

Statement of scientists, intellectuals and artists against the introduction genetically modified (GM) maize into the Mexican environment and for protecting Mexico's maize diversity.

Mexico City, September 29, 2009.

President of Mexico, Mr. Felipe Calderón Hinojosa:

This year you stand in a historical position to prevent irreversible damage to one of the World's most precious resources: Mexico's maize diversity. We observe that your Administration may be rushing to introduce genetically modified (GM) maize into the Mexican environment and we are convinced, from our understanding of the scientific evidence, that this move represents a disproportionate risk which should be avoided for the benefit of Mexico and the World. Joined together in our well-informed concern, we urge you to move aggressively to ensure that no GM maize is planted in Mexico, the Center of Origin and Diversification of this important crop.

We are scientists, intellectuals and artists with expertise ranging from biology, biotechnology, agronomy and ecology, to the humanities, social sciences, anthropology, economy, biosafety, policy and jurisprudence; our joint expertise is the minimum that would be needed to understand the complexities posed by the agroecological as well as socioeconomic and cultural significance of maize in Mexico. We have noted with dismay that well-founded scientists and cultural experts' pleas to apply best scientific and social practices to the question of whether to introduce GM maize into the Mexican environment have gone largely unheeded. Indeed, experimental evidence produced in Mexico 15 years ago in trials leading to a justified moratorium on GM plantings from 1998 to 2003, has been set aside in a new drive towards unbridled release of GM maize in Mexico.

We are compelled to write this letter, given the latest element of a scientifically unjustifiable drive, embodied in the publication of amendments to the Law for the Biosafety of Genetically Modified Organisms (published by the Diario Oficial de la Federación on March 6, 2009), which disable the Special Protection Regime for Maize and other crops, for which Mexico is center of origin and diversification. Such amendments prepare the legal grounds to authorize field releases of GM maize varieties in the states of Sinaloa, Sonora, Tamaulipas, Jalisco, Nayarit and Chihuahua. Given the proven capacity of the maize germplasm to disperse through pollen or seed-flow, we can be certain that such release will lead to the increased presence of transgenic materials elsewhere throughout the Mexican territory.

After a quarter-century of experimental releases and more than a decade of commercial distribution of transgenic maize, there is plenty of evidence that the benefits offered by such lines do not compensate for the risks posed by their release. A review of the scientific literature and even the expert opinions offered by some of us through the official consultation of the Mexican Ministry of Agriculture agencies (SENASICA) makes this fact clear. Many other governments in the world have taken this experience into account to stop the planting, and in many cases even the importation of transgenic maize materials, making the position of your government, Mr. President, even more puzzling and unjustifiable.

The risks of GMO release may escalate at centers of crop origin and diversification. Here, transgenes will inevitably become inserted in a variety of different landraces (with diverse genomic contexts and backgrounds).

Below you will find a detailed listing of concerns and problems associated with the possibility of transgenic maize being released in Mexico, but we would like to highlight here a few particular examples. We are specially concerned by the fact that maize is currently used as a "bioreactor", a biological factory planted in the field to yield not food, but industrial products such as plastics, industrial oils, biofuels and pharmaceuticals. Because of the open cross pollination nature of maize reproduction and the specific conditions of the Mexican agroecosystem, it is to be expected that transgenic bioreactor materials will permeate the human food-chain, a risk of enormous consequences for the Mexican and world human populations. Accidental mixing of non-transgenic seed by bioreactor

transgenic maize from experimental and commercial plantings has already occurred in seed storage silos in the United States.

Equally troubling are the consequences of the penetration of patented transgenes into maize lines cultivated by most farmers in Mexico, opening the prospect of complex, large and expensive liabilities for individuals that use, trade or exchange maize seed or grain containing them. These examples add to the possibility of transgene contamination of the Mexican teosinte (the wild relative and ancestor of maize), which in itself implies potential negative impacts to the genetic pool of the species and the agronomical management of teosinte.

Unlike chemical pollution, the transgenic transformation of maize germplasm, a heritage stewarded by indigenous people and farmers in Mexico, might be irreversible and likely to accumulate of transgenes in its genome, making the responsibility of our generation towards future populations even greater. Because there is no visible difference between GM and non-GM maize varieties, which nevertheless hold extremely different physiological qualities, the responsibility of producers and regulators, farmers and food processors to protect the environment and the public is also much greater than for other kinds of pollution. Because there is no visible difference between GM and non-GM maize varieties, which nevertheless hold extremely different physiological qualities, the responsibility of producers and regulators, farmers and food processors to protect the environment and the public is also much greater than for other kinds of pollution. Furthermore, given the complex structure of native maize populations resulting from the informal seed sector and gene flow via pollen, a reliable tracing system in Mexico for segregating GM and non-GM maize lines at any typically acceptable level is not available or indeed possible. Therefore, release of GM lines into the open field in Mexico will only increase the chance of introgression and accumulation of transgenes in the genomes of native maize stocks. This will remove the possibility of a responsible involvement of farmers, food-processors and consumers in ensuring that their stocks remain free of unwanted transgenic elements. Yet despite this increased onus of responsibility on producers of transgenic lines and regulators, the introduction of GM germplasm into Mexico is done with only partial or no consultation, and the details of the materials introduced are not disclosed due to business interests.

Also, the infrastructure that would be necessary to review proposed releases and to monitor the panoply of potential damages caused by such releases is not available in Mexico or elsewhere. We believe that under these circumstances, the only justifiable protection of the invaluable Mexican maize germplasm is to establish an official and effective moratorium on the cultivation of GM maize cultivars until long-term research on the impact of transgenic maize in Mexico is conducted. Such research should not imply the risks that wanted to be avoided.

In sum, Mr. President, we beseech you to engage actively with your administration to achieve the following goals that we believe are reasonable, easily achievable and scientifically justified as the most basic requirement to ensure the safety and long-term availability of key genetic resources for Mexicans and for the world:

1. Establish an official banning of any and all field releases of commercial GM maize varieties, and at the same time, support rigorous scientific investigation on the potential of diverse and alternative agro-technologies in Mexico, as well as the risks implied in their use in centers of origin and diversification. That research must be designed and performed in public institutions and/or by independent scientists free of conflicts of interest.
2. Increase to a level of scientifically-sound efficacy the infrastructure necessary to monitor and independently evaluate seed and grain entering Mexico from countries that produce GM maize varieties.
3. Adopt a clear and effective policy to ensure that no food plant, such as maize, will be used as a bioreactor to produce non-edible substances in Mexico or in any other country.

We are ready to provide more detailed scientific data or expand the arguments that further support our statements, as well as to collaborate in initiatives that guarantee the prevention of transgene accumulation in the world's maize genetic resources.

Looking forward to your response concerning this urgent and delicate matter,

Sincerely yours,

# NAME	FIELD OF STUDY	INSTITUTION	POSITION & AWARDS	COUNTRY
1. Antonio Serratos, PhD.	Biología y Bioseguridad	Universidad Autónoma de la Ciudad de México	1er Premio de ICyT DF (2009)	México
2. Elena Alvarez-Buylla Roces, PhD.	Genética Molecular de Plantas	Instituto de Ecología UNAM	Premio Ciudad Capital: "Heberto Castillo Martínez" ICyTGDF 2008. Miembro del "Faculty of 1000". "Sor Juana Inés de la Cruz", UNAM 2005. "International Fellow", Santa Fe Institute, USA. 2004. Academia Mexicana de Ciencias 1999. Pew, "Latin American Fellow" 1996. Universidad Nacional para Jóvenes Académicos 1997. Young Investigator Award, American Naturalist, 1994.	Mexico
3. Richard Levins, PhD.	Ecologist	Harvard School of Public Health	Edinburgh Science Medal 1996	United States of America
4. Montgomery Slatkin, PhD.	Genetics	University of California at Berkeley		United States of America
5. Héctor Bourges Rodríguez, PhD.	Nutriología	Instituto Nacional de Ciencias Médicas y Nutrición	Premio FAO	México
6. Alma Piñeyro Nelson, BSc.	Genética Molecular de Plantas	Instituto de Ecología UNAM		México

7. Eckart Boege, PhD.	Patrimonio Biocultural Pueblos Indígenas	Instituto Nacional de Antropología e Historia		México
8. León Olive, PhD.	Philosophy	Instituto de Investigaciones Filosóficas UNAM		México
9. Hugo Perales, PhD.	Conservación de recursos genéticos agrícolas	El Colegio de la Frontera Sur		México
10. Bruce G. Ferguson, PhD.	Agroecology	El Colegio de la Frontera Sur		México
11. Alejandro Morón, PhD.	Ecología	El Colegio de la Frontera Sur		Mexico
12. Neptali Ramírez Marcial, PhD.	Ecología Vegetal	El Colegio de la Frontera Sur		México
13. Jorge Galindo González, PhD.	Ecología y conservación	INBIOTECA		México
14. Alejandro Espinosa Calderón, PhD.	Mejoramiento genético y producción de semillas	INIFAP/FESC-UNAM	SNI III	México
15. David Barkin, PhD.	Ecological Economics	Universidad Autónoma Metropolitana		Mexico
16. Rémy Vandame, PhD.	Ecología	El Colegio de la Frontera Sur		México
17. Jorge Enrique Linares, PhD.	Philosophy (ethics)	Facultad de Filosofía y Letras		México
18. Ana Ma. Lopez, MSc.	Manejo de recursos naturales	Instituto de Biología		México
19. Diana Perez-Staples, PhD.	Behavioral ecology	INBIOTECA		Mexico
20. José Pablo Liedo Fernández, PhD.	Ecología de insectos y manejo de plagas	El Colegio de la Frontera Sur	Reconocimiento Merito Investigacion Cientifica Chiapas	México

cc Lic. Francisco Javier Mayorga Castañeda, Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, SAGARPA (Agriculture Ministry).
 cc Ing. Juan Rafael Elvira Quesada, Secretaría del Medio Ambiente y Recursos Naturales, SEMARNAT (Environment Ministry).
 cc Dr. José Ángel Córdova Villalobos, Secretaría de Salud, SSA (Health Ministry).
 cc Ing. Gerardo Ruiz Mateos, Secretaría de Economía, SE (Economy Ministry).
 cc Dr. Agustín Carstens Carstens, Secretaría de Hacienda y Crédito Público, SHCP (Treasury Ministry).
 cc Mtro. Alonso Lujambio Irazábal, Secretaría de Educación Pública, SEP (Education Ministry).
 cc Mtro. Juan Carlos Romero Hicks, Consejo Nacional de Ciencia y Tecnología, CONACYT (National Research and Technology Council).
 cc Dr. R. Ariel Álvarez Morales, Comisión Intersecretarial de Bioseguridad de los Organismos Genéticamente Modificados, CIBIOGEM (Biosafety Office).
 cc Dr. Enrique Sánchez Cruz, Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria, SENASICA (Food protection Agency).
 cc Lic. Miguel Ángel Toscano Velasco, Comisión Federal para la Protección contra Riesgos Sanitarios, COFEPRIS (Drug and Health Evaluation Agency).

Here we present a synthesis of the main issues that translate into important uncertainties and potential risks that have not been adequately addressed with scientific research. These issues can pose important threats to human health, to maize genome or diversity and the biodiversity of its agroecosystem if GM maize is introduced into Mexico in its present form.

1) There is still insufficient scientific evidence on the technological potential and risks of the present-day GM maize lines, and the ones being proposed for release are already obsolete. Moreover, the legal and technological instruments and institutional capabilities that are required for such evaluations are not in place. Experimenting with GM maize in the agroecosystems of Mexico implies high uncertainties and potential risks, while this technology does not guarantee benefits for the great majority of Mexican maize producers. Alternative technologies should be explored before adopting this transgenic maize technology, which has been tailored for different environmental and socioeconomic conditions. Some examples that support this statement:

- Pests for which maize transgenic lines have been engineered are not important or present in Mexico. Local maize varieties are well adapted to resist important pests in each locality and the introduction of transgenic lines may also affect the ecological balance of different pests and create new pest problems for Mexican agriculture.
- Recent technical assessments have shown that the GM maize lines used to date have not increased yields. In the few observed cases that yield has increased, this has been due to techniques from classical maize breeding rather than to an introduced transgene. See report "Failure to Yield" by Union of Concerned Scientists.
- The use of maize genetic variation combining bioinformatics, contemporary molecular biology approaches and the use of novel transgenic approaches that overcome some of the limitations and risks of the first generations of GMO is promising. Such approaches would render native varieties very valuable and should be a much more appropriate biotechnological approach for Centers of Crop Origin and Diversification. Mexico should devote enough resources to develop a truly scientific and cutting-edge program of crop improvement and development for national and international needs, taking advantage of its diverse crop germplasm.
- Recent technological breakthroughs in maize transgenesis imply fewer negative side-effects that render all lines to be tested obsolete (Shukla et al. 2009. Nature 459: 437- 440)

2) Some of the current experimental field trials under evaluation violate the LBOGM. Furthermore, the amendments to the biosafety regulations published on March 6th, 2009, eliminate the Special Protection

Regime present in the aforementioned Law. Such Regime was meant to safeguard the genetic diversity of local, wild and/or cultivated varieties of crop plants that had their origin or diversification in Mexico.

Current requests for experimental field trials submitted for approval contradict the LBOGM in articles 40, 42 and 43 since some of the GM maize lines, that are currently under review, possess novel transgene combinations that have not been de-regulated in their country of origin (USA; see table 1). The LBOGM clearly states "GMOs, that have not been authorized in their country of origin or by the National Ministry of Health, shall not be imported or released in Mexico under any regime".

The amendments not only affect the Special Protection Regime but also oversee the fact that the centers of origin, domestication and diversification of maize have not been established. The decision on the requested permits must be on hold until the relevant agency on this issue, the National Commission for the Knowledge and Use of Biodiversity (CONABIO, in Spanish), publishes this information.

3) Recent scientific evidence has shown that transgenes have made their way into native maize varieties within several different agricultural zones in Mexico. This data suggest that coexistence of GM-maize lines with conventional maize varieties without gene-flow is virtually impossible once the former are planted in the field. Furthermore, detection of such gene flow has been hindered by the lack of public access to reliable sequence data on all the recombinant constructs that could be involved, as well as restricted access to the plasmids and transgenic lines needed as positive controls. This impedes expedite and accurate detection of transgenes in Mexico. Furthermore, the certified standard methods to detect transgenes in hybrid maize in the USA and Europe are inadequate for monitoring transgenes in landrace varieties.

Scientific papers documenting the presence of transgenes in Mexican native maize varieties: 1) In Sierra Juárez, state of Oaxaca in 2000: Quist and Chapela. (2001) *Nature*, 414, 541-543; 2) In the conservation area of the Federal District (Mexico City), in 2003: Serratos-Hernández et al. (2007) *Frontiers in Ecology and the Environment*, 5(5): 247-252; 3) In Sierra Juárez, state of Oaxaca in 2001 and 2004: Piñeyro-Nelson et al. (2009) *Molecular Ecology*, 18:50-761. ; 4) In localities of the states of Guanajuato, Veracruz, Oaxaca and Yucatán in 2002: Dyer, G. et al. (2009) *PlosOne*. Vol. 4(5): e5734 doi:10.1371/journal.pone.0005734; 5) Peer-reviewed papers addressing other transgene biomonitoring efforts made by governmental agencies and NGOs in Mexico: Mercer and Wainwright (2008) *Agriculture, Ecosystems and Environment*, 123, 109 -115. 6) Recent comments in *Molecular Ecology* concerning transgene detection methods (Piñeyro et al. in press: "Resolution of the Mexican transgene detection controversy: error sources and scientific practice in commercial and ecological contexts").

4) Mexican Government agencies in charge of biosafety (Agriculture, Environment and Health, among others) have been unable to detect, investigate and prevent the introduction or impact of transgenes in Mexican native maize varieties. Changes in policy have precluded consolidation of a biosafety system in Mexico, paradoxically, after more than twenty years of experience in this area. The biosafety and biomonitoring infrastructure provided by the Mexican authorities is insufficient: there is only one national laboratory certified for GM maize detection, the CENICA, which was certified for this activity until 2005. Since 2007, a national network of GMO monitoring laboratories has been created, but it is still not operating and it is not clear how will it be supervised by the Government.

Publication where no transgenes were detected based on analyses made in a commercial laboratory in the United States (no data from a National laboratory are provided) in the Sierra Juárez of Oaxaca in 2003-2004: Ortíz-García et al. (2005) *Proceedings of the National Academy of Sciences*, 102:12, 338-343; 2) Web page to the CENICA laboratory: <http://www.ine.gob.mx/dgcenica/certificado2006.html>; 3) Information about the national network of GMO biomonitoring laboratories: http://www.ine.gob.mx/bioseguridad/red_laboratorio.html

5) Mexico comprises the centers of origin, domestication and diversification of maize and thus, harbors the majority of the genetic diversity of maize worldwide, while being home of all its known wild relatives. This genetic diversity is dynamically recreated in the fields of many small-scale farmers that produce maize for their subsistence, for local or regional markets. Farmers in the diverse agronomical systems present in different parts of Mexico, rely on saving seed from one agricultural season to the next as well as on frequent seed exchange among farmers within and outside of the communities. These activities are at the heart of the dynamic system that ensues the generation and maintenance of genetic diversity in maize. This system also implies that dispersal of GM maize and introgression of transgenes into native maize varieties cannot be avoided in Mexico if GM maize lines are planted in the open field.

Such dispersal should be avoided by monitoring entries (grain imported from countries which produce and plant GM maize, commercial maize hybrids that are sold in Mexico, etc.) of such materials and cancelling (eg., treating grain to avoid viability; this could be achieved by radiation treatments that also kill harmful fungi) their way to local landraces. The recent publication of: "Origen y Diversificación del Maíz, una revisión analítica"; By Kato and collaborators, funded by CONABIO and other agencies, shows that practically all areas of Mexico are under landrace transgene contamination risk, if GM maize is planted in the open field. Ongoing new collections to those considered in this study are likely to demonstrate that there are additional landraces in several locations of Mexico; specially in the North. Therefore, the map will likely show a high risk of contamination in practically all of the Mexican territory. This is further supported by computer simulations (Van Heerwaarden and Alvarez-Buylla, in preparation) that forecast GM dispersal by considering both pollen and seed flow. This study demonstrates that transgene movement might occur at longer distances, than those that were considered in order to establish the risk categories considered in the work by Kato and collaborators. Under these circumstances, unwanted and unpredictable gene stacking will likely occur, giving way to additional uncertainties and risks.

Additional scientific papers addressing seed management dynamics among Mexican farmers: 1) G. Dyer and Taylor. 2008. Proceedings of the National Academy of Sciences. 105(2), 470-475; 2) Dyer, G. et al. (2009) PlosOne 4(5): e5734 doi:10.1371/journal.pone.0005734; 3) Serratos et al. (2004) Environmental Biosafety Research 3(3): 149 - 157; 4) Turrent y Serratos (2004) Secretariat of the Commission for Environmental Cooperation of North America; 5) Turrent et al. (2009) Agrociencia 43: 257 - 265.

6) Maize is a basic staple of the country, consumed daily with little processing and in large quantities, and thus possesses a critical agricultural, nutritional, economic and cultural significance for Mexican people. Furthermore, it's the third staple of the world, with increased consumption in countries within Africa and an important source of feed in many other nations. The health consequences of GMO consumption under these regimes have not been investigated thoroughly, but the few available appropriate experiments point to possible negative effects. This issue is being actively discussed in the United States, Europe and Latin America by groups of medical professionals, scientists, regulators and non-government organizations.

See upcoming meeting to discuss these issues by the European Food Safety Authority to be held in Parma, Italy (October 2nd, 2009).

See FAOstats: <http://faostat.fao.org/>

7) In the USA, transgenic and non-transgenic maize seeds are not segregated and maize stocks that should not have transgenes have been reported to harbor more than 1% of GM maize. This shows that even in a country in which seed systems are mostly closed and controlled by relatively few companies, transgenes have not been contained within approved stocks, lines or sites of release.

Union of Concerned Scientist Report: "Gone to Seed"http://www.ucsusa.org/assets/documents/food_and_agriculture/seedreport_fullreport.pdf and several other reports and scientific papers.

This fact is of great concern, given fact (2) and that:

8) Multiple maize lines expressing pharmaceuticals and other industrial substances (so called pharma and industrial crops), that should not be consumed by animals or humans have been produced and tested in experimental fields in the United States for over a decade (**see below**) . Companies have not been able to keep transgenic and non transgenic lines segregated and several escapes from experimental plots of pharma-crops unauthorized for consumption have been reported. Therefore, even if such events could occur at very low probabilities and have limited impact on maize stocks in the USA, once in the Mexican territory, the frequency and dispersal of such sequences could be amplified. For that reason, the probabilities of occurrence of such escapes in Mexico should be estimated rigorously in order to establish efficient monitoring and biosecurity methods.

The use of maize as a pharma-crop is more worrisome if we consider that the identity, name, and sequence of current proteins expressed in such crops is not available publicly and thus, hinders biomonitoring. It is clear, from points 2 and 3, that conventional maize varieties can inadvertently be

introgressed with transgenes from pharma-crops, significantly affecting the human food chain.

9) Once GM maize lines are released, transgenes will insert and accumulate in diverse landraces and wild maize relative species (teosintes). It is well documented that the phenotypic effect of a transgene largely depends on the genome context and background where it is inserted. Therefore, unavoidable gene flow will lead to uncertainties and ramified ecological and agroecological consequences.

Ellstrand et al. (2007) *J. of Heredity*, 98(2):183-187; Timmons et al. (1996) *Nature* 380: 487; Warwick et al. (2008) *Molecular Ecology* 17:1387-1395. Hails and Morley (2005) *Trends in Ecology and Evolution* 20:245-252; Pilson et al. (2004) *Annual Rev. Ecol. Evol. Syst.* 35: 149-174.

10) There is ample evidence demonstrating that stable alternatives exist that can meet and even exceed the needs which transgenic maize is purported to meet, without the risk that its release involves.

CONCLUSIONS:

All experimental field trials of GM maize should be banned until the issues mentioned above are settled and scientific evidence regarding the biosafety of GM maize in Mexico is reached, based on a thorough analysis of the best available data.

Table 1. Applications to test maize transgenic lines in the open field of Mexico (presented by Monsanto, Agro Dow and Pioneer Hybred corporations between april and may of 2009)

Event	Trait	No. exps. (2 ha each)	Location	Application #
I MON-00603-6	Glyphosate (herbicide) tolerance; Faena® family. Gene cp4 epsps from <i>Agrobacterium sp.</i> Strain: CP4.	8 (16)	Sonora, Sinaloa, Tamaulipas & Chihuahua.	0014_20090019_2_009 0020_20090023_2_0090005_20090006_20090009_20090012_2009
II MON-00603-6 x MON-89034-3	Insect resistant (Lepidoptera) and glyphosate. Combines gene cp4-epsps from <i>Agrobacterium sp.</i> Strain: CP4 and from <i>Bacillus thuringiensis</i>(Bt), proteins: Cry1A.105 y Cry2Ab2.	4	Sonora, Sinaloa & Tamaulipas	0015_20090017_2_009 0022_20090025_2009
III MON-89034-3 x MON-88017-3	Insect resistant (Lepidoptera and Coleoptera), and glyphosate tolerant. Expresses <i>Bacillus thuringiensis</i> (Bt) proteins: Cry1A.105 and Cry2Ab2; plus cp4 epsps gene from <i>Agrobacterium sp.</i> strain CP4, plus <i>Bacillus thuringiensis</i>(Bt) subsp. <i>Kumamotoensis</i> Cry3Bb1 protein.	4	Sonora, Sinaloa & Tamaulipas	0013_20090018_2_009 0021_20090024_2_009
IV DAS-01507-1	Insect resistant and herbicide tolerant. Expresses truncated Cry1F protein, strain PS81I (NRRL B-18484) and <i>Bacillus thuringiensis</i>.	4	Sonora, Chihuahua, Sinaloa y	0001_20090004_2_009 0007_20090010_2_009

	<i>var. aizawai</i> and PAT protein.		Tamaulipas	
V DAS-01507-1 x MON-00603-06	Insect resistant and herbicide tolerant. <u>With gene cp4 epsps from <i>Agrobacterium sp.</i> strain CP4</u>	4	Sonora, Chihuahua, Sinaloa & Tamaulipas	<u>0002_20090005_2009</u> <u>0008_20090011_2009</u>

(http://go.ucsusa.org/food_and_environment/pharm/index.php?s_keyword=XX)

<http://www.unionccs.net/comunicados/index.php?doc=sciencetrmaize>