



“El Maíz Transgénico en Colombia, amenaza la soberanía alimentaria de los pueblos”

Los impactos adversos del cultivo de variedades transgenicas en la soberania y la seguridad alimentaria

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¿ Cuales son las mayores
innovaciones de la
humanidad?

Espigeta de teosinto selvagem com uma fileira de cariopses revestidas por uma rígida cápsula

Espiga do milho domesticado atual com muitas fileiras de cariopses maiores e sem proteção







“No hay país en el mundo que haya presentado tanta resistencia a la siembra de maíz transgénico como México.”

Wall Street Journal, 9 dic 2010

<http://online.wsj.com/article/>

Velada por el maíz
Zócalo de la Cd de México

Campaña nacional
Sin maíz no hay país







Cultivos predominantes



ZONA GLACIAL
4700Mt 0°C



PARAMO
3000Mt

< 10°C



FRIO
2000 Mt

> 10°C



TEMPLADO
1000 Mt

> 17°C

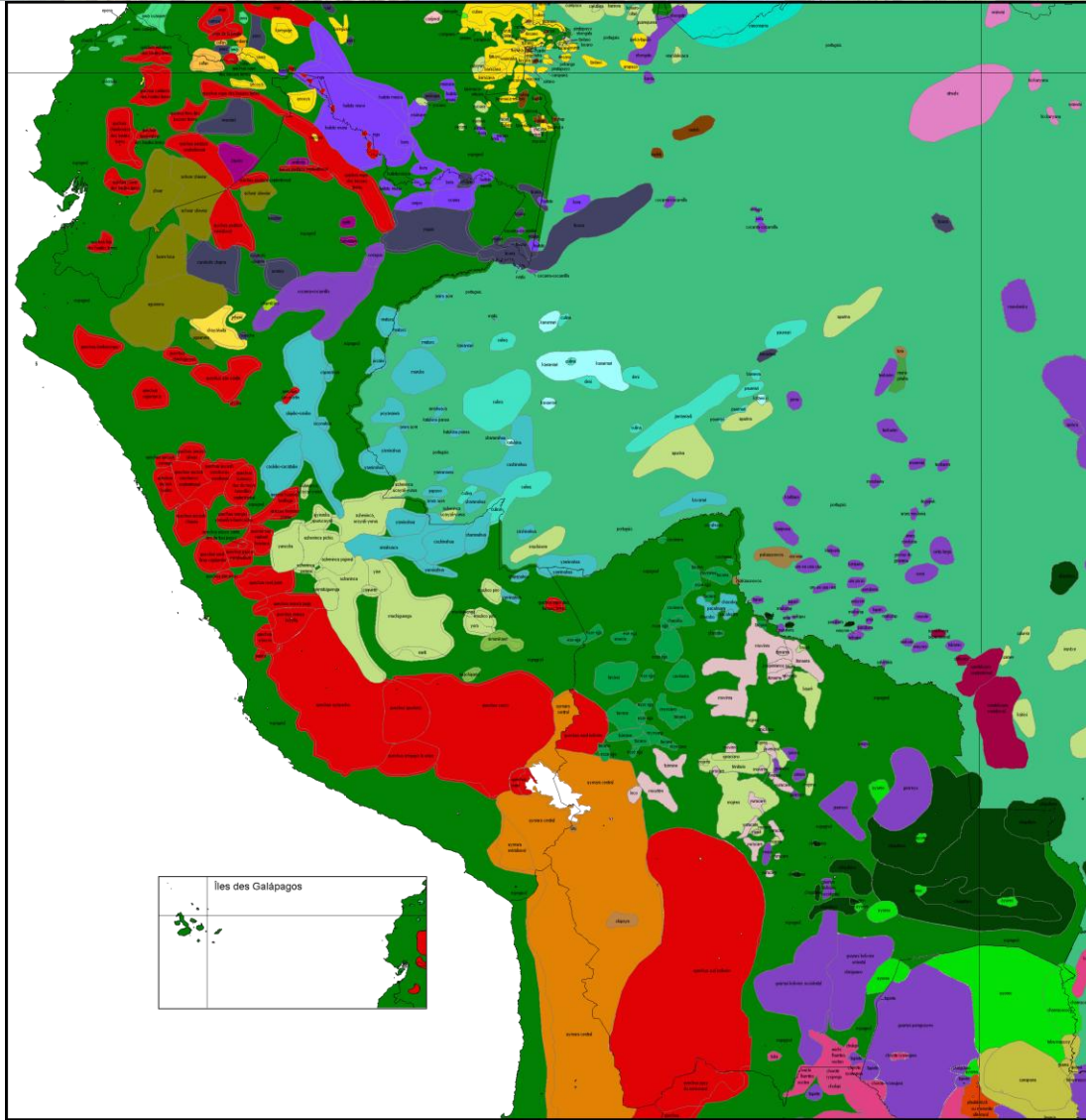


CALIDO
0Mt

> 24°C



DIVERSIDAD CULTURAL





Agrobiodiversidad

La diversidad en los centros de diversidad genética es resultado de factores de naturaleza **histórica**, **ecológica**, **genética** y **cultural**.

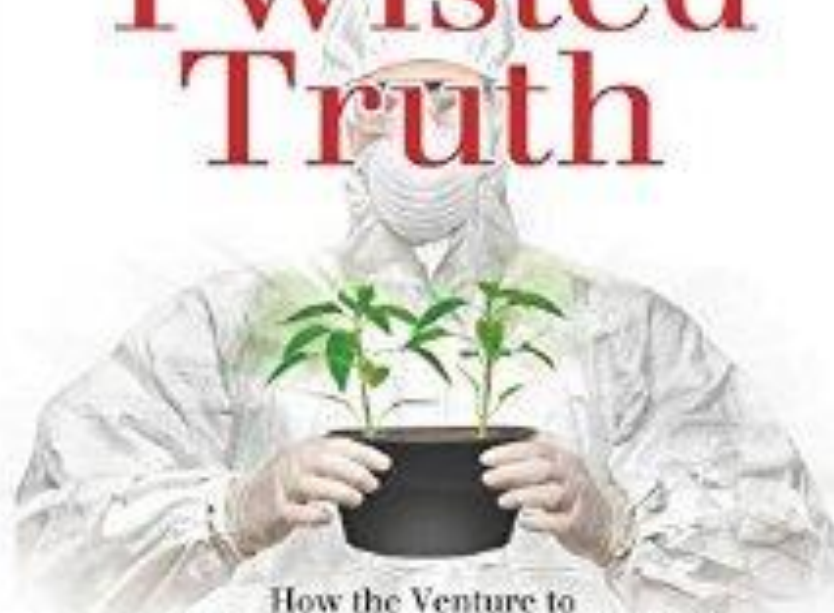


Sementes: Patrimônio
do povo,
a serviço da humanidade.

"ONE OF THE MOST IMPORTANT BOOKS OF THE LAST 50 YEARS."

— Jane Goodall, from the Foreword

Altered Genes, Twisted Truth



How the Venture to
Genetically Engineer Our Food Has
Subverted Science, Corrupted Government,
and Systematically Deceived the Public

STEVEN M. DRUKER

Genes alterados,
Verdad Destorcida:
Como la Venture de
manipular
genéticamente
Nuestra Comida
subvirtió la Ciencia,
Corrompió Gobiernos
y sistemáticamente,
engañó el público.



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ADVANCEMENT OF
SCIENCE

SCIENCE

18 OCTOBER 1991
VOL. 254 ■ PAGES 345-488

\$6.00

1994 – primera
planta
transgénica
comercial

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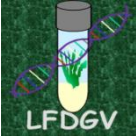




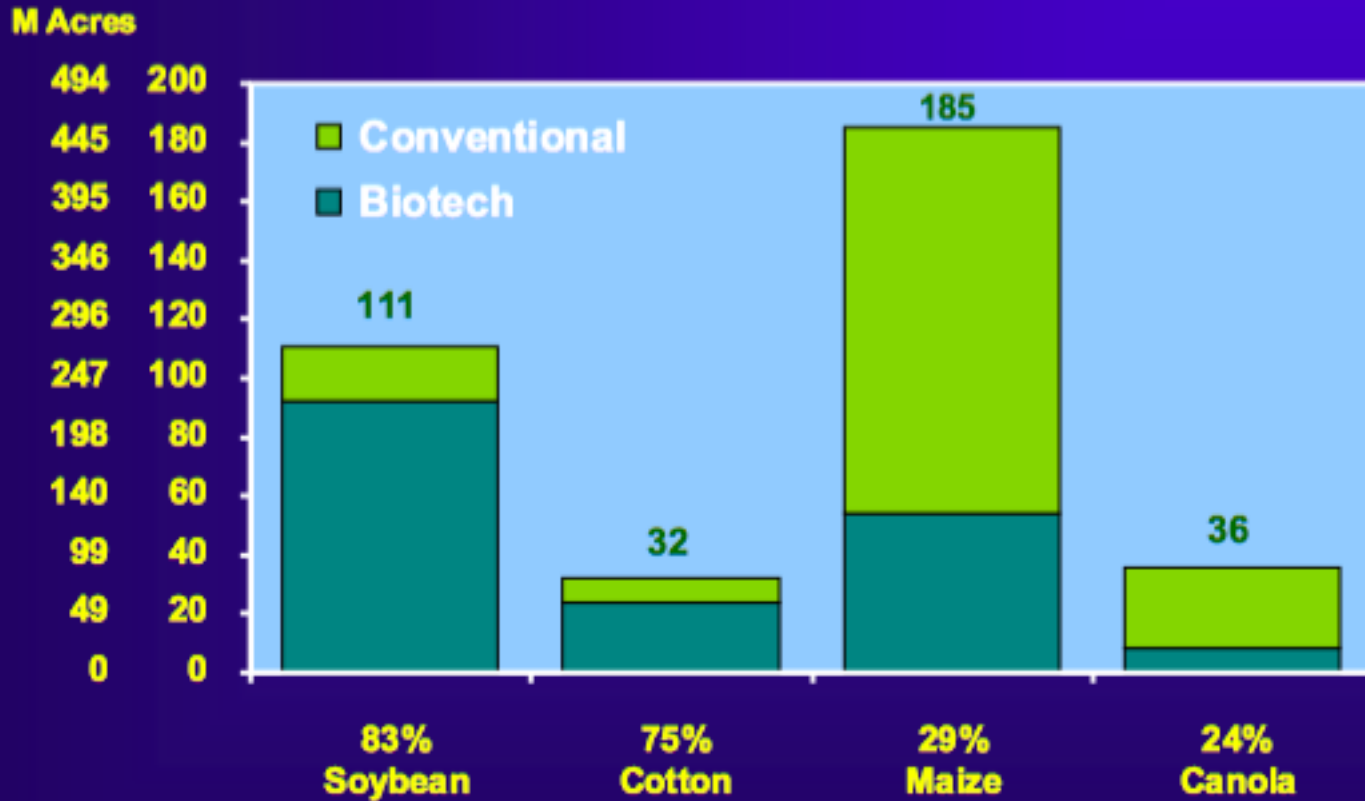
¿Cuanto tiempo el Tomato Flavr Savr se quedo en mercado? 2 años

¿ Cuales son las razones del fracaso?

1. Problemas no previstos: rechazo de los consumidores y maior costo industrial.
2. Efectos no intencionales: peor gusto, menor resiliencia a distintos ambientes, cultivo más costoso.
3. Otras



Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares, Million Acres), 2015



Source: Clive James, 2015
Hectarage based on FAO Data for 2013.

¿Que pasa con el arroz dorado o arroz de tolo?

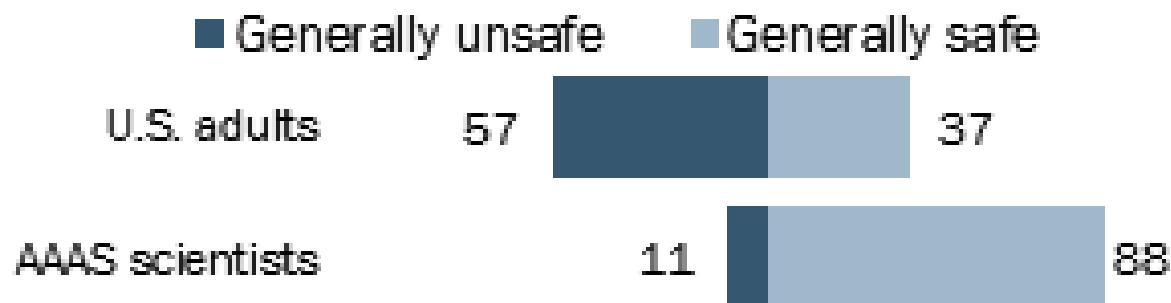


<http://www.goldenrice.org/index.php>

In *Golden Rice* two genes have been inserted into the rice genome by genetic engineering, to restart the carotenoid biosynthetic pathway leading to the production and accumulation of β -carotene in the grains. Both genes are naturally involved in carotene biosynthesis. The difference here is that the reconstructed pathway is not subject to downregulation, as usually happens in the grain.

Eating Genetically Modified Foods

% of each group saying it is generally safe or unsafe to eat genetically modified foods



Survey of U.S. adults Aug. 15-25, 2014. Q38. AAAS scientists survey Sept. 11 - Oct. 13, 2014. Q28 Those saying don't know or giving no answer are not shown

PEW RESEARCH CENTER



RIESGOS.....

Riesgos no estão relacionados a lo que los científicos saben, más a lo que ellos no saben.

Riesgos están asociados a **incertidumbres**.

Caruso, D. Intervention. San Francisco, Hybrid Vigor Press, 2006, 252p.

En el contexto de la **incertidumbre** que progresa la esperanza, el juicio y la valoración de la subjetividad, capaz de concretizar lo inesperado.

Lieber, RR. & Romano-Lieber NS. Risco, incerteza e as possibilidades de ação na saúde ambiental. *Rev. Bras. Epidemiol.*, 6(2):121-34, 2003.



¿...?



<http://www.goldenrice.org/index.php>

In *Golden Rice* two genes have been inserted into the rice genome by genetic engineering, to restart the carotenoid biosynthetic pathway leading to the production and accumulation of β -carotene in the grains. Both genes are naturally involved in carotene biosynthesis. The difference here is that the reconstructed pathway is not subject to downregulation, as usually happens in the grain.



¿ Cules son los
impactos del mayz
transgénico ?



1- Perdida de las
semillas de identidad o
criollas

Caminando para la
privatización de las
semillas...



STARLINK: scandal harms the farmers

Cry19C – solamente como pienso



www.greenpeace.org.uk/files/images/gm_crops/gm_maize.jpg&imgrefurl





Milho *Bt* StarLink: el otro gran Fiasco!

- Liberado para consumo animal;
- Detectado en productos; alimentícios para seres humanos en los EUA;
- Detectado en productos alimenticios y bebidas en otros países;
- Detectado en **semillas** de otras variedades (en 10.688 das 118.622 muestras evaluadas – 9%);
- **Sospechoso** de causar alergias por lo menos en 7 personas.

Fonte: The Royal Society of Canada. Elements of precaution: recommendations for the regulation of food biotechnology in Canadá. 224p. 2201



Environ. Biosafety Res.
© ISBR, EDP Sciences, 2011
DOI: 10.1051/ebr/2011100

Available online at:
www.ebr-journal.org

Case study

Cross-fertilization between genetically modified and non-genetically modified maize crops in Uruguay

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The cultivation of genetically modified (GM) Bt maize (*Zea mays* L.) events MON810 and Bt11 is permitted in Uruguay. Local regulations specify that 10% of the crop should be a non-GM cultivar as refuge area for biodiversity, and the distance from other non-GM maize crops should be more than 250 m in order to avoid cross-pollination. However, the degree of cross-fertilization between maize crops in Uruguay is unknown. The level of



Table 2. Analysis of the progeny of non-GM plants sampled from commercial maize crops studied in Uruguay.

| Case | Site ^a | DAS-ELISA | | p^c (%) | PCR ^d | | | Nearest GM crop | |
|------|-------------------|------------------------------|--------------------|-----------|------------------|--------|------|-----------------|---------------|
| | | Nr of positives ^b | Observed frequency | | 35S | MON810 | Bt11 | Distance (m) | Event |
| 1 | 1.1 | 1/180 | 0.56% | 1.7 | + | - | + | 40 | MON810 + Bt11 |
| | 1.2 | 0/120 | 0 | < 2.5 | - | | | 190 | MON810 + Bt11 |
| | 2.1 | 0/120 | 0 | < 2.5 | + | + | - | 380 | MON810 |
| 2 | 2.2 | 0/120 | 0 | < 2.5 | - | | | 180 | MON810 |
| | 2.3 | 1/120 | 0.83% | 2.5 | - | | | 100 | MON810 |
| 3 | 3.1 | 0/180 | 0 | < 1.7 | - | | | 20 | MON810 |
| 4 | 4.1 | 1/764 | 0.13% | 0.39 | + | + | - | 330 | Bt11 |
| 5 | 5.1 | 0/180 | 0 | < 1.7 | - | | | 30 | unknown |

^a For Case 1, two sites within the same non-GM field were sampled at different distances from the neighbor GM field. For Case 2, three sites were sampled.

^b Number of positive plants on the total number of tested plants.

^c Estimated frequency in the population with 95% confidence for probability of detection, P_d , based on DAS-ELISA observed frequencies and sample sizes (see Materials and methods).

^d Specific primers for 35S were used as a marker for transgenicity, primers VW01/VW03 for MON810, and PatB/IVS2-2 primers for Bt11. (+) indicates detection of the transgene.



THE IMPOSSIBLE COEXISTENCE – CASE STUDY IN SPAIN

Rosa Binimelis

THE IMPOSSIBLE COEXISTENCE – CASE STUDY IN SPAIN –

Reducing of the cultivated area Organic Corn

by 75% in Aragon (2004-2007)

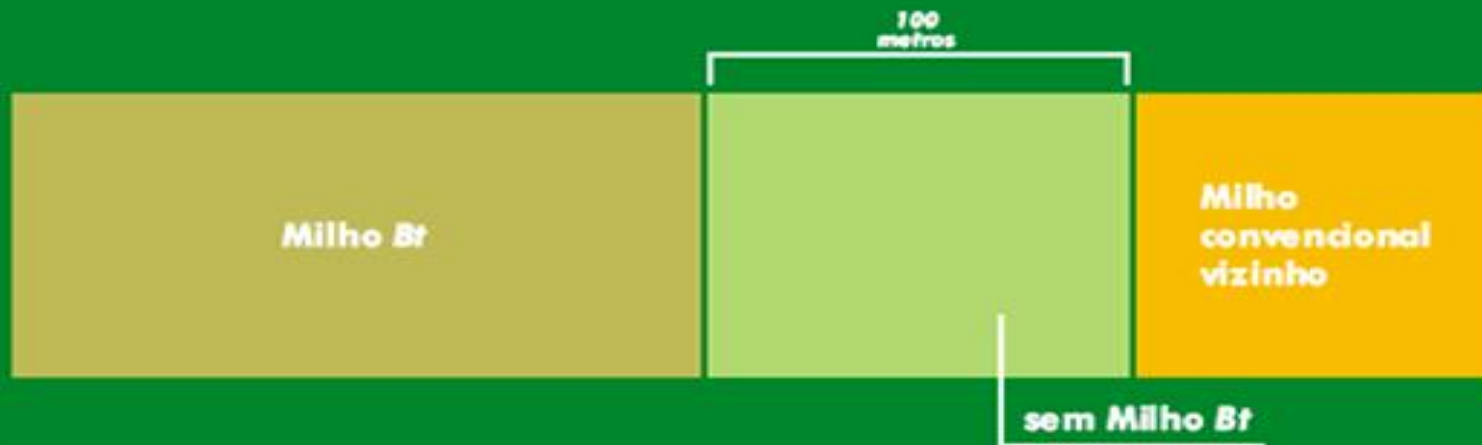
by 95% in Catalonia (2002-2008)

Binimelis, 2008. Coexistence of plants, coexistence of farmers: Is an individual choice possible? *Journal of Agricultural and Environmental Ethics*, 21: 437–457

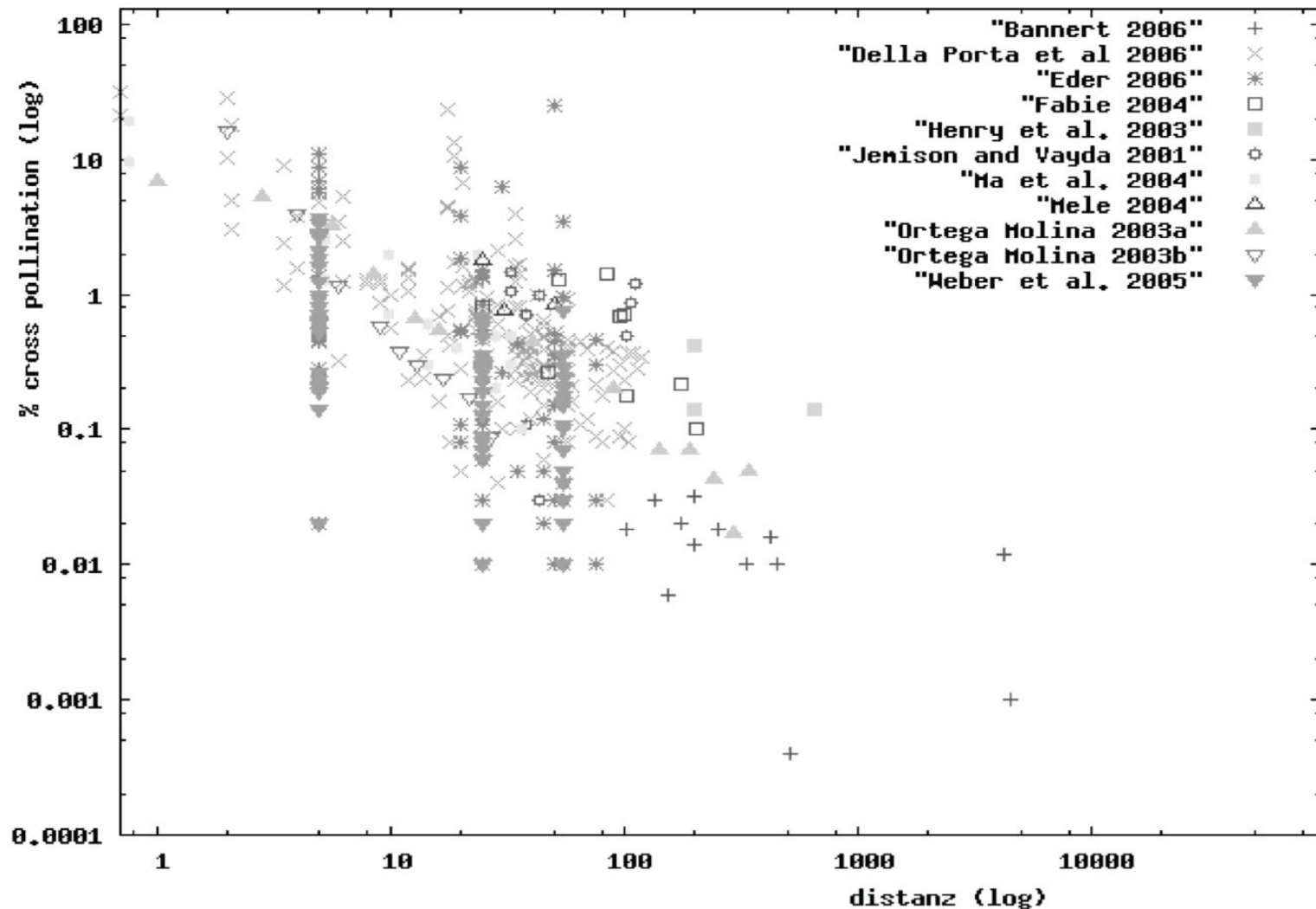


Brasil — Resolução Normativa nº 04

O objetivo da coexistência é estabelecer as distâncias mínimas de isolamento a serem observadas entre cultivos comerciais de milho geneticamente modificados e cultivos de milho convencional, permitindo a coexistência entre os diferentes sistemas de produção no campo.



Compilación de la percentage de polinización (11 estudios mejores documentados)







Brasil não tem controle sobre milho transgênico



O agricultor Ademir Ferronato em sua plantação de milho convencional no Paraná; ele teme contaminação por lavoura transgênica

Detection of Transgenes in Local Maize Varieties of Small-Scale Farmers in Eastern Cape, South Africa

Marianne Iversen^{1*}, Idun M. Grønsberg¹, Johnnie van den Berg², Klara Fischer³, Denis Worlanyo Aheto⁴, Thomas Bøhn^{1,5}

1. GenØk –Centre for Biosafety, Tromsø, Norway, **2.** Unit for Environmental Sciences and Development, North-West University, Potchefstroom, South Africa, **3.** Department of Urban and Rural Development, Swedish University of Agricultural Sciences, Uppsala, Sweden, **4.** College of Agriculture and Natural Sciences, School of Biological Sciences, University of Cape Coast, Cape Coast, Ghana, **5.** Faculty of Health Sciences, UIT The Arctic University of Norway, Tromsø, Norway

*marianne.iversen@genok.org

ive of the 20 seed samples (25%). Three of the 20 seed samples (15%) included herbicide tolerant maize (NK603) intentionally grown by the farmers from seed bought from local seed retailers or acquired through a currently running agricultural development program. The two remaining positive seed samples (10%) included genes for insect resistance (from MON810). In both cases the farmers were unaware of the transgenes present. In conclusion, we demonstrate that transgenes are mixed into seed storages of small-scale farming communities where recycling

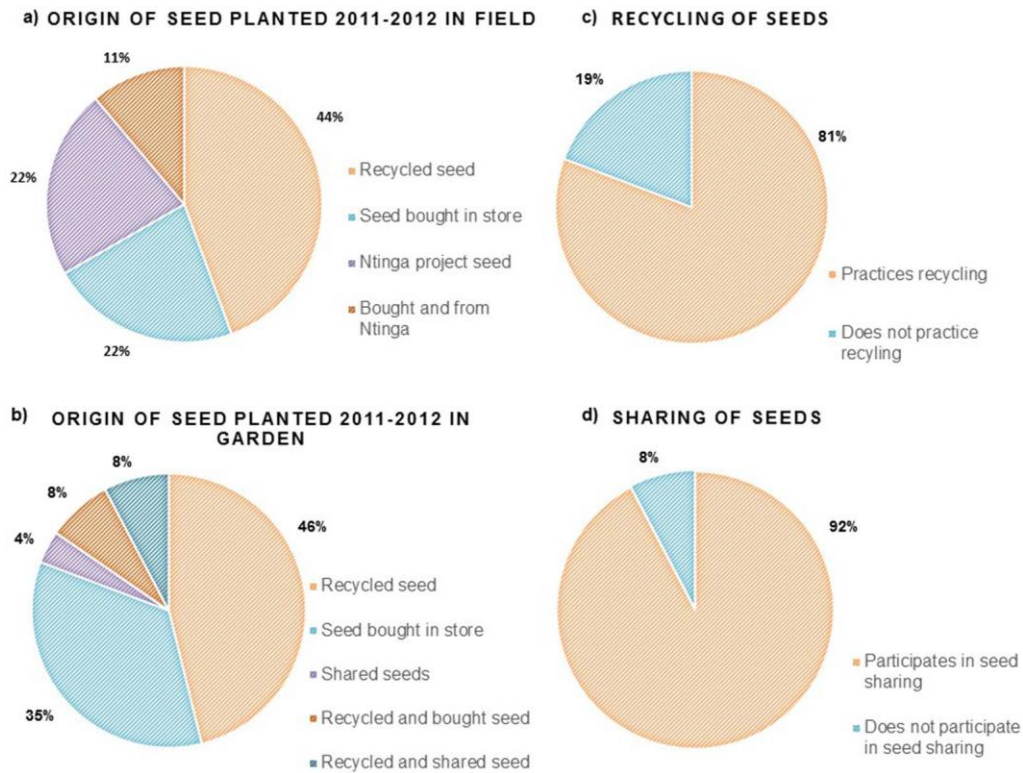
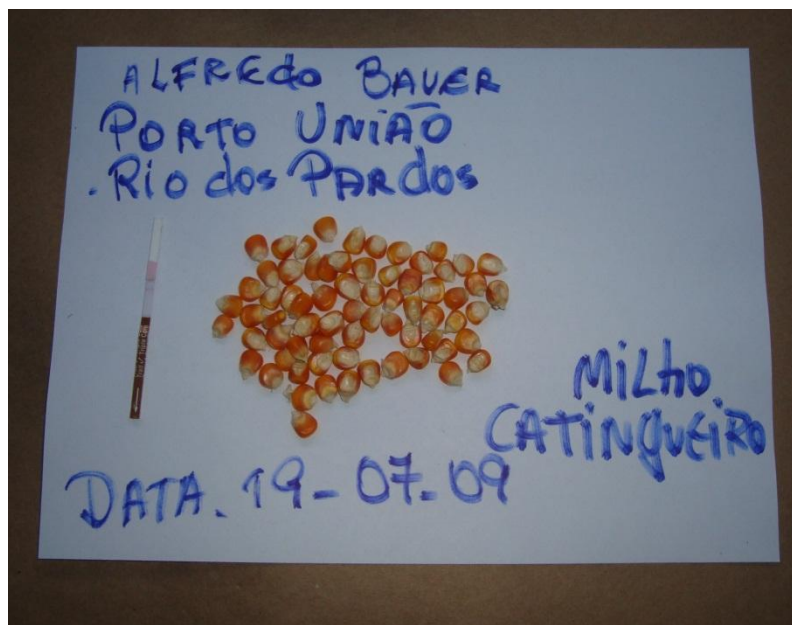
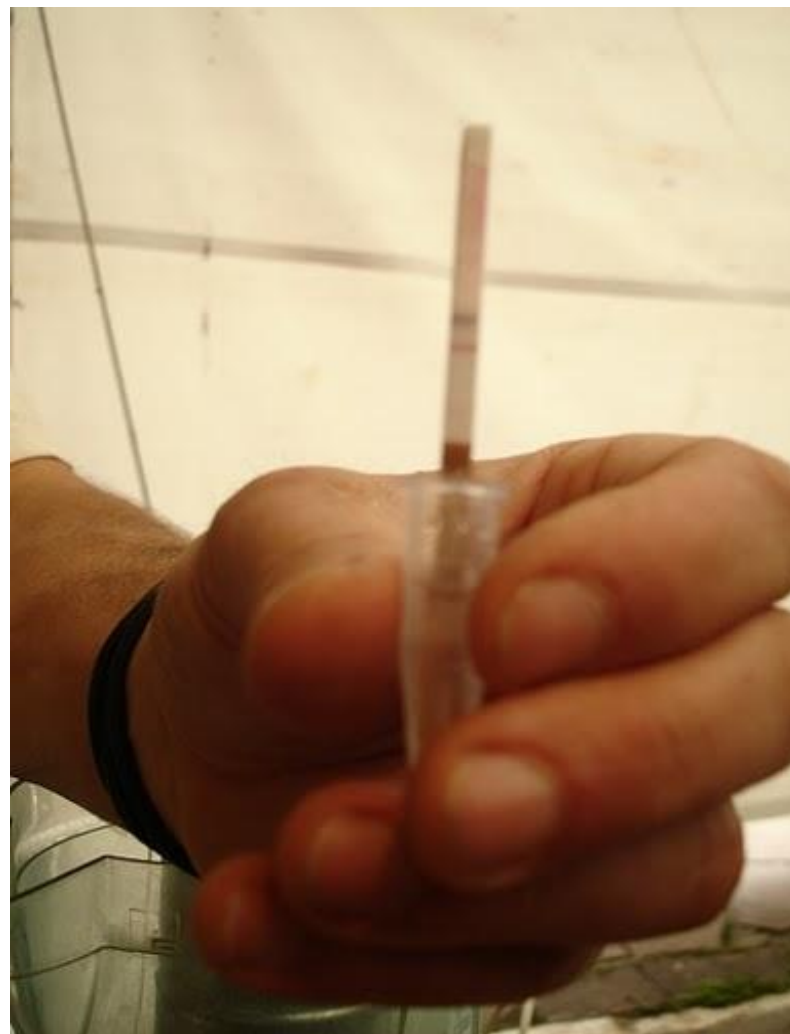


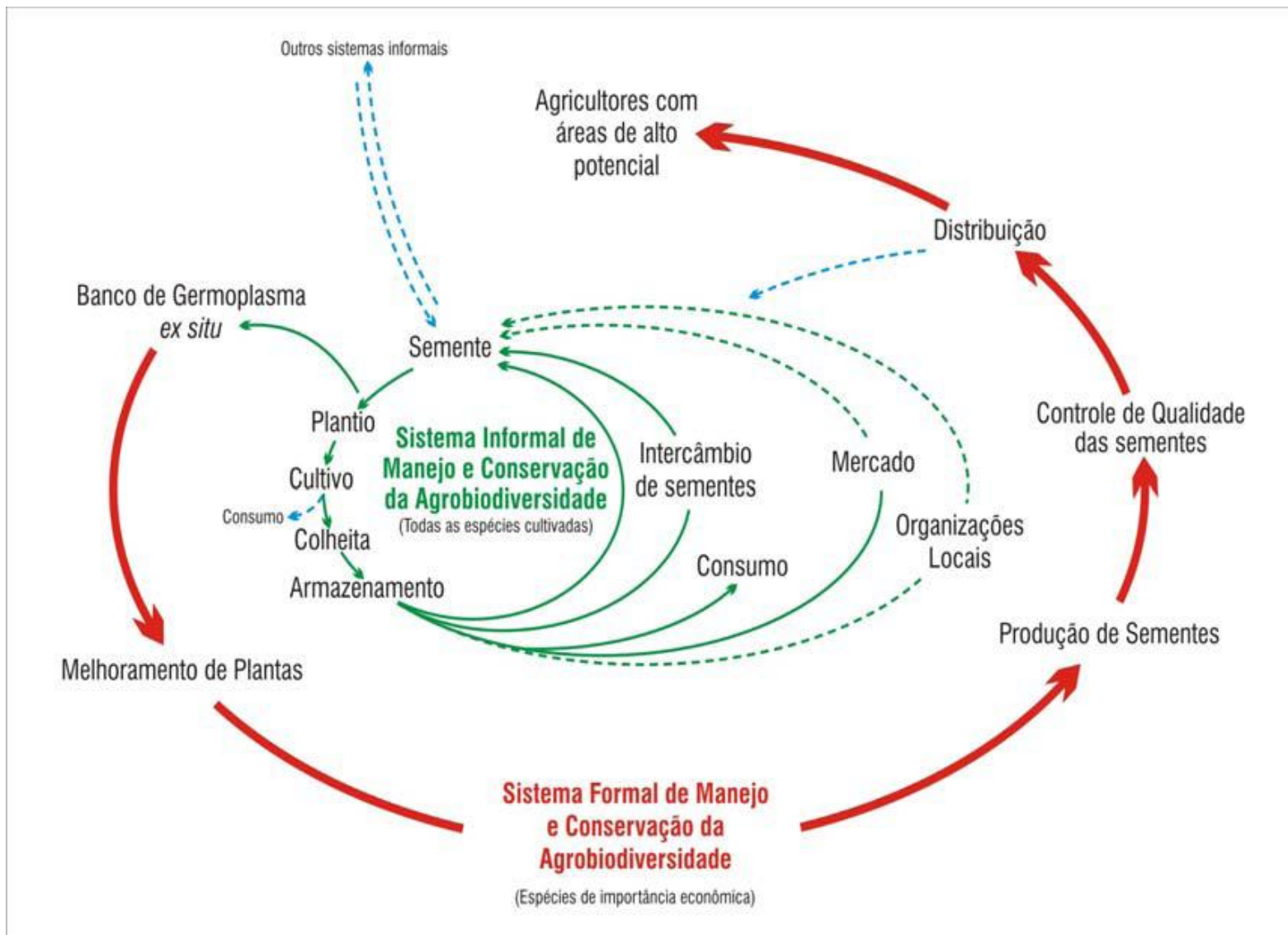
Fig. 2. Survey Data. Survey data on seed origin showing what kind of seed was planted in a) fields and b) gardens during the 2011–2012 season; and on seed management in general showing the proportions of farmers c) recycling seed and d) participating in sharing (d). N=26.

Quick Test to detect Transgene presence





Manejo y conservación de la agrobiodiversidad del sistema formal e informal





Documentos

ISSN 1678-1953
Dezembro, 2012

179

Pesquisa e Política de
Sementes no Semiárido
Paraibano



Courtesy: Gabriel Fernandes,
ASPTA

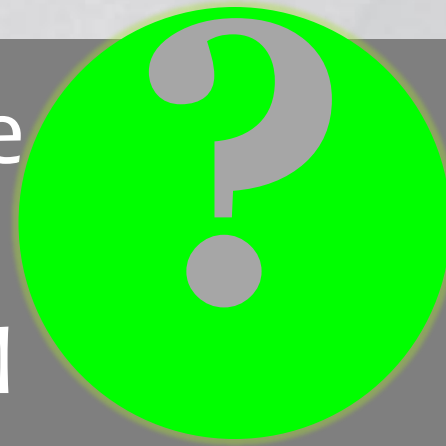


2- Efectos adversos en organismos benéficos

Hace a la **destrucción** de biodiversidad...



Cuanto de la toxina produce un cultivo *Bt* comparado con los niveles naturales del suelo?



| Natural <i>Bt</i> Soil Microorganisms | <i>Bt</i> Cotton | <i>Bt</i> Corn |
|---------------------------------------|------------------|--------------------|
| 0.25 g | 400 – 1000 g/ha | 2,800 – 4,200 g/ha |

Bt cotton produces up to **4,000 times** more *Bt* than soil microorganisms, while *Bt* corn produces up to **16,800 times** more.

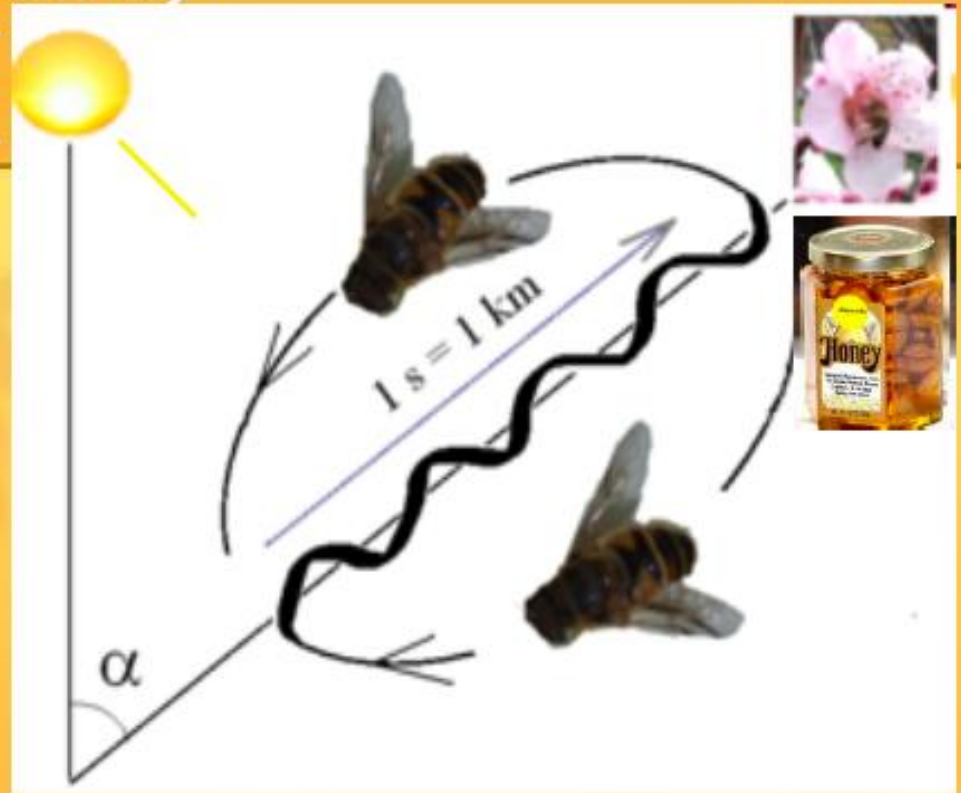
Blackwood, C.B., J.S. Buyer, 2004. “Soil Microbial Communities Associated with *Bt* and Non-*Bt* Corn in Three soils,” *J. Environmental Quality*, Vol. 33, pages 832-836

Bees dancing



The Sun

Sweet Target

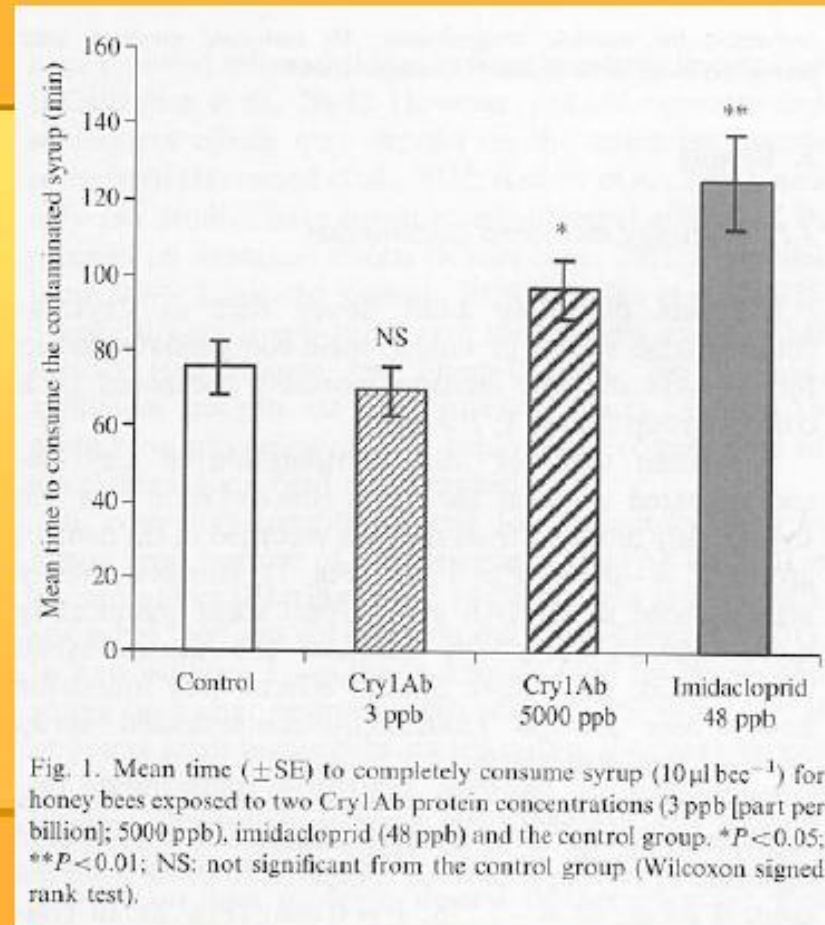


- Indicates direction...
- and distance to food
- Dialects!

Cry1Ab pollen slows down feeding



Time for syrup consumption

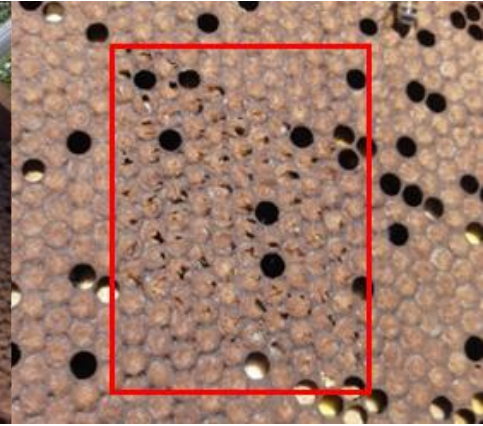


From Ramirez-Romero et al. 2008



Comportamiento higiénico

(Leon Bizzochi)



Decreció con polen transgénico



3- Aumento de la frecuencia de plagas resistentes al toxinas de Bt?

La estrategia perfecta para producir **superplagas...**

Dominant Inheritance of Field-Evolved Resistance to *Bt* Corn in *Busseola fusca*

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Abstract

Transgenic crops expressing *Bacillus thuringiensis* (*Bt*) toxins have been adopted worldwide, notably in developing countries. In spite of their success in controlling target pests while allowing a substantial reduction of insecticide use, the sustainable control of these pest populations is threatened by the evolution of resistance. The implementation of the “high dose/refuge” strategy for managing insect resistance in transgenic crops aims at delaying the evolution of resistance to *Bt* crops in pest populations by promoting survival of susceptible insects. However, a crucial condition for the “high dose/refuge” strategy to be efficient is that the inheritance of resistance should be functionally recessive. *Busseola fusca* developed high levels of resistance to the *Bt* toxin *Cry 1Ab* expressed in *Bt* corn in South Africa. To test whether the inheritance of *B. fusca* resistance to the *Bt* toxin could be considered recessive we performed controlled crosses with this pest and evaluated its survival on *Bt* and non-*Bt* corn. Results show that resistance of *B. fusca* to *Bt* corn is dominant, which refutes the hypothesis of recessive inheritance. Survival on *Bt* corn was not lower than on non-*Bt* corn for both resistant larvae and the F_1 progeny from resistant \times susceptible parents. Hence, resistance management strategies of *B. fusca* to *Bt* corn must address non-recessive resistance.





Field-Evolved Resistance to Bt Maize by Western Corn Rootworm

Aaron J. Gassmann*, Jennifer L. Petzold-Maxwell, Ryan S. Keweshan, Mike W. Dunbar

Department of Entomology, Iowa State University, Ames, Iowa, United States of America

Abstract

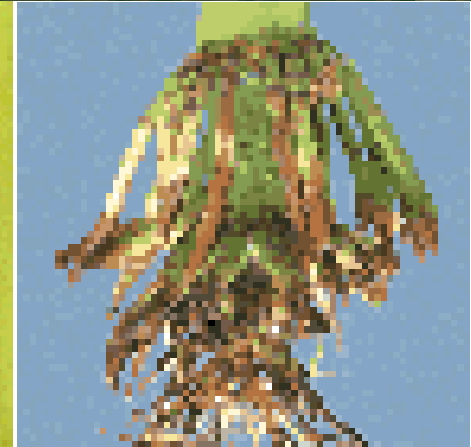
Background: Crops engineered to produce insecticidal toxins derived from the bacterium *Bacillus thuringiensis* (Bt) are planted on millions of hectares annually, reducing the use of conventional insecticides and suppressing pests. However, the evolution of resistance could cut short these benefits. A primary pest targeted by Bt maize in the United States is the western corn rootworm *Diabrotica virgifera virgifera* (Coleoptera: Chrysomelidae).

Methodology/Principal Findings: We report that fields identified by farmers as having severe rootworm feeding injury to Bt maize contained populations of western corn rootworm that displayed significantly higher survival on Cry3Bb1 maize in laboratory bioassays than did western corn rootworm from fields not associated with such feeding injury. In all cases, fields experiencing severe rootworm feeding contained Cry3Bb1 maize. Interviews with farmers indicated that Cry3Bb1 maize had been grown in those fields for at least three consecutive years. There was a significant positive correlation between the number of years Cry3Bb1 maize had been grown in a field and the survival of rootworm populations on Cry3Bb1 maize in bioassays. However, there was no significant correlation among populations for survival on Cry34/35Ab1 maize and Cry3Bb1 maize, suggesting a lack of cross resistance between these Bt toxins.

Conclusions/Significance: This is the first report of field-evolved resistance to a Bt toxin by the western corn rootworm and by any species of Coleoptera. Insufficient planting of refuges and non-recessive inheritance of resistance may have contributed to resistance. These results suggest that improvements in resistance management and a more integrated approach to the use of Bt crops may be necessary.



Gusano de la raíz del maíz



©1996 Medlin E. Rice

Diabrotica virgifera, the Western Corn Rootworm
www.ent.iastate.edu/rootworm.



Lavoura furada

O Brasil enfrenta infestação sem precedentes de lagartas em lavouras de milho GM. Agricultores, técnicos e empresas difusoras de tecnologia divergem sobre a causa do ataque.

Ariosto Mesquita

Agro DBO, March, 2013

Ponto de vista

Goleada no campo

Uso generalizado de OGMs traz contratempos aos agricultores em termos econômicos, em pragas e ervas daninhas resistentes.

Rogério Arioli Silva *



Nesse caso o prejuízo fica apenas no bolso do produtor que investiu numa nova opção biotecnológica e, mesmo assim, precisou pulverizar sua lavoura com inseticidas, além de perder produtividade com o ataque das lagartas. Primeiro, a culpa dessa ineficiência foi debitada aos produtores que não teriam utilizado a tecnologia de maneira correta, deixando de implantar as áreas de refúgio. Posteriormente, observou-se que não foi bem isso que aconteceu e sim a quebra de resistência das pragas, abreviando a vida útil do evento biotecnológico.



02/07/2014 07h13 - Atualizado em 02/07/2014 07h22

Milho que deveria resistir às pragas traz problemas para produtores de MS

Lavouras com variedades transgênicas têm grande infestações. Saída foi aumentar o número de aplicações de defensivos.

Do Globo Rural

Comente agora

Tweetar 42

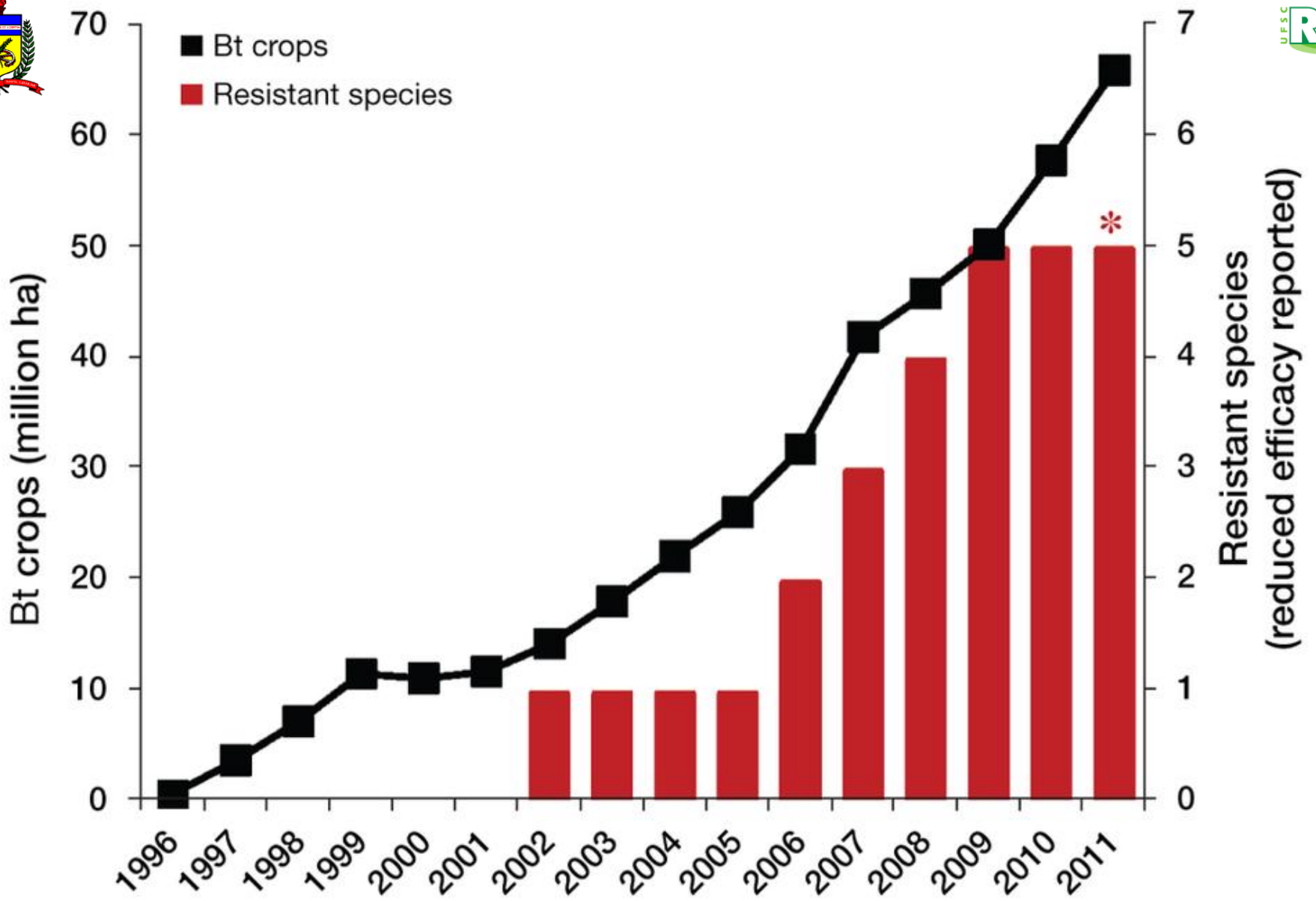
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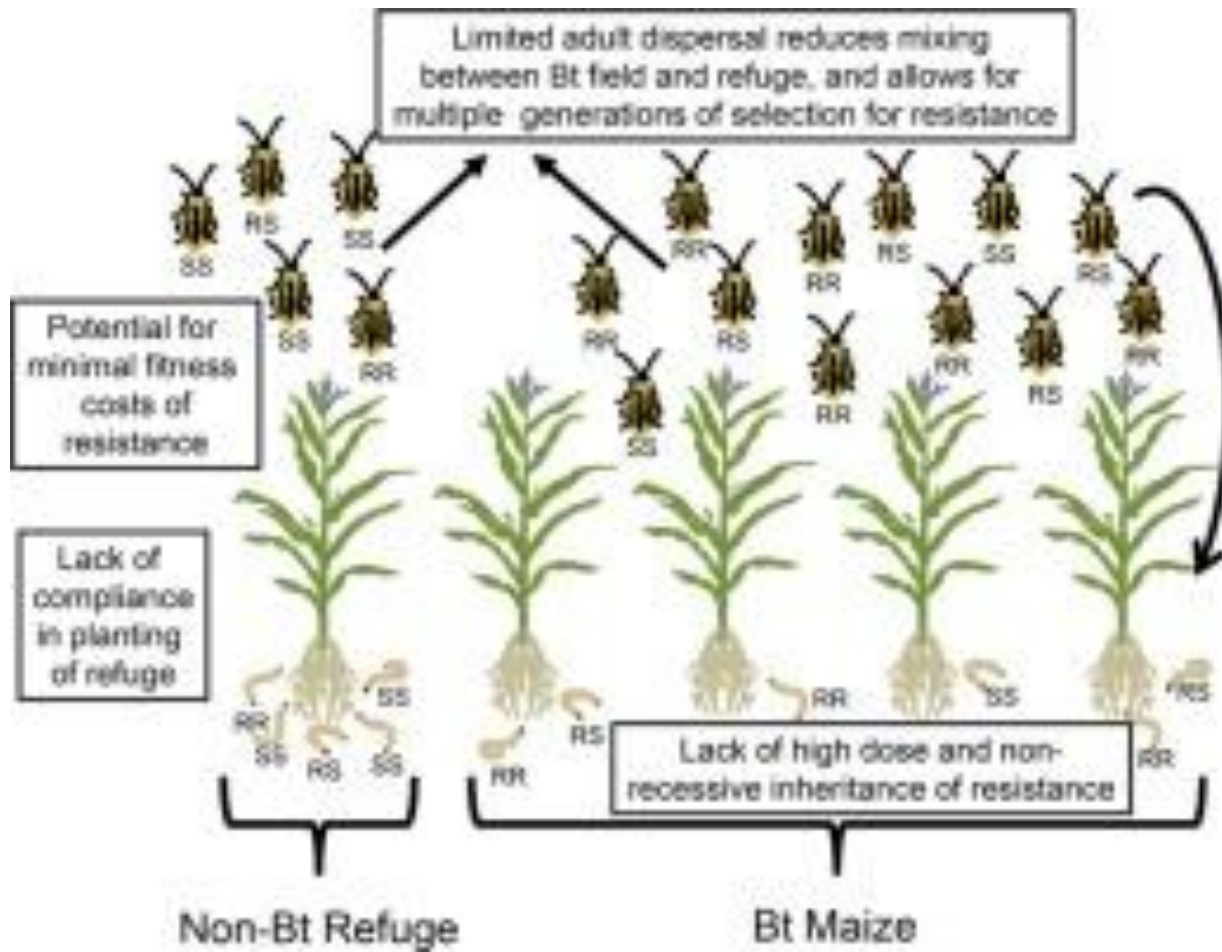


<http://g1.globo.com/economia/agronegocios/noticia/2014/07/milho-que-deveria-resistir-pragas-traz-problemas-para-produtores-de-ms.html>



Agro DBO, March, 2013





<http://ars.els-cdn.com/content/image/1-s2.0-S221457451630044X-fx1.jpg>



4- Aumento del numero de plagas!

Plagas secundárias se tornam plagas primarias

o

Organismos no blanco se transforman en plagas



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Research

Cite this article: Hagenbucher S, Wäckers FL, Wettstein FE, Olson DM, Ruberson JR, Romeis J. 2013 Pest trade-offs in technology: reduced damage by caterpillars in Bt cotton benefits aphids. *Proc R Soc B* 280: 20130042. <http://dx.doi.org/10.1098/rspb.2013.0042>

Received: 7 January 2013

Accepted: 18 February 2013

Pest trade-offs in technology: reduced damage by caterpillars in Bt cotton benefits aphids

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³Crop Protection and Management Research Unit, USDA-ARS, Tifton, GA, USA

⁴Department of Entomology, University of Georgia, Tifton, GA, USA

The rapid adoption of genetically engineered (GE) plants that express insecticidal Cry proteins derived from *Bacillus thuringiensis* (Bt) has raised concerns about their potential impact on non-target organisms. This includes the possibility that non-target herbivores develop into pests. Although studies have now reported increased populations of non-target herbivores in Bt cotton, the underlying mechanisms are not fully understood. We propose that lack of herbivore-induced secondary metabolites in Bt cotton represents a mechanism that benefits non-target herbivores. We show that, because of effective suppression of Bt-sensitive lepidopteran herbivores, Bt cotton contains reduced levels of induced terpenoids. We also show that changes in the overall level of these defensive secondary metabolites are associated with improved performance of a Bt-insensitive herbivore, the cotton aphid, under glasshouse

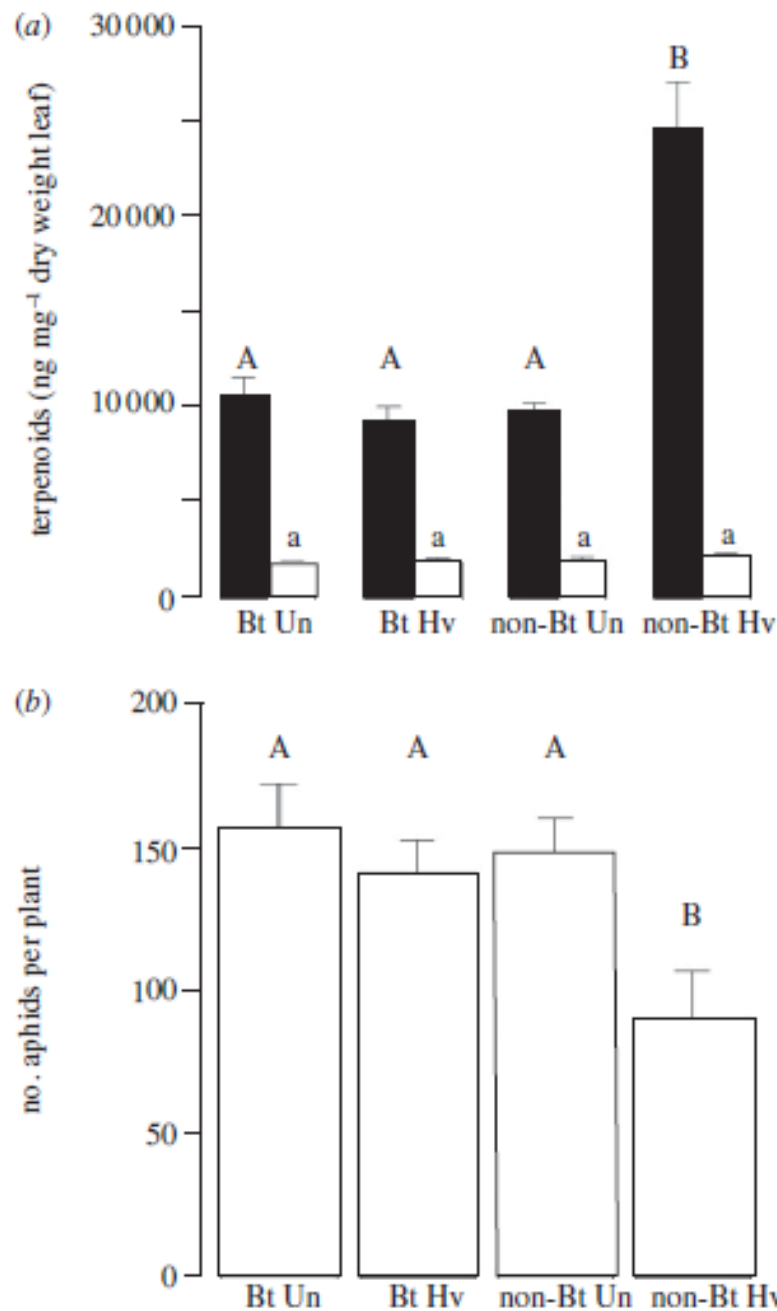


Figure 1. Terpenoid levels (ng mg⁻¹ dw) and aphid numbers on Bt and non-Bt cotton as affected by prior infestation with *Heliopsis virescens* in a glasshouse experiment. (a) Total terpenoid concentration (mean + s.e.) in the youngest and oldest true leaf of Bt and non-Bt cotton plants that were uninfested (Un) or infested (Hv) with *H. virescens*. (b) Numbers of *Aphis gossypii* per Bt and non-Bt cotton plant (mean ± s.e.) that was uninfested or infested with *H. virescens*. Different letters above bars indicate significant differences among treatments ($p \leq 0.05$; ANOVA followed by Tukey HSD test), (a) uppercase letters, young leaves; lowercase letters, old leaves.

Figure 1. Terpenoid levels (ng mg⁻¹ dw) and aphid numbers on Bt and non-Bt



¿Que pasa con algodón Bt?

...los cultivadores del Bt estaban usando en promedio entre 16 y 22 aplicaciones de insecticidas, mientras que los algodones convencionales agricultores estaban usando sólo 11-17 aplicaciones por año.

Zhao, J.H., Ho, P. and Azadi, H. (2011) Benefits of Bt cotton counterbalanced by secondary pests? Perceptions of ecological change in China. *Environ. Monit. Assess.* 173, 985–994.



Review article

The impact of secondary pests on *Bacillus thuringiensis* (*Bt*) crops

Rui Catarino^{1,*}, Graziano Ceddia², Francisco J. Areal¹ and Julian Park¹

¹*School of Agriculture, Policy and Development, University of Reading, Reading, UK*

²*Department of Public Governance and Sustainable Development, MODUL University, Vienna, Austria*

- En el espacio de aproximadamente **10 años**, la ventaja inicial de los cultivos Bt se había ido;
- Hoy en día esos insectos que antes se consideraban de menor relevancia son en realidad la **principal preocupación** de los agricultores;
- La caída en el uso de insecticidas y la **ineficacia de algodón Bt** contra estas plagas secundarias ha dado lugar a una inversión de la función ecológica de algodón.



REVEZAMENTO DE PRAGAS

Como os transgênicos mudaram a relação do ambiente com agricultura na China



Fotos "Science"

SAEM DE CENA

Lagartas-do-algodão >> A *Helicoverpa armigera*, praga que mais afetava as plantações de algodão na China acabou sendo controlada após a introdução de transgênicos



ENTRAM EM CENA

Percevejos mirídeos >> Mirídeos, que não eram pragas, proliferaram. Imunes à toxina Bt, eles acabaram ocupando o nicho antes vazio e se espalharam para plantações



Nueva plaga en soya RR y algodón GM: GM: *Helicoverpa armigera*





5- ¿ Adonde se van
las plagas resistentes
al Bt despues?

Atacar otras
especies....



Geral

Lagarta do Cartucho já infesta 50% das lavouras do município

Em algumas pastagens são até 200 lagartas por metro quadrado e a Secretaria de Agricultura tem recebido muitos pedidos de orientação



ANCHIETA

Uma infestação da chamada Lagarta do Cartucho vem preocupando os produtores rurais de Anchieta. Segundo o secretário municipal de Agricultura, Mario Signor, a infestação já atinge 50% das propriedades rurais no município, causando prejuízos. O engenheiro agrônomo da prefeitura, Carlos Antonietti, diz que a Secretaria tem recebido inúmeros pedidos de orientação e registra casos de pastagens com até 200 lagartas por metro quadrado.

Segundo ele, o ciclo de vida do inseto é de 12 a 30 dias, sendo que cada lagarta põe em média 300 ovos. Para evitar maiores perdas, a Secretaria de Agricultura tem orientado os

http://portalgc.com.br/portal/noticias/9368/Lagarta_do_Cartucho_j%C3%A1_infesta_50_das_lavouras_do_munic%C3%ADpio_.html

10/04/2014 16:14





6- Aumento de la
frecuencia de plantas
resistentes a los
herbicidas!

Estrategia para
producir
supermalezas....

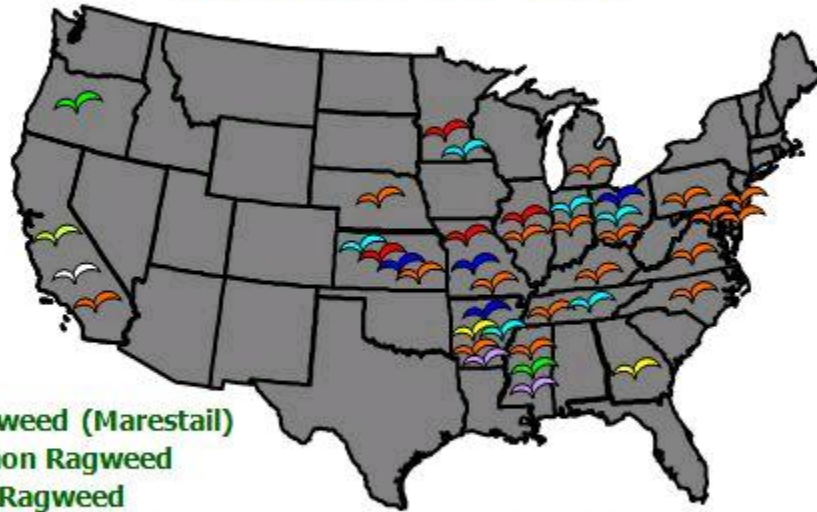
Dossie de la Monsanto para la aprobacion de la soya RR presentado para USDA en 1994

D. The Likelihood of the Appearance of Glyphosate-resistant Weeds

Several decades ago, herbicide resistant weeds were virtually unknown. Today there are some 109 herbicide resistant weed biotypes with over half of them resistant to triazines (Le Baron, 1991). Major factors which can contribute to the development of resistant weeds include: a single target site and a specific mode of action, broad spectrum of activity, long residual activity and the capacity to control weeds year-long, and frequent applications without rotation to other herbicides or cultural control practices. Using these criteria and based on current use data, glyphosate is considered to be a herbicide with low risk for weed resistance (Benbrook, 1991).

Attached in Appendix V are opinions from several academists located across the soybean growing belt regarding the likelihood of the development of glyphosate-resistant weeds, shifts in weed populations, and overwintering of soybeans. These experts are in agreement that it is highly unlikely that weed resistance to glyphosate will become a problem as a result of the commercialization of glyphosate-tolerant soybeans. Glyphosate has been used for over 20 years in various preplant, directed, spot or post harvest weed management systems with no known reports of weed resistance. This is most likely due to biological and chemical properties demonstrated by glyphosate and the use patterns of the herbicide. Glyphosate essentially has no residual

Confirmed Glyphosate Resistant Weeds in the U.S.



- Horseweed (Marestail)
- Common Ragweed
- Giant Ragweed
- Palmer Amaranth
- Common Waterhemp
- Hairy Fleabane

- Italian Ryegrass
- Rigid Ryegrass
- Johnsongrass



Argentina

Herbicide resistant weeds costing farmers millions in lost yield, increased expense
Delta Farm Press, 25 Feb 2011

<http://deltafarmpress.com/soybeans/herbicide-resistant-weeds-costing-farmers-millions-lost-yield-increased-expense>

Sorghum halepense resistant to glyphosate.



Ejemplos de impactos ya detectados



El cultivo sucesivo de Soya RR acelera el aparecimiento de plantas resistentes a herbicidas



**Foto:
Robinson Osipe**

XXX Congresso Brasileiro da Ciência das Plantas Daninhas

22 a 26 de agosto de 2016, Curitiba – PR

Tema: Conhecimento e Tecnologia a Serviço do Agricultor



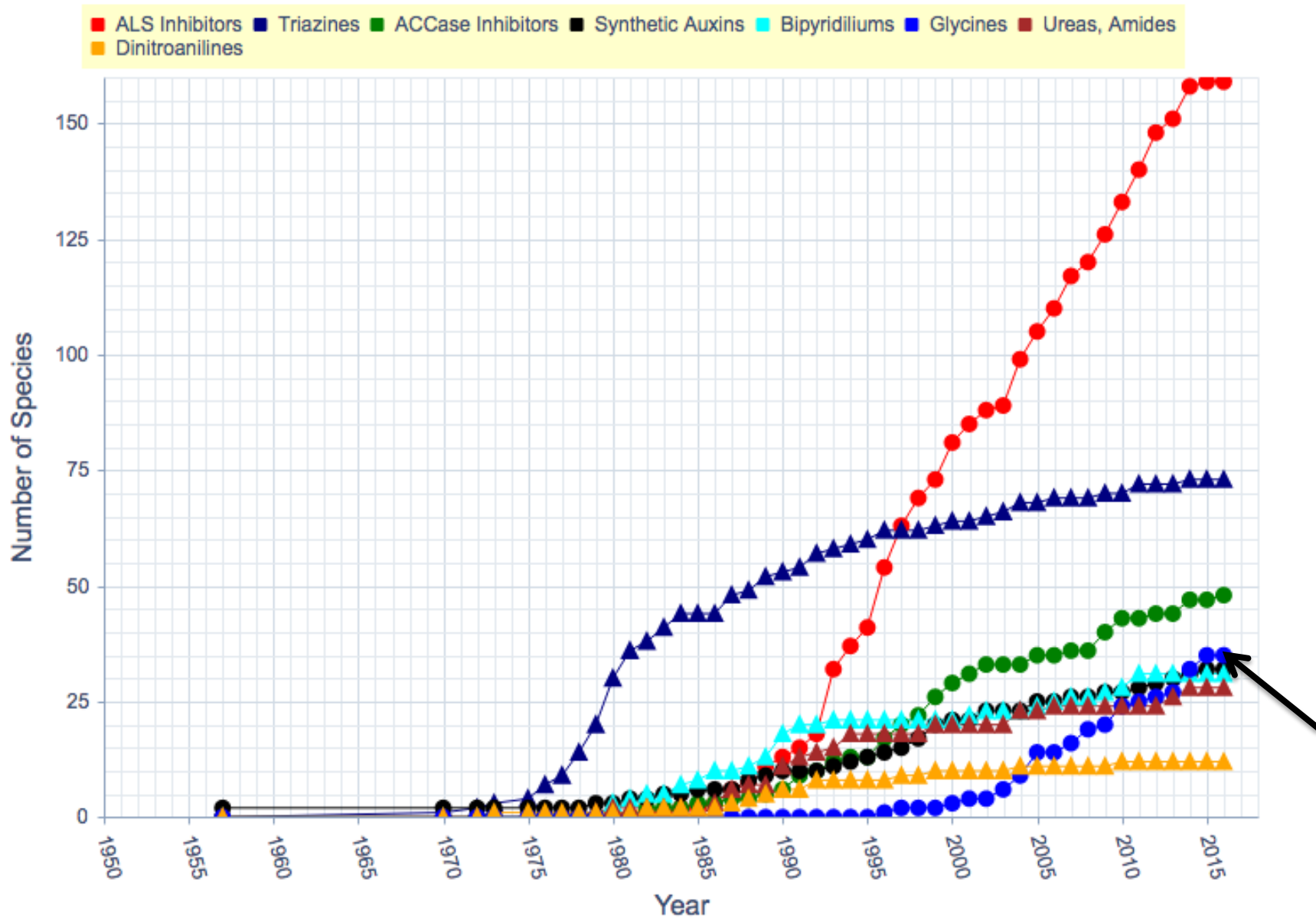
Foto: Fernando Adegas



A University of California extension agent stands behind a patch of herbicide-resistant marestail (also known as horseweed) and talks about its effect on farmers. This aggressive weed, which can grow to be six feet tall, has emerged in many parts of the country but is particularly problematic in the Midwest and eastern United States.

Union of Concerned Scientists. *The Rise of Superweeds— and What to Do About It.* 2014, 8p.

Chronological increase in Resistant weeds Globally





7- El maíz de
transformo en una
maleza!

Estrategia para
desconstruir os
alimentos....



Cultivo de feijão depois de milho transgênico – Dois Vizinhos, PR



Foto: Joel Donazzolo, UTFPr, fev/2014



Embrapa alerta al posibilidad de que el maíz RR convertirse en una maleza!



<http://www.valor.com.br/agro/3630820/embrapa-alerta-que-milho-rr-pode-virar-planta-daninha-na-soja#> 29/07/2014 - 15:54

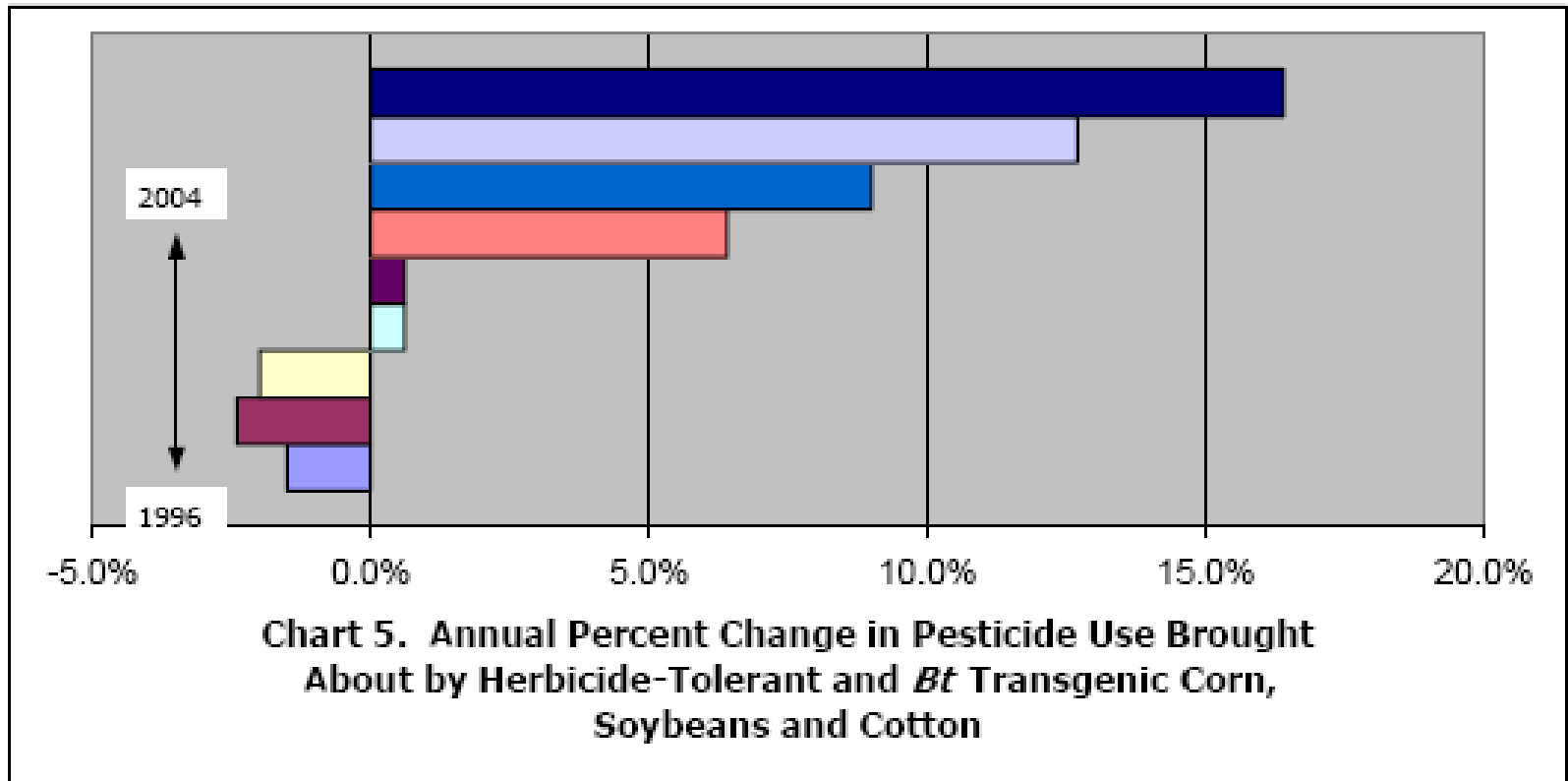


8 – Aumento del
consumo de
plaguidas!

Sin embargo,
prometeran el
contrario...

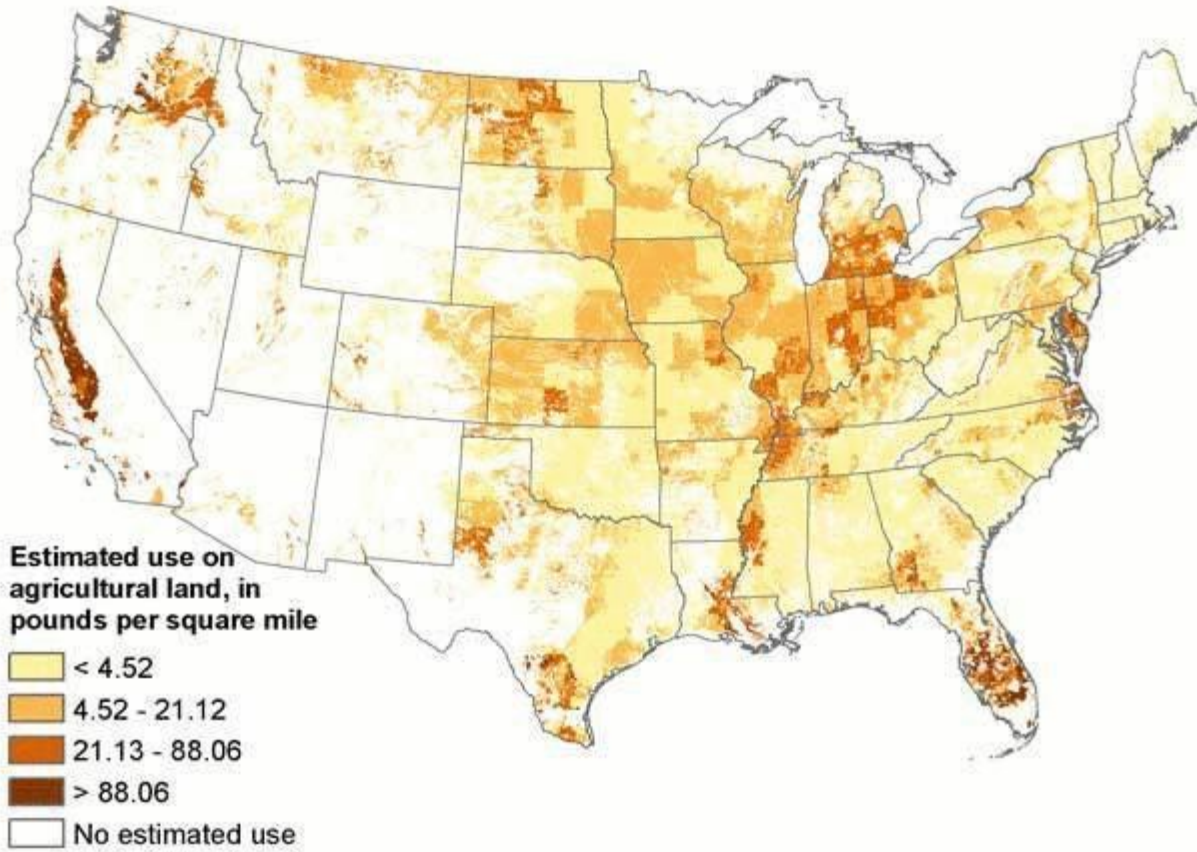


Consumo de plaguicidas (venenos ?) aumentó !



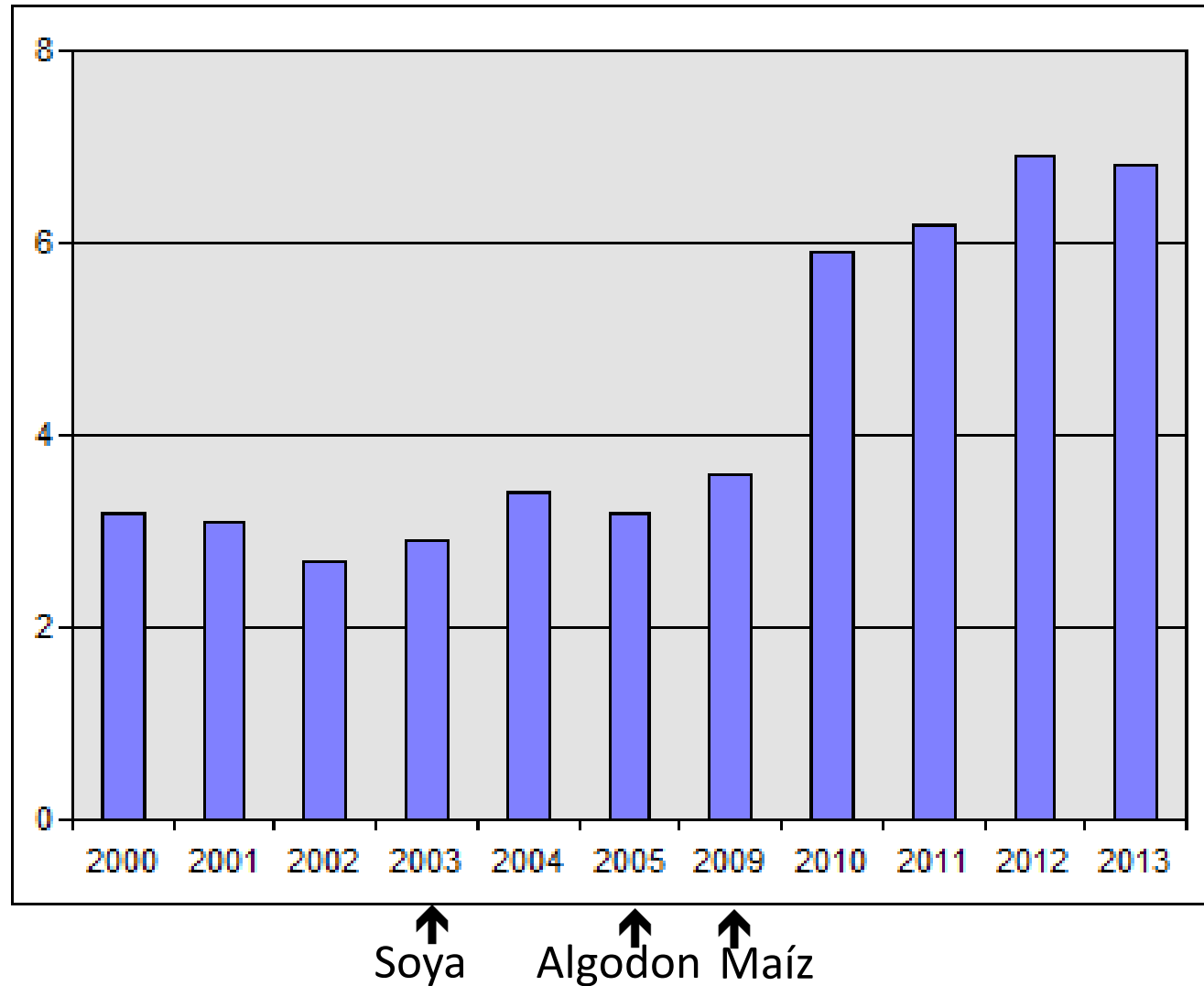
Human exposures to Roundup residues in steadily increasing

Estimated Agricultural Use for Glyphosate, 1992





k/ha



Consumo de plaguicidas en Brasil. (kg por ha de ingredientes activos)

Source: <http://www.sidra.ibge.gov.br/bda/tabela/protabl2.asp?c=771>



9 – Impactos a la salud de animales y humanos



El primer estudio de larga duración – efectos crónicos –

1. Por primera vez se evalúa, por dois años, el efecto del maíz NK 603, en **54 parametros** de **34 organos** (características bioquímicas y fisiológicas) de 200 ratas;
2. Las alteraciones bioquímicas y las fallas fisiológicas son **más graves** en ratas alimentadas con **maíz transgénico NK603** con o sin fumagacion de **Roundup** y con **Roundup** que cuando alimentadas con maíz convencional;
3. Se comprobó al efecto non-linear de **desrelugador endocrino** del Roundup;

Mammary glands (F)



Séralini, G.-E., et al. Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize. *Food Chem. Toxicol.* (2012), <http://dx.doi.org/10.1016/j.fct.2012.08.005>



El primer estudio de larga duración – efectos crónicos –

4. Las alteraciones bioquímicas y las fallas fisiológicas **elevarán la probabilidad** de desarrollo de tumores en las ratas.

5. Los tumores cancerígenos aparecen a los **4 meses** en ratas macho y a los **7 meses** en ratas hembras.

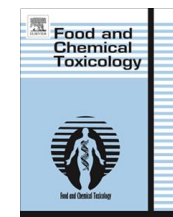
Todavía las agencias exigen estudios de apenas 3 meses !!! Porque???



Contents lists available at [SciVerse ScienceDirect](#)

Food and Chemical Toxicology

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



Glyphosate induces human breast cancer cells growth via estrogen receptors



Siriporn Thongprakaisang^a, Apinya Thiantanawat^{b,c}, Nuchanart Rangkadilok^{a,c}, Tawit Suriyo^c, Jutamaad Satayavivad^{a,c,d,*}

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Contents lists available at [ScienceDirect](#)

Free Radical Biology and Medicine

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



Original Contribution

Roundup disrupts male reproductive functions by triggering calcium-mediated cell death in rat testis and Sertoli cells



Vera Lúcia de Liz Oliveira Cavalli^a, Daiane Cattani^a, Carla Elise Heinz Rieg^a, Paula Pierozan^b, Leila Zanatta^a, Eduardo Benedetti Parisotto^c, Danilo Wilhelm Filho^c, Fátima Regina Mena Barreto Silva^a, Regina Pessoa-Pureur^b, Ariane Zamoner^{a,*}

^a Departamento de Bioquímica and Centro de Ciências Biológicas, Universidade Federal de Santa Catarina, 88040-970 Florianópolis, Santa Catarina, Brazil

^b Departamento de Bioquímica, Instituto de Ciências Básicas da Saúde, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil

^c Departamento de Ecologia e Zoologia, Centro de Ciências Biológicas, Universidade Federal de Santa Catarina, 88040-970 Florianópolis, Santa Catarina, Brazil

A long-term toxicology study on pigs fed a combined genetically modified (GM) soy and GM maize diet

Judy A. Carman^{1,2*}, Howard R. Vlieger³, Larry J. Ver Steeg⁴, Verlyn E. Sneller³, Garth W. Robinson^{5**}, Catherine A. Clinch-Jones¹, Julie I. Haynes⁶, John W. Edwards²

Table 3. The proportion of pigs in each dietary group with adverse findings on gross pathology

| Organ | Condition | Proportion with condition | | | | Relative risk of condition in GM-fed pigs | 95% confidence interval of the relative risk | p ^a |
|------------|-----------------------------------|---------------------------|------|----------------|------|---|--|----------------|
| | | Non-GM-fed | | GM-fed | | | | |
| | | No. N=73 | % | No. N=72 | % | | | |
| Kidney | Any abnormality | 0 | 0.0 | 0 | 0.0 | — ^b | — ^b | — ^b |
| Heart | Any abnormality ^c | 11 | 15.1 | 5 | 6.9 | 0.46 | 0.17-1.26 | 0.119 |
| Liver | Any abnormality ^d | 6 | 8.2 | 3 | 4.2 | 0.51 | 0.13-1.95 | 0.494 |
| Spleen | Any abnormality ^e | 3 | 4.1 | 2 | 2.8 | 0.68 | 0.12-3.93 | 1.000 |
| Lung | Pneumonia ^f | 42 | 57.5 | 43 | 59.7 | 1.04 | 0.79-1.36 | 0.789 |
| | Fibrous pleuritis or pericarditis | 9 | 12.3 | 4 | 5.6 | 0.45 | 0.15-1.40 | 0.153 |
| | Abnormal lymph nodes ^g | 13 | 17.8 | 16 | 22.2 | 1.25 | 0.65-2.40 | 0.506 |
| Stomach | Nil inflammation | 4 | 5.4 | 8 | 11.1 | 2.03 | 0.64-6.44 | 0.218 |
| | Mild inflammation | 31 | 42.5 | 23 | 31.9 | 0.75 | 0.49-1.16 | 0.190 |
| | Moderate inflammation | 29 | 39.7 | 18 | 25.0 | 0.63 | 0.39-1.03 | 0.058 |
| | Severe inflammation | 9 | 12.3 | 23 | 31.9 | 2.59 | 1.29-5.21 | 0.004** |
| | Erosion(s) | 63 | 86.3 | 58 | 80.6 | 0.93 | 0.81-1.08 | 0.352 |
| | Pin-point ulcer(s) | 13 | 17.8 | 9 | 12.5 | 0.70 | 0.32-1.54 | 0.373 |
| | Frank ulcer(s) | 15 | 20.5 | 17 | 23.6 | 1.15 | 0.62-2.12 | 0.657 |
| | Bleeding ulcer(s) | 0 | 0.0 | 2 | 2.8 | — ^b | — ^b | 0.245 |
| Intestines | Any abnormality | 0 | 0.0 | 0 | 0.0 | — ^b | — ^b | — ^b |
| Uterus | Filled with fluid ^h | 0 ⁱ | 0.0 | 2 ^j | 5.6 | — ^b | — ^b | 0.493 |
| Ovary | Any abnormality | 0 ^k | 0.0 | 0 ^l | 0.0 | — ^b | — ^b | — ^b |

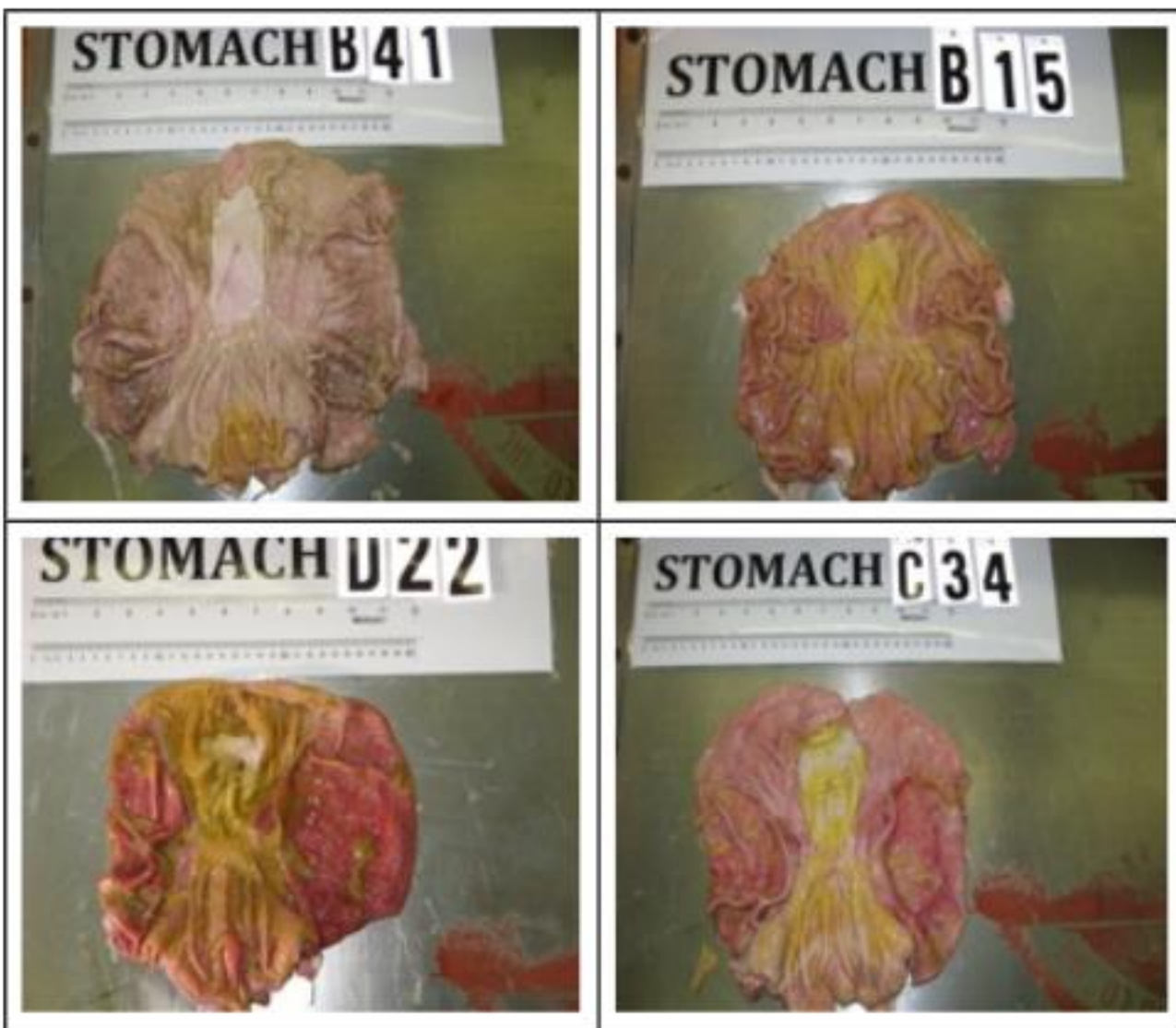


Figure 1. Different levels of stomach inflammation found (clockwise from top left): nil (from a non-GM-fed pig, number B41), mild (from a non-GM-fed pig, number B15), moderate (from a GM-fed pig, number C34) and severe (from a GM-fed pig, number D22).

Carman et al. 2013. A long-term toxicology study on pigs fed a combined genetically modified (GM) soy and GM maize diet. *Journal of Organic Systems*, 8(1), 2013. p.38-54.



Residuos metabólicos del glifosato y también de la toxina Cry1Ac fueron encontrados en sangre de mujeres embarazadas ó no y en fetos.

Reproductive Toxicology xxx (2011) xxx–xxx

Contents lists available at ScienceDirect

Reproductive Toxicology

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



ELSEVIER



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

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^b Clinical Research Centre of Sherbrooke University Hospital Centre, Sherbrooke, Quebec, Canada

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ABSTRACT

Pesticides associated to genetically modified foods (PAGMF), are engineered to tolerate herbicides such as glyphosate (GLYP) and glufosinate (GLUF) or insecticides such as the bacterial toxin bacillus thuringiensis (Bt). The aim of this study was to evaluate the correlation between maternal and fetal exposure, and to determine exposure levels of GLYP and its metabolite aminomethyl phosphoric acid (AMPA), GLUF and its metabolite 3-methylphosphinopropionic acid (3-MPPA) and Cry1Ab protein (a Bt toxin) in Eastern Townships of Quebec, Canada. Blood of thirty pregnant women (PW) and thirty-nine nonpregnant

Unico estudio epidemiológico: La proteína Cry é transmitida para el feto en mamiferos (incluso humanos)

- Análisis de sangre de 30 mujeres embarazadas (MG) e 39 mujeres no embarazadas (MNG) (Canadá)
- Toxina Cry1Ab:
 - 93% MG
 - e 80% en los fetos.
 - 69% MNG

No hay otros estudios para comparar los resultados oitidos



Tabela 11 – Total de amostras detectadas e frequência de detecção de agrotóxicos analisados em leite humano em amostra (n=62) de nutrizes residentes em Lucas do Rio Verde-MT, 2010.

| Substância | Total de amostras detectadas | Detectado abaixo do LQM | Detectado acima do LQM | % de Detecção (n=62) |
|-----------------------|-------------------------------------|--------------------------------|-------------------------------|-----------------------------|
| p,p'- DDE | 62 | 44 | 18 | 100% |
| β -endossulfam | 27 | 25 | 2 | 44% |
| deltametrina | 23 | 23 | 0 | 37% |
| aldrin | 20 | 20 | 0 | 32% |
| α -endossulfam | 20 | 20 | 0 | 32% |
| α -HCH | 11 | 11 | 0 | 18% |
| p,p'- DDT | 8 | 5 | 3 | 13% |
| trifluralina | 7 | 7 | 0 | 11% |
| lindano | 4 | 4 | 0 | 6% |

Pesticidas: aplicase en un lugar, pero se va para otro...



Glifosato e
Toxinas de Bt,
otras
moléculas



Exposición de los non o recién nacidos a plaguicidas por agua, leche materno y comida !

THE ULTIMATE KILLING MACHINE





10 – Semillas modernas son **incompatibles** con la Seguridad alimentaria y nutricional.



Seguridad alimentaria

Situación existente cuando todas las personas tienen en todo momento el acceso físico, social y económico a alimentos suficientes, inocuos y nutritivos que satisfacen sus necesidades y **preferencias alimentarias** para llevar una vida activa y sana.

FAO. 2001. El estado de la inseguridad alimentaria en el mundo. <http://www.fao.org/docrep/003/y1500s/y1500s00.htm>

<ftp://ftp.fao.org/docrep/fao/003/y1500s/>



Soberanía alimentaria

Soberanía alimentaria es definida como el **derecho** de los pueblos y estados soberanos determinar democráticamente sus políticas agrícolas y de alimentaciones.

FAO. 2001. El estado de la inseguridad alimentaria en el mundo. <http://www.fao.org/docrep/003/y1500s/y1500s00.htm>

<ftp://ftp.fao.org/docrep/fao/003/y1500s/>



Fases del uso de los recursos genéticos

???

15 a 10 mil años

Colector-cazador

Sedentarismo
promoción
cosecha-siembra
domesticación
selección

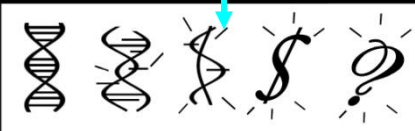
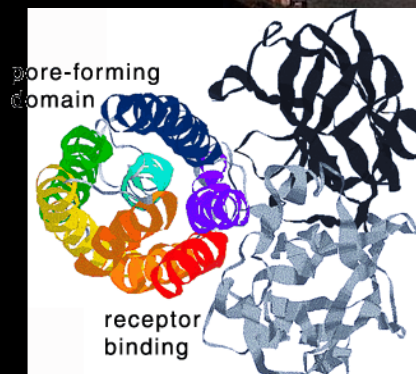


29jun07

Revolución Industrial

1950

Agricultura química
Fertilizantes
Pesticidas
Semillas
DPI
Transgenia



biotecnología
sintética







ISSN 0028-280X

nature



CAN SCIENCE FEED THE WORLD?

PLANETARY SCIENCE

The first 400 years

THE NEW MADRID

EARTHQUAKES

Spreading the risk

DIABETES

The circadian

dimension

HOTPLANE
Polio in Iceland



PROMISE

**FEED THE WORLD through
increased productivity**

Cortesía de Angelika Hilbeck

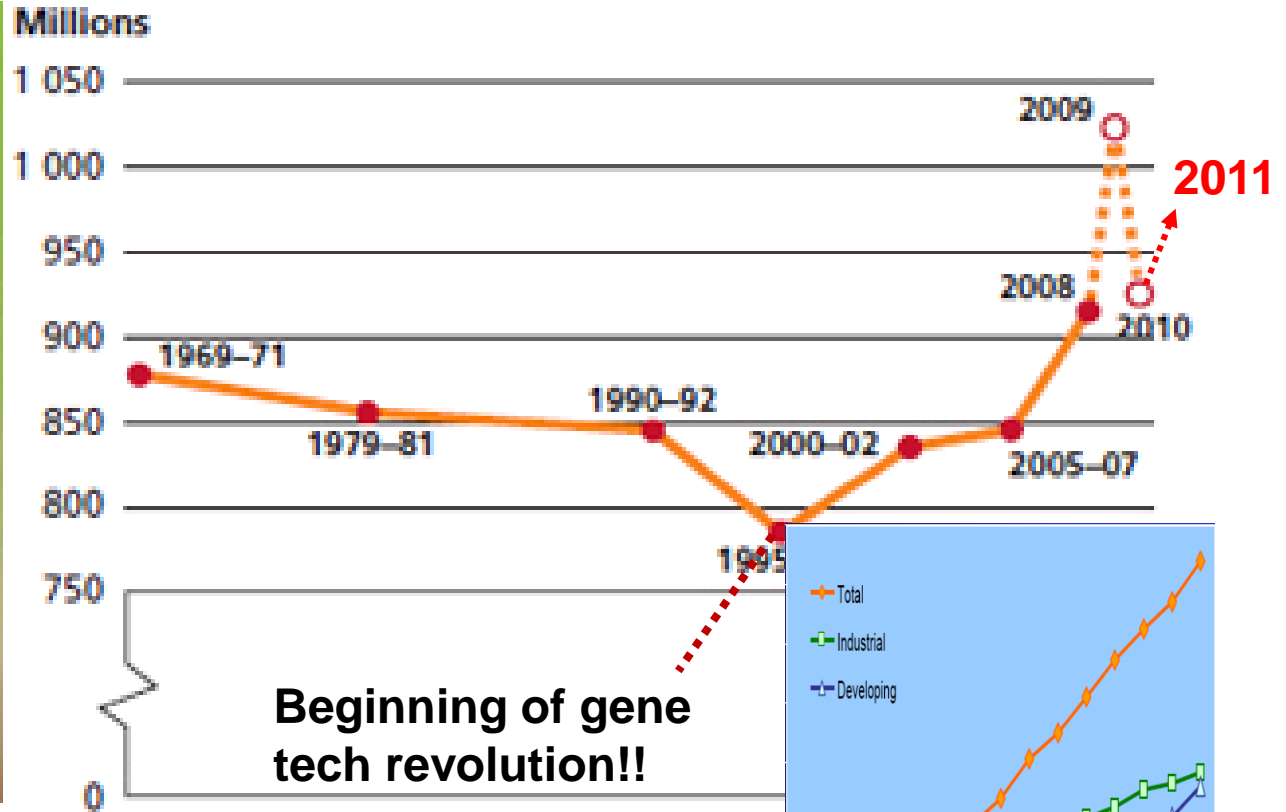
‘The hunger curve’

2010



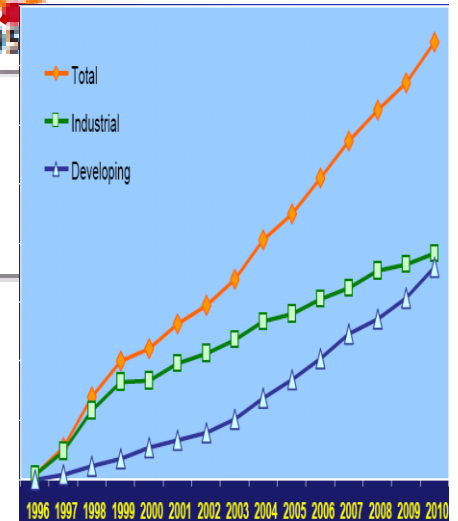
The State of Food Insecurity in the World

Addressing food insecurity in protracted crises



Beginning of gene tech revolution!!

NO key technology to solve world hunger



Cortesia de Angelika Hilbeck



EVIDÊNCIA DA LIGAÇÃO ENTRE BIODIVERSIDADE, NUTRIÇÃO E SAÚDE

- Hipótese: **Dieta diversificada = saúde;**
- Quantidade da diversidade necessária para proporcionar a nutrição adequada para humanos;
- Diversidade de plantas usadas nas dietas reduzem o risco de doenças e mortalidade;
- Biodiversidade e **tradição cultural** da alimentação;
- Estudos populacionais.



EVIDÊNCIA DA LIGAÇÃO ENTRE BIODIVERSIDADE, NUTRIÇÃO E SAÚDE

| Escore de Diversidade | Mortalidade (odds/ratio) |
|-----------------------|-----------------------------|
| 7 | 1 |
| 10 | 0,82 |
| 12 | 0,71 |
| 15 | 0,69 |

A Prospective Study of Diet Quality and Mortality in Women. Kant et al. *JAMA*.2000; 283: 2109-2115.



CERVEJAS COM ALTO TEOR DE MILHO

Amostras de algumas das cervejas mais consumidas no país alcançam teor de milho e outras gramíneas tropicais pouco inferior a 50%, sugere análise da USP de Piracicaba. São elas:

Antarctica

Antarctica Malzbier

Antarctica Original

Antarctica Subzero

Bohemia

Brahma Extra

Brahma Malzbier

Caracu

Crystal Malzbier

Glacial

Itaipava Malzbier

Kaiser Summer Draft

Nova Schin

Nova Schin Malzbier

Nova Schin Munich

Skol

Skol Beats



¿ Qué ha sido hecho con esta riqueza genética por el mejoramiento genético formal o classico?

Piorando la calidad....

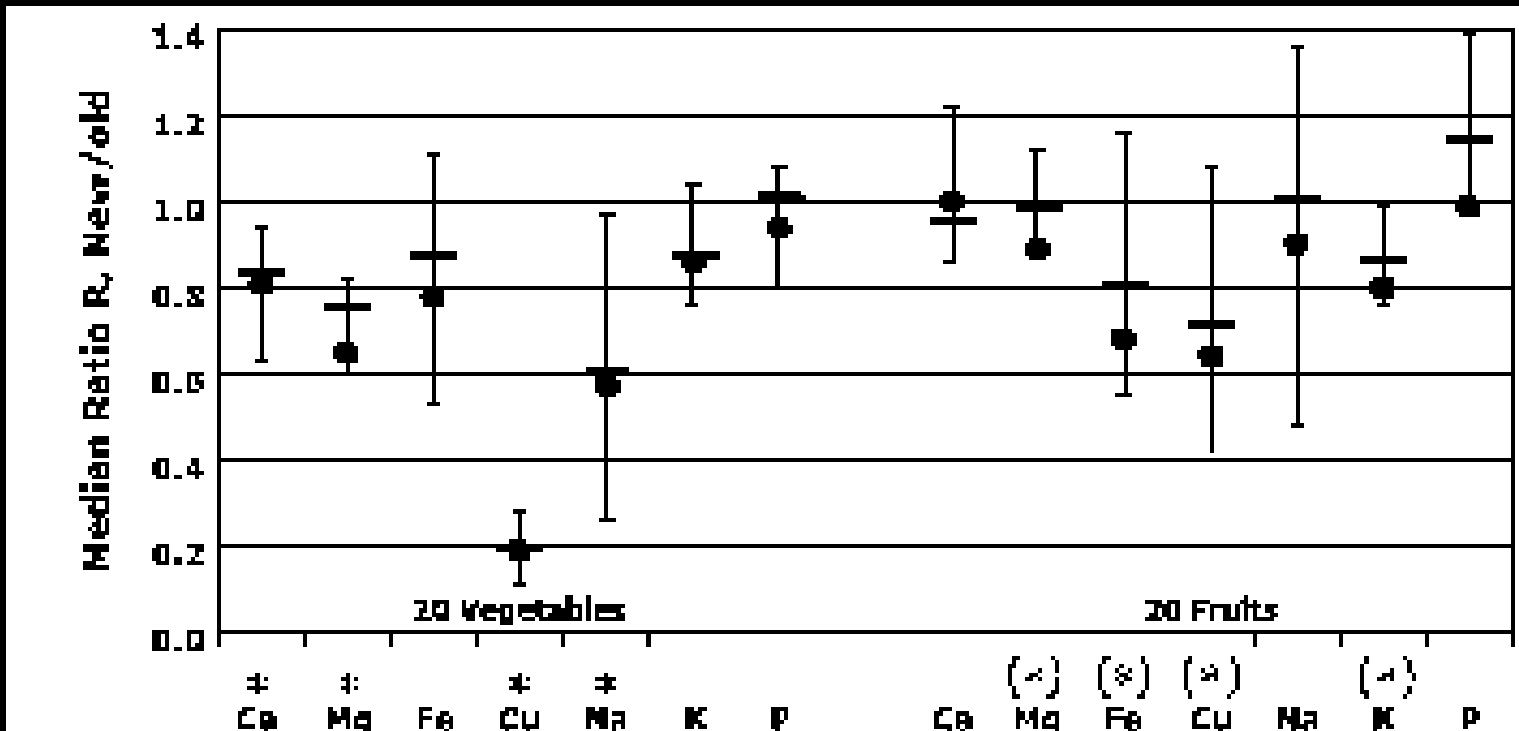


Declining Fruit and Vegetable Nutrient Composition: What Is the Evidence?

Donald R. Davis^{1,2,3}

Biochemical Institute, The University of Texas, Austin, TX 78712; and Bio-Communications Research Institute, 3100 North Hillside Avenue, Wichita, KS 67219

Additional index words. nutritive value, history, dilution effect, genetic dilution effect, agriculture, grains



Mudanças aparentes na concentração de nutrientes em 20 hortícolas e 20 frutas com IC de 95% (partially recalculated from Mayer, 1997; U.K. data, 1930s to 1980s).

Davis, D.R. 2009. HORTSCIENCE, V.44(1):15-19, 2009



Evidências apontam para o declínio de nutrientes em frutas e hortícolas disponíveis nos USA e UK

estudos de adubação encontraram relação inversa entre rendimento e concentração de minerais — denominado ‘efeito diluição’;

três estudos recentes da composição histórica dos alimentos revelaram declínio aparente da mediana de 5% a 40% ou mais em alguns minerais em grupos de hortícolas e talvez em frutas; um estudo também avaliou vitaminas e proteínas com resultados similares; e

recente plantios lado a lado de cultivares de brócolis e grãos de alto ou baixo rendimento encontraram consistentemente correlações negativas entre rendimento e concentrações de minerais e proteínas, um reconhecido ‘efeito diluição’ novo.

Davis, D.R. 2009. HORTSCIENCE, V.44(1):15-19, 2009



Evidências apontam para o declínio de nutrientes em frutas e hortícolas disponíveis nos USA e UK

estudos de adubação encontraram relação inversa entre rendimento e concentração de minerais — denominado ‘efeito diluição’;

Maior aumento de P e de biomassa;
Menores teores de N, K, Ca, Mg, Mn, Fe, Cu, B, e Zn.

Davis, D.R. 2009. HORTSCIENCE, V.44(1):15-19, 2009



Evidências apontam para o declínio de nutrientes em 27 híbridos modernos de brocolis disponíveis nos USA

Correlação negativa entre o tamanho da cabeça do brocolis e a concentração de minerais;

No caso do Cálcio, a média da quantidade nos híbridos modernos foi de 3,4 mg/g – muito menor que a média de Cálcio de variedades dos anos 1950 (12,9 mg/g) ou dos anos 1963 (9,4mg/g)



Davis, D.R. 2009. HORTSCIENCE, V.44(1):15-19, 2009



Evidências apontam para o declínio de nutrientes em trigos modernos disponíveis nos USA

Rendimento foi praticamente o dobro comparativo às variedades antigas;

Todas as correlações entre rendimento e teor de minerais foram negativas

A taxa de declínio de seis minerais foi de 0,33% ao ano (Fe, Zn, Cu, P, S e Se), o que corresponde a 22-39% num período de pouco mais de 100 anos



Davis, D.R. 2009. HORTSCIENCE, V.44(1):15-19, 2009



Evidências apontam para o declínio de nutrientes em 45 milhos modernos disponíveis em Iowa

Concentração de Proteína,
óleo e três amino ácidos
decreceu nos oitenta anos
de estudos;

Davis, D.R. 2009. HORTSCIENCE,
V.44(1):15-19, 2009





¿ Por que las empresas restringen el uso de las semillas no transgénicas?

Disminuindo la diversidad en cultivo...



Agência Brasil, 18/05/2010 -19:09

http://agenciabrasil.ebc.com.br/home?p_p_id=56&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&p_p_col_id=column-4&p_p_col_count=3&56_groupId=19523&56_articleId=954751

Agricultores reclamam que Monsanto restringe acesso a sementes de soja convencional

Danilo Macedo, Repórter da Agência Brasil

Brasília - A Associação Brasileira dos Produtores de Soja (Aprosoja) e a Associação Brasileira de Produtores de Grãos Não Geneticamente Modificados (Abrange) estudam recorrer ao Conselho Administrativo de Defesa Econômica (Cade), do Ministério da Justiça, contra a Monsanto. Segundo as duas entidades, a empresa norte-americana está restringindo o acesso de produtores a sementes de soja convencional (não transgênica).

“Eles estão impondo uma proporção de venda de **85% de sementes transgênicas para 15% de convencionais**. A produção de sementes tem que atender ao mercado. Não se pode monopolizar ou fazer o mercado”, reclamou o novo presidente da Aprosoja, Glabuer Silveira.

A estimativa do setor produtivo é que aproximadamente 55% das sementes de soja plantadas no país sejam transgênicas. Silveira disse que o problema não é o uso da biotecnologia, mas sim a retirada da opção que o produtor tem de plantar a semente convencional. “A Monsanto tem uns 70% do



¿ Que ventajas tienen las semillas de identidad o crioullas?

Garantizando la salud y la sostenibilidad ambiental y agrícola....



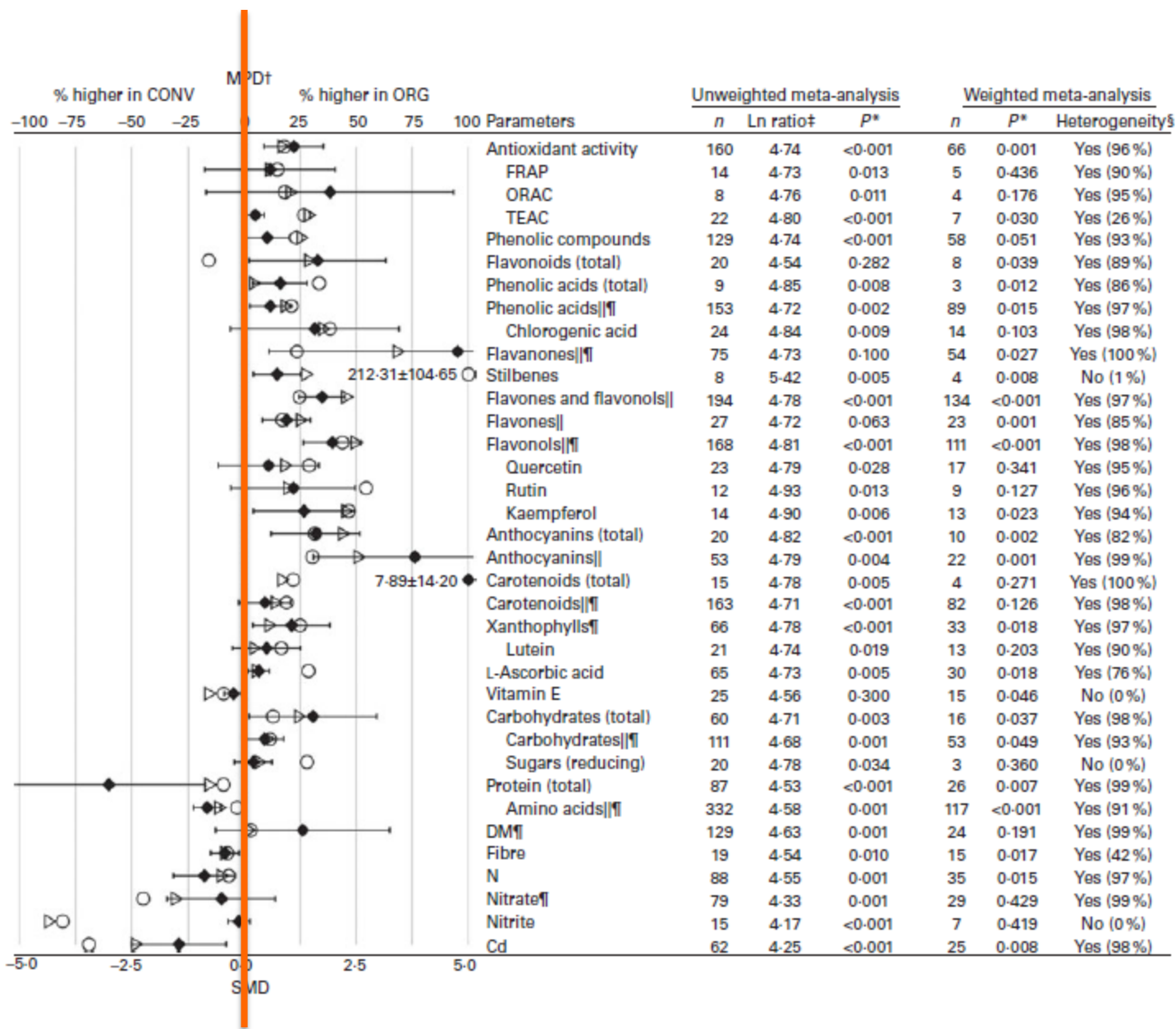
Dados referentes al peso de mazorcas (Kg/ha), media de tres años, de los ensaios realizados en los años agrícolas de 2002/2003; 2003/2004 e 2004/2005 y evaluación visual realizada por los agricultores de la comunidad de Muqui.

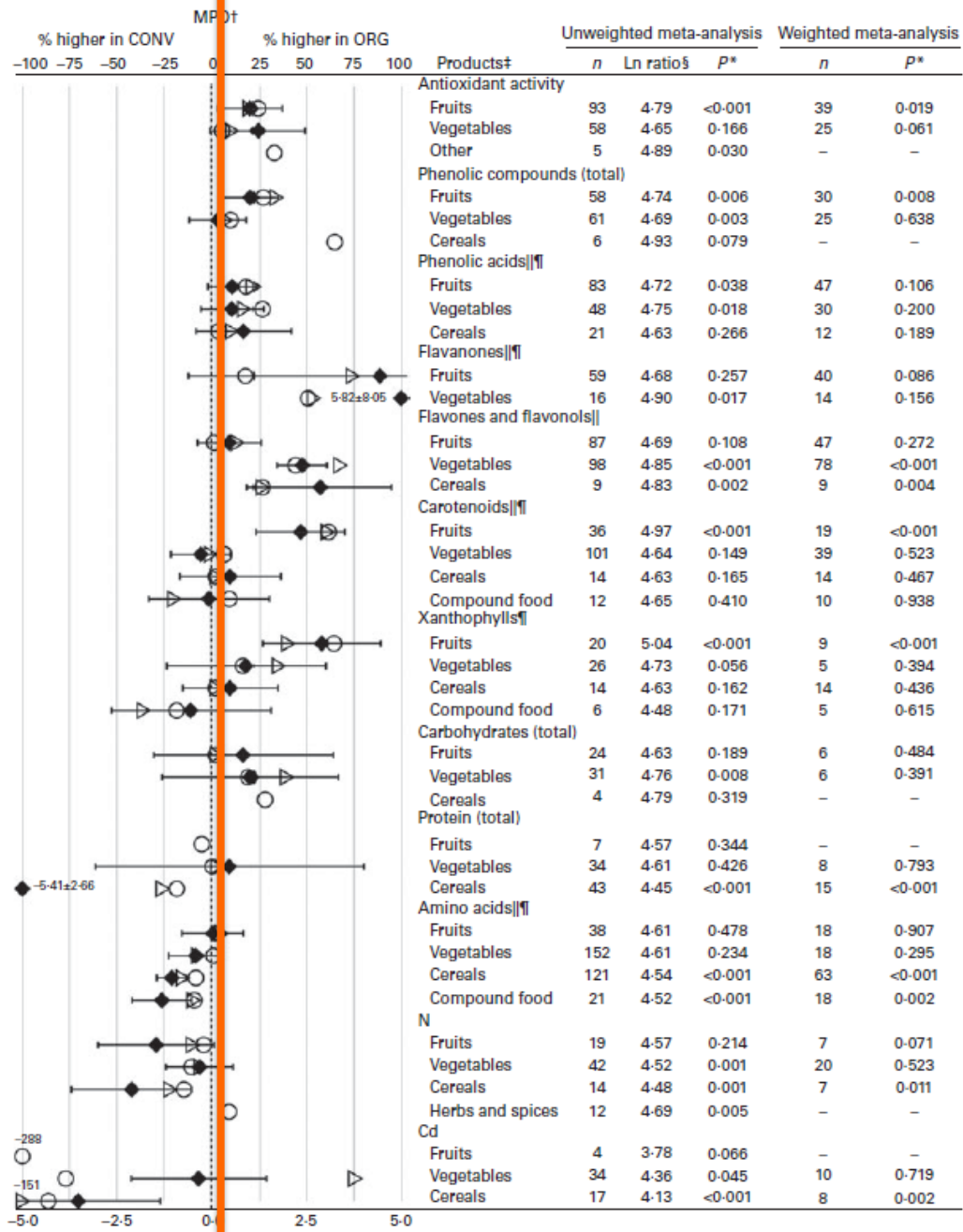


| Variedades | 2002/2003 | 2003/2004 | 2004/2005 | Class.visual |
|----------------------|--------------|-------------|--------------|--------------|
| Sol da Manhã | 5700 | 7380 | 7880 | 4 |
| Eldorado | 7280 | 9580 | 11280 | 1 |
| BR 106 | 6620 | 8320 | 8340 | 10 |
| BR 473 | 5540 | 7180 | 7140 | 9 |
| BR 451 | 5100 | 6100 | 7360 | 8 |
| Saracura | 5260 | 7680 | 7020 | 7 |
| Caiano | | | | |
| de Sobrália | 7300 | 9060 | 9100 | 5 |
| Palha Rôxa SC | 5000 | 7980 | 10280 | 2 |
| Caiano ES | 5360 | 7360 | 8820 | 6 |
| Fortaleza | 6680 | 8560 | 10580 | 3 |
| Média Geral | 5980 | 7920 | 8780 | |
| CV (%) | 20,26 | 9,39 | 11,01 | |

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Marcin Barański¹, Dominika Średnicka-Tober¹, Nikolaos Volakakis¹, Chris Seal², Roy Sanderson³, Gavin B. Stewart¹, Charles Benbrook⁴, Bruno Biavati⁵, Emilia Markellou⁶, Charilaos Giotis⁷, Joanna Gromadzka-Ostrowska⁸, Ewa Rembiałkowska⁸, Krystyna Skwarło-Sońta⁹, Raija Tahvonen¹⁰, Dagmar Janovská¹¹, Urs Niggli¹², Philippe Nicot¹³ and Carlo Leifert^{1,10*}





M. Barański *et al.*

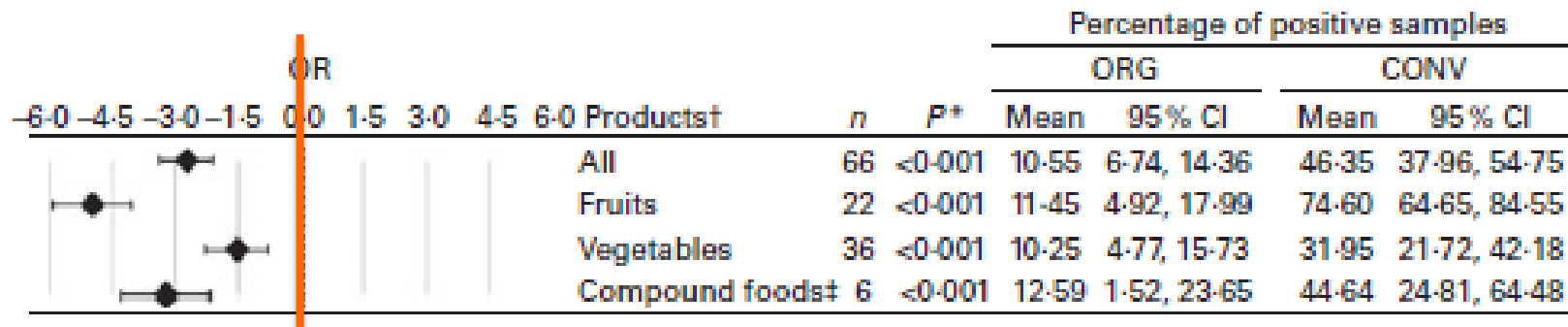


Fig. 5. Results of the standard weighted meta-analysis comparing In OR for the frequency of occurrence of pesticide residues (percentage of positive samples) in organic and conventional crops. A mixed-effect model with crop/product group as a moderator was used. OR, In OR for each product group (◆); ORG, organic food samples; CONV, conventional food samples; n, number of data points included in the meta-analyses. Values are odds ratios, with 95% confidence intervals represented by horizontal bars. *P value <0.05 indicates a significant difference between ORG and CONV. †Crops/product groups for which n ≤ 3 were removed from the plots. ‡Compound foods.



Que hacer ?

- Muchas cosas, pero de forma colectiva;
- Aumentar los proyectos de investigación participativa;
- Restablecer la asociación entre campesinos y consumidores;
- Resolver el descompaso entre políticas publicas y la realidad de los campesinos.



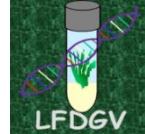
Pesquisa participativa
com sementes crioulas
permite o resgate da
dignidade dos
agricultores



Melhoramento genético participativo

Uma forma de resgatar a dignidade que foi abafada no século XX





POR BIODIVERSIDAD. EL CONCEJO METROPOLITANO APROBÓ DECLARATORIA

Lima ya es territorio libre de transgénicos

Conveagro saludó la iniciativa y exhortó al gobierno a promulgar la Ley de Moratoria por diez años.

La Municipalidad de Lima, en su sesión plenaria del Concejo Metropolitano, aprobó ayer el dictamen que declara a Lima como "Territorio Libre de Transgénicos u organismos genéticamente modificados (OGM)".

Presidida por la alcaldesa Susana Villarán, la declaratoria fue aprobada por amplia mayoría, con el objetivo de proteger, de manera precautoria, la salud de los limeños, así como preservar la biodiversidad y el medio ambiente.

En base a ello, el municipio pro-



LIMA. Sesión del Consejo de la Municipalidad que dirige Susana Villarán.

Convención Nacional del Agro Peruano (Conveagro), presente en la sesión, saludó la declaratoria que se

cumplir otras obligaciones.

"En el mes del campesino peruano que alimenta a los peruanos

EL DATO

PROMULGACIÓN. Conveagro se pronuncia: "Esperamos que el presidente de la República, Alan García, reconozca que su gestión está errada en promover el ingreso de transgénicos al país y, haciendo el mea culpa respectivo, promulgue la Ley de Moratoria por 10 años aprobada por el Congreso, con el voto de sus mismos partidarios. El agro peruano, que fue desatendido por este gobierno, merece por lo menos esta última señal", anotó el dirigente agrario Jorge Prado.

cipio sienta su posición sobre el tema, en vista de que el Ejecutivo puede observar la norma aprobada

França proíbe definitivamente milho transgênico da Monsanto



Recomende



56.732 views



108



Salva

AP



75 municipios declarados
libres de transgénicos

92% de los
cantones



Orotina, Montes de Oro, San Mateo, Turrubares, Pococí, Carrillo, Alajuelita, Bagaces, Golfito, Siquirres, Pamíta, Matina, Mora, Alfaro Ruiz, Coronado, San Rafael, La Cruz, Limón, Tilarán, San Carlos, Alajuela, Tarrazú, León Cortés, Acosta, Poas, Valverdevega, Santa Bárbara, Upala, Puntarenas, Liberia, Heredia, Atenas, La Unión, Flores, Guácimo, Goicoechea, El Guarco, Puriscal, Escazú, Grecia, Guatuso, Naranjo, Palmares, San Ramón, Alvarado, Oreamuno, Paraíso, Turrialba, Abangares, Hojancha, Nandayure, Nicoya, Santa Cruz, Barva, Belén, San Isidro, Santo Domingo, Talamanca, Aguirre, Buenos Aires, Corredores, Coto Brus, Esparza, Osa, Aserri, Desamparados, Dota, Montes de Oca, Moravia, Perez Zeledón, San José, Santa Ana, Tibás, Garabito, San Pablo.



Diversidade genética, ambiental e cultural

Oligopólio e dominação





Conclusiones

Son muchos los efectos **adversos** ya ocurridos, tan pocos los **estudios** científicos en los trópicos y ningún **seguimiento** establecido, condiciones claras de gran **incertidumbre económica, social y de seguridad alimentaria**, o que requiere el uso del principio **precautorio**.



**OUR CULTURE
OUR FREEDOM
OUR RIGHTS
OUR FAMILY
WAY OF LIFE
ARE ALL ROOTED
IN OUR LAND**



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