutamate dehydrogenase (GLDH), glutamate oxaloacetate transaminase (GOT), creatinine kinase CK), nephrotoxicity, (urea, creatine), cholesterol and the trace elements as manganese (Mn), cobalt (Co), selenium (Se), copper (Cu) and zinc (Zn) were investigated. All cows excreted glyphosate in their urine but in varying concentrations. Increased levels of GLDH, GOT and CK in cows from all farms demonstrate a possible effect of glyphosate on liver and muscle cells. High urea levels in some farms could be due to nephrotoxicity of glyphosate. Also the unexpected very low levels of Mn and Co were observed in all animals which could be explained due to a strong mineral chelating effect of glyphosate. In contrast the mean levels of Cu, Zn and Se were within the normal reference range. In conclusion, this study gives the first documentation to which extent Danish dairy cattle are exposed to Glyphosate and its impact on blood parameters.

EXPOSITION

Insgesamt ließen sich bei 99,6 Prozent von insgesamt 2000 Probanden eindeutig Glyphosatrückstände nachweisen. Die höchsten Belastungen zeigten sich bei Kindern im Alter von 0 bis neun und Jugendlichen von zehn bis 19 Jahren, nach Berufsgruppen vor allem bei Landwirten. Studienteilnehmer, die Fleisch konsumieren, wiesen höhere Belastungen als Vegetarier und Veganer auf.

Die Belastung bei 75 Prozent der untersuchten Menschen liegt um ein Fünffaches höher liegt, als es der Grenzwert für Trinkwasser zulässt. Ein Drittel der Bevölkerung hat demnach sogar eine zehnfache bis zu 42-fache Menge der für Trinkwasser zulässigen Grenzwerte im Urin.

http://www.umweltinstitut.org/aktuelle-meldungen/meldungen/glyphosat-praktisch-jeder-belastet.html

http://www.umweltbundesamt.de/themen/neue-uba-untersuchung-zu-glyphosat

EXPOSURE

EMISA (Multidisziplinärer Raum für ökologische Interaktion) von der argentinischen Univerität La Plata durchforstete zahlreiche Supermärkte und Apotheken nach Baumwollprodukten aller Marken. Wattestäbchen, Tampons, Binden, Wattepads, Pflaster, Verbandsmaterial. Bei der Untersuchung bestätigte sich ihr Verdacht: „**85% der untersuchten Produkte waren Glyphosat-positiv, und 62% enthielten den Abbaustoff AMPA (Aminomethylphosphorische Säure)**“, berichtet Dr. Damián Marino, der Leiter des Forschungsprojektes.

http://www.taz.de/!5251145/

GESUNDHEITSEFFEKTE

International Agency for Research on Cancer

World Health Organization

20 March 2015

IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides

Lyon, France, 20 March 2015 – The International Agency for Research on Cancer (IARC), the specialized cancer agency of the World Health Organization, has assessed the carcinogenicity of **five organophosphate pesticides**. A summary of the final evaluations together with a short rationale have now been published online in The Lancet Oncology, and the detailed assessments will be published as Volume 112 of the IARC Monographs.

What were the results of the IARC evaluations?

The herbicide **glyphosate** and the insecticides **malathion** and **diazinon** were classified as *probably carcinogenic to humans* (Group 2A).

https://www.iarc.fr/en/media-centre/iarcnews/pdf/MonographVolume112.pdf

efsa

European Food Safety Authority

EFSA Journal 2015;13(11):4302

CONCLUSION ON PESTICIDE PEER REVIEW

Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate[1]

European Food Safety Authority (EFSA)[2]

European Food Safety Authority (EFSA), Parma, Italy

ABSTRACT

"…. EFSA concluded that glyphosate is **unlikely** to pose **a carcinogenic hazard** to humans and The evidence does not support classification with regard to its carcinogenic potential according to Regulations (EC) No 1272/2008."

http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/4302.pdf

November 27, 2015

Schlagabtausch zwischen WHO IARC und EFSA zu Glyphosat/Roundup Risk Assessment

Mr. Vytenis Andriukaitis
Commissioner Health & Food Safety
European Commission
Rue de la Loi / Wetstraat 200
1049 Brussels
Belgium

Cc: (email only)
Mr. Phil Hogan, European Commissioner for Agriculture and Human Development
Dr. Ladislav Miko, Deputy Director-General, DG Health & Food Safety
Dr. Bernhard Url, Executive Director, EFSA
Dr. Giovanni La Via, Chair, ENVI Committee
EFSA Panel on Plant Protection Products and their Residues
Mr. Christian Schmidt, Minister of Food and Agriculture
Dr. Helmut Tschiersky, President of the Federal Office of Consumer Protection and Food Safety (BVL)
Professor Dr. Dr. Andreas Hensel, President, BFR
Dr. Christopher Wild, Director, IARC
Mr. Jim Jones, Assistant Administrator, USEPA

http://www.zeit.de/wissen/umwelt/2015-11/glyphosat-offener-brief.pdf

Open letter: Review of the Carcinogenicity of Glyphosate by EFSA and BfR

Prof. Christopher J. Portier (Corresponding Author)
Senior Contributing Scientist, Environmental Defense Fund, Washington, DC
Visiting Professor, Maastricht University, Maastricht, The Netherlands
Adjunct Professor, Emory University, Atlanta, Georgia, USA
Honorary Professor, University of Queensland, Brisbane, Queensland, Australia
Former Director, National Center for Environmental Health, Atlanta, USA
Former Director, Agency for Toxic Substances and Disease Registry, Atlanta, USA
Former Associate Director, US National Toxicology Program, RTP, NC, USA

Schlagabtausch zwischen WHO IARC und EFSA zu Glyphosat/Roundup Risk Assessment

http://www.zeit.de/wissen/umwelt/2015-11/glyphosat-offener-brief.pdf

Industriedaten

We believe that the arguments promoted by the BfR to negate the human, animal and mechanistic evidence are fundamentally and scientifically flawed and should be rejected. We strongly object to the almost non-existent weight given to studies from the literature by the BfR and the strong reliance on non-publicly available data in a limited set of assays that define the minimum data necessary for the approval of a pesticide. We believe that the IARC WG evaluation of *probably carcinogenic to humans* accurately reflects the results of the published scientific literature on glyphosate and, on the face of it, the unpublished studies to which the BfR refers. Conversely, the BfR evaluation, and consequently the EFSA evaluation, do not reflect the available science.

Schlagabtausch zwischen WHO IARC und EFSA zu Glyphosat/Roundup Risk Assessment

efsa
European Food Safety Authority

EXECUTIVE DIRECTOR

13 January 2016
Ref. BU/JK/JR/aa (2016) – out-15124233

Prof. Christopher J. Portier
Senior Contributing Scientist
Environmental Defense Fund
1875 Connecticut Ave NW, Ste 600
Washington, DC 20009
United States of America

Subject: Open letter: Review of the Carcinogenicity of Glyphosate by EFSA and BfR

Dear Professor Portier,

Schlagabtausch zwischen WHO IARC und EFSA zu Glyphosat/Roundup Risk Assessment

IARC's broad screening covered both the active substance glyphosate and glyphosate-based pesticide formulations, whereas EFSA focused only on the active substance as it is required to do by EU legislation. In the EU, individual Member States are responsible for evaluating the safety of pesticide formulations used on their territory, including the assessment of the other ingredients (the co-formulants).

I agree that IARC carries out an important role in the screening assessment of the carcinogenic potential of agents. However, we should not compare this first screening assessment with the more comprehensive hazard assessment done by authorities such as EFSA, which are designed to support the regulatory process for pesticides in close cooperation with the Member States in the EU.

c) Conclusion

Considering a weight of evidence approach, taking into account the quality and reliability of all available data, it is concluded that glyphosate is unlikely to be genotoxic *in vivo* and does not require hazard classification regarding mutagenicity according to the CLP Regulation. It is noted that unpublished studies that were the core basis of the EFSA evaluation were not available to the IARC experts as reported in the IARC monograph 112 on glyphosate.

GESUNDHEITSEFFEKTE

Myers *et al. Environmental Health* (2016) 15:19
DOI 10.1186/s12940-016-0117-0

Environmental Health

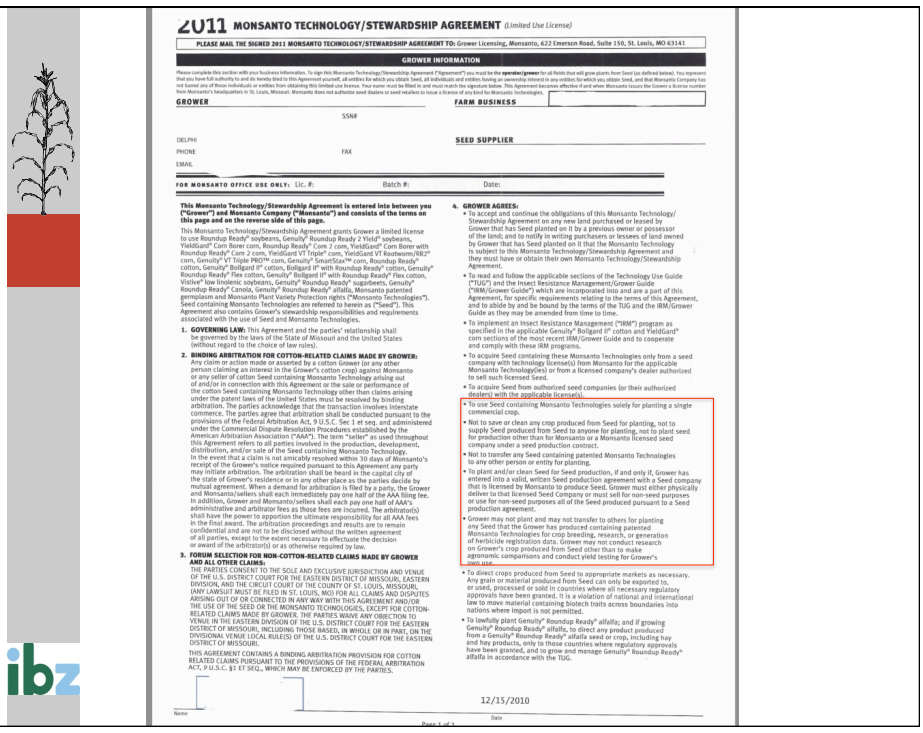
REVIEW Open Access

Concerns over use of glyphosate-based herbicides and risks associated with exposures: a consensus statement

John Peterson Myers[1,13*], Michael N. Antoniou[2], Bruce Blumberg[3], Lynn Carroll[4], Theo Colborn[4], Lorne G. Everett[5], Michael Hansen[6], Philip J. Landrigan[7], Bruce P. Lanphear[8], Robin Mesnage[2], Laura N. Vandenberg[9], Frederick S. vom Saal[10], Wade V. Welshons[11] and Charles M. Benbrook[12*]

Ökologische Effekte:

Nutzen gegen Schäden aufgewogen?



2011 MONSANTO TECHNOLOGY/STEWARDSHIP AGREEMENT (Limited Use License)

PLEASE MAIL THE SIGNED 2011 MONSANTO TECHNOLOGY/STEWARDSHIP AGREEMENT TO: Grower Licensing, Monsanto, 622 Emerson Road, Suite 150, St. Louis, MO 63141

GROWER INFORMATION

Please complete this section with your business information. To sign this Monsanto Technology/Stewardship Agreement ("Agreement") you must be the **operator/grower** for all fields that will grow plants from Seed (as defined below). You represent that you have full authority to and do hereby bind to this Agreement yourself, all entities for which you obtain Seed, all individuals and entities having an ownership interest in any entities for which you obtain Seed, and that Monsanto Company has not barred any of those individuals or entities from obtaining this limited-use license. Your name must be filled in and must match the signature below. This Agreement becomes effective if and when Monsanto issues the Grower a license number from Monsanto's headquarters in St. Louis, Missouri. Monsanto does not authorize seed dealers or seed retailers to issue a license of any kind for Monsanto technologies.

GROWER

SSN#

DELPHI

PHONE FAX

EMAIL

FARM BUSINESS

SEED SUPPLIER

FOR MONSANTO OFFICE USE ONLY: Lic. #: Batch #: Date:

This Monsanto Technology/Stewardship Agreement is entered into between you ("Grower") and Monsanto Company ("Monsanto") and consists of the terms on this page and on the reverse side of this page.

This Monsanto Technology/Stewardship Agreement grants Grower a limited license to use Roundup Ready® soybeans, Genuity® Roundup Ready 2 Yield® soybeans, YieldGard® Corn Borer corn, Roundup Ready® Corn 2 corn, YieldGard® Corn Borer with Roundup Ready® Corn 2 corn, YieldGard VT Triple® corn, YieldGard VT Rootworm/RR2® corn, Genuity® VT Triple PRO™ corn, Genuity® SmartStax™ corn, Roundup Ready® cotton, Genuity® Bollgard II® cotton, Bollgard II® with Roundup Ready® cotton, Genuity® Roundup Ready® Flex cotton, Genuity® Bollgard II® with Roundup Ready® Flex cotton, Visitive® low linolenic soybeans, Genuity® Roundup Ready® sugarbeets, Genuity® Roundup Ready® Canola, Genuity® Roundup Ready® alfalfa, Monsanto patented germplasm and Monsanto Plant Variety Protection rights ("Monsanto Technologies"). Seed containing Monsanto Technologies are referred to herein as ("Seed"). This Agreement also contains Grower's stewardship responsibilities and requirements associated with the use of Seed and Monsanto Technologies.

1. **GOVERNING LAW:** This Agreement and the parties' relationship shall be governed by the laws of the State of Missouri and the United States (without regard to the choice of law rules).
2. **BINDING ARBITRATION FOR COTTON-RELATED CLAIMS MADE BY GROWER:** Any claim or action made or asserted by a cotton Grower (or any other person claiming an interest in the Grower's cotton crop) against Monsanto or any seller of cotton Seed containing Monsanto Technology arising out of and/or in connection with this Agreement or the sale or performance of the cotton Seed containing Monsanto Technology other than claims arising under the patent laws of the United States must be resolved by binding arbitration. The parties acknowledge that the transaction involves interstate commerce. The parties agree that arbitration shall be conducted pursuant to the provisions of the Federal Arbitration Act, 9 U.S.C. Sec 1 et seq. and administered under the Commercial Dispute Resolution Procedures established by the American Arbitration Association ("AAA"). The term "seller" as used throughout this Agreement refers to all parties involved in the production, development, distribution, and/or sale of the Seed containing Monsanto Technology. In the event that a claim is not amicably resolved within 30 days of Monsanto's receipt of the Grower's notice required pursuant to this Agreement any party may initiate arbitration. The arbitration shall be heard in the capital city of the state of Grower's residence or in any other place as the parties decide by mutual agreement. When a demand for arbitration is filed by a party, the Grower and Monsanto/sellers shall each immediately pay one half of the AAA filing fee. In addition, Grower and Monsanto/sellers shall each pay one half of AAA's administrative and arbitrator fees as those fees are incurred. The arbitrator(s) shall have the power to apportion the ultimate responsibility for all AAA fees in the final award. The arbitration proceedings and results are to remain confidential and are not to be disclosed without the written agreement of all parties, except to the extent necessary to effectuate the decision or award of the arbitrator(s) or as otherwise required by law.
3. **FORUM SELECTION FOR NON-COTTON-RELATED CLAIMS MADE BY GROWER AND ALL OTHER CLAIMS:** THE PARTIES CONSENT TO THE SOLE AND EXCLUSIVE JURISDICTION AND VENUE OF THE U.S. DISTRICT COURT FOR THE EASTERN DISTRICT OF MISSOURI, EASTERN DIVISION, AND THE CIRCUIT COURT OF THE COUNTY OF ST. LOUIS, MISSOURI. (ANY LAWSUIT MUST BE FILED IN ST. LOUIS, MO) FOR ALL CLAIMS AND DISPUTES ARISING OUT OF OR CONNECTED IN ANY WAY WITH THIS AGREEMENT AND/OR THE USE OF THE SEED OR THE MONSANTO TECHNOLOGIES, EXCEPT FOR COTTON-RELATED CLAIMS MADE BY GROWER. THE PARTIES WAIVE ANY OBJECTION TO VENUE IN THE EASTERN DIVISION OF THE U.S. DISTRICT COURT FOR THE EASTERN DISTRICT OF MISSOURI, INCLUDING THOSE BASED, IN WHOLE OR IN PART, ON THE DIVISIONAL VENUE LOCAL RULE(S) OF THE U.S. DISTRICT COURT FOR THE EASTERN DISTRICT OF MISSOURI.

THIS AGREEMENT CONTAINS A BINDING ARBITRATION PROVISION FOR COTTON RELATED CLAIMS PURSUANT TO THE PROVISIONS OF THE FEDERAL ARBITRATION ACT, 9 U.S.C. §1 ET SEQ., WHICH MAY BE ENFORCED BY THE PARTIES.

4. **GROWER AGREES:**
   - To accept and continue the obligations of this Monsanto Technology/ Stewardship Agreement on any new land purchased or leased by Grower that has Seed planted on it by a previous owner or possessor of the land; and to notify in writing purchasers or lessees of land owned by Grower that has Seed planted on it that the Monsanto Technology is subject to this Monsanto Technology/Stewardship Agreement and they must have or obtain their own Monsanto Technology/Stewardship Agreement.
   - To read and follow the applicable sections of the Technology Use Guide ("TUG") and the Insect Resistance Management/Grower Guide ("IRM/Grower Guide") which are incorporated into and are a part of this Agreement, for specific requirements relating to the terms of this Agreement, and to abide by and be bound by the terms of the TUG and the IRM/Grower Guide as they may be amended from time to time.
   - To implement an Insect Resistance Management ("IRM") program as specified in the applicable Genuity® Bollgard II® cotton and YieldGard® corn sections of the most recent IRM/Grower Guide and to cooperate and comply with these IRM programs.
   - To acquire Seed containing these Monsanto Technologies only from a seed company with technology license(s) from Monsanto for the applicable Monsanto Technology(ies) or from a licensed company's dealer authorized to sell such licensed Seed.
   - To acquire Seed from authorized seed companies (or their authorized dealers) with the applicable license(s).
   - To use Seed containing Monsanto Technologies solely for planting a single commercial crop.
   - Not to save or clean any crop produced from Seed for planting, not to supply Seed produced from Seed to anyone for planting, not to plant seed for production other than for Monsanto or a Monsanto licensed seed company under a seed production contract.
   - Not to transfer any Seed containing patented Monsanto Technologies to any other person or entity for planting.
   - To plant and/or clean Seed for Seed production, if and only if, Grower has entered into a valid, written Seed production agreement with a Seed company that is licensed by Monsanto to produce Seed. Grower must either physically deliver to that licensed Seed Company or must sell for non-seed purposes or use for non-seed purposes all of the Seed produced pursuant to a Seed production agreement.
   - Grower may not plant and may not transfer to others for planting any Seed that the Grower has produced containing patented Monsanto Technologies for crop breeding, research, or generation of herbicide registration data. Grower may not conduct research on Grower's crop produced from Seed other than to make agronomic comparisons and conduct yield testing for Grower's own use.
   - To direct crops produced from Seed to appropriate markets as necessary. Any grain or material produced from Seed can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted.
   - To lawfully plant Genuity® Roundup Ready® alfalfa; and if growing Genuity® Roundup Ready® alfalfa, to direct any product produced from a Genuity® Roundup Ready® alfalfa seed or crop, including hay and hay products, only to those countries where regulatory approvals have been granted, and to grow and manage Genuity® Roundup Ready® alfalfa in accordance with the TUG.

12/15/2010

Name Date

Page 1 of 2


MONSTANTO TECHNOLOGY/STEWARDSHIP AGREEMENT (Limited Use License)
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ibz
http://thefarmerslife.com/whats-in-a-monsanto-contract/#jp-carousel-6513


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Keine unabhängige Forschung – Forschung nur mit Erlaubnis der Industrie möglich
ibz
http://thefarmerslife.com/whats-in-a-monsanto-contract/#jp-carousel-6513

Lösungen à la Industrie

2,4 D – resistente GV Pflanzen

R 51/53 poisonous for aquatic organisms, can have damaging effects in the long run in aquatic systems

S 13 Keep away from food, beverages and feed

umweltgefährlich reizend

Dicamba - resistente GV Pflanzen

http://www.blw.admin.ch/psm/produkte/index.html?lang=de&item=1293

Leading trait technology. Exceptional weed control. DOW

Weed control gets easier with the very latest trait technology. Enlist™ traits enable exceptional control against the toughest weeds — while giving you greater application and planting flexibility.

With tolerance to a new 2,4-D and glyphosate, Enlist corn, soybeans and cotton build on the Roundup Ready® system. Enlist E3™ soybeans combine tolerance to a new 2,4-D, glyphosate and glufosinate in a single gene insertion for efficient breeding and better varietal performance.

Tolerance to 2,4-D means fewer plant-back restrictions — you can plant Enlist crops immediately after applying 2,4-D for burndown.[1]

ROUNDUP READY 2 XTEND® SOYBEANS MONSANTO

ROUNDUP READY 2 XTEND SOYBEANS

INNOVATIVE TRAIT

Roundup Ready 2 Xtend® soybeans combine the proven yield potential of the Genuity® Roundup Ready 2 Yield® soybean trait, along with tolerance to both dicamba and glyphosate. Genuity® Roundup Ready 2 Yield®, which is a key component of Roundup Ready 2 Xtend® soybeans, has been shown to produce more beans per pod and more bushels per acre vs. original Roundup Ready® soybeans.

CORPORATE SOLUTION OPTIONS: LOADED CROPS/FOOD

GENUITY® SMARTSTAX® RIB COMPLETE™ CORN — MONSANTO

genuity SMARTSTAX CORN RIB COMPLETE

Contains:
6 Bt transgenes
2 resistance transgenes against 2 broad spectrum herbicides

Harvested products of GM plants contain:

6 Bt toxins + residues of 2 herbicides + usual residues of neonicotinoids + the usual other insecticide- and fungicide sprays

ibz

Wer hatte Recht?

The Contributions of Plant Biotechnology to Agriculture in the Coming Decades, R. T. Fraley

Krattiger, A.F. and A. Rosemarin. **1994**. Biosafety for Sustainable Agriculture: Sharing Biotechnology Regulatory Experiences of the Western Hemisphere.

Herbicide-tolerant plants will have the **positive impact of shifting overall herbicide usage through substitution of more effective and environmentally acceptable products**.

The commercial strategy behind engineering herbicide tolerance is to gain market share through a shift in herbicide use, **not to increase the overall use of herbicides as is popularly held by critics** (Goldburg et al., 1990).

Ein Realitätscheck

Höhere Erträge?

ibz

GLOBALE ERTRAGSENTWICKLUNG

International Journal of Agricultural Sustainability

Sustainability and innovation in staple crop production in the US Midwest

Jack A. Heinemann, Melanie Massaro, Dorien S. Coray, Sarah Zanon Agapito-Tenfen & Jiajun Dale Wen

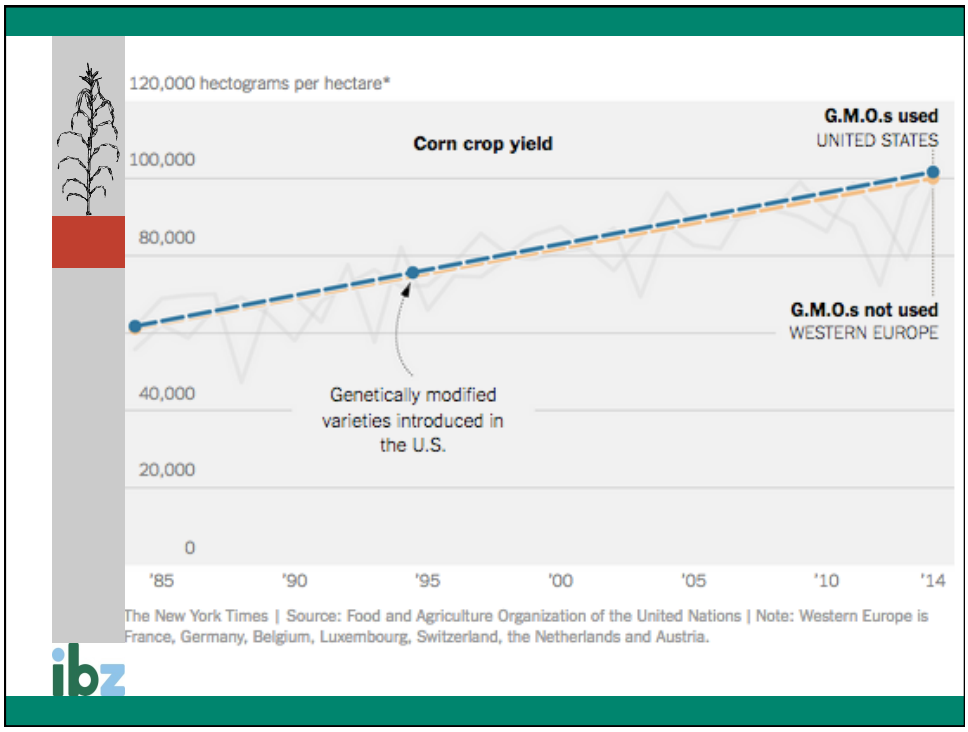
Hilbeck *et al. Environmental Sciences Europe* 2013, **25**:12
http://www.enveurope.com/content/25/1/12

Environmental Sciences Europe
a SpringerOpen Journal

DISCUSSION Open Access

Farmer's choice of seeds in four EU countries under different levels of GM crop adoption

Angelika Hilbeck[1*], Tamara Lebrecht[1], Raphaela Vogel[1], Jack A Heinemann[2] and Rosa Binimelis[3,4]


120,000 hectograms per hectare*
Corn crop yield
G.M.O.s used
UNITED STATES
100,000
80,000
G.M.O.s not used
WESTERN EUROPE
40,000
Genetically modified varieties introduced in the U.S.
20,000
0
'85
'90
'95
'00
'05
'10
'14
The New York Times | Source: Food and Agriculture Organization of the United Nations | Note: Western Europe is France, Germany, Belgium, Luxembourg, Switzerland, the Netherlands and Austria.
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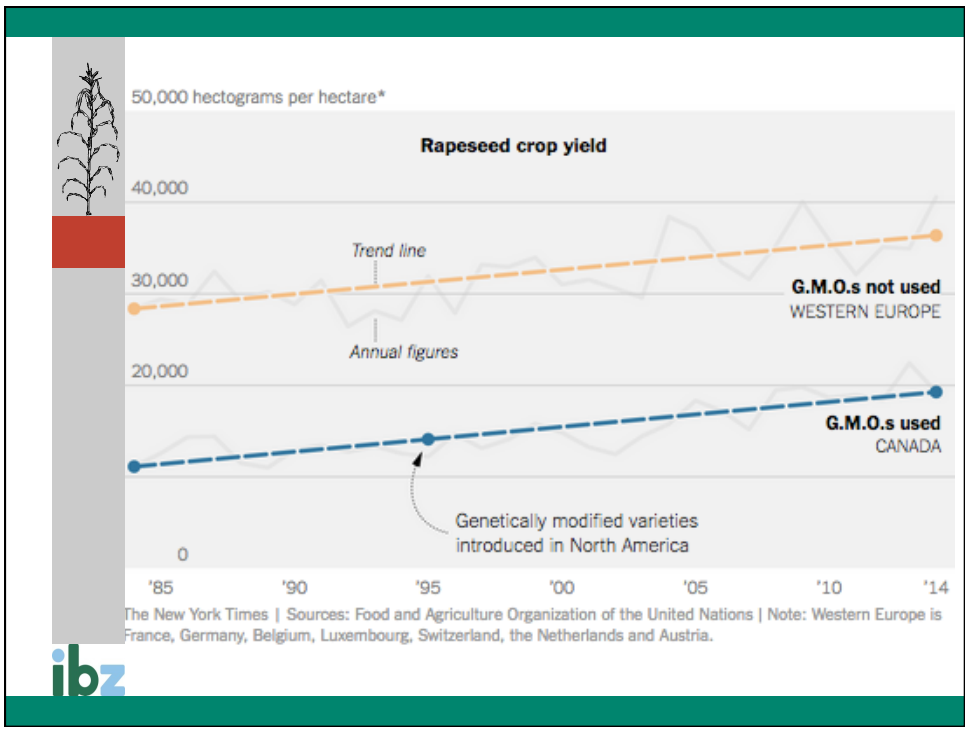
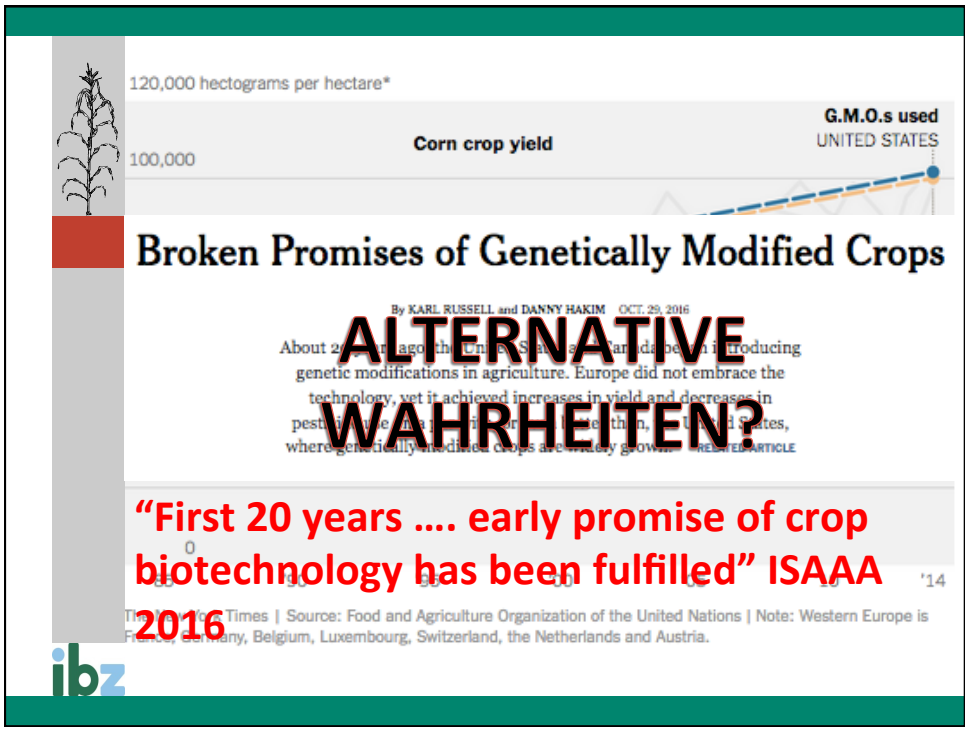

50,000 hectograms per hectare*
Rapeseed crop yield
40,000
Trend line
30,000
G.M.O.s not used
WESTERN EUROPE
Annual figures
20,000
G.M.O.s used
CANADA
Genetically modified varieties introduced in North America
0
'85
'90
'95
'00
'05
'10
'14
The New York Times | Sources: Food and Agriculture Organization of the United Nations | Note: Western Europe is France, Germany, Belgium, Luxembourg, Switzerland, the Netherlands and Austria.
ibz



Wir müssen uns über Landwirtschaftssysteme unterhalten!

Industrielle Landwirtschaft mit Fokus auf **Rohstoffgewinnung** für lange, profit-maximierte, export-orientierte Wertschöpfungsketten

oder

Kleinräumige, bäuerliche Landwirtschaft mit Fokus auf **Nahrungsmittel**, Direktvermarktung, lokale kurze Wertschöpfungsketten

Danke für’s Zuhören!