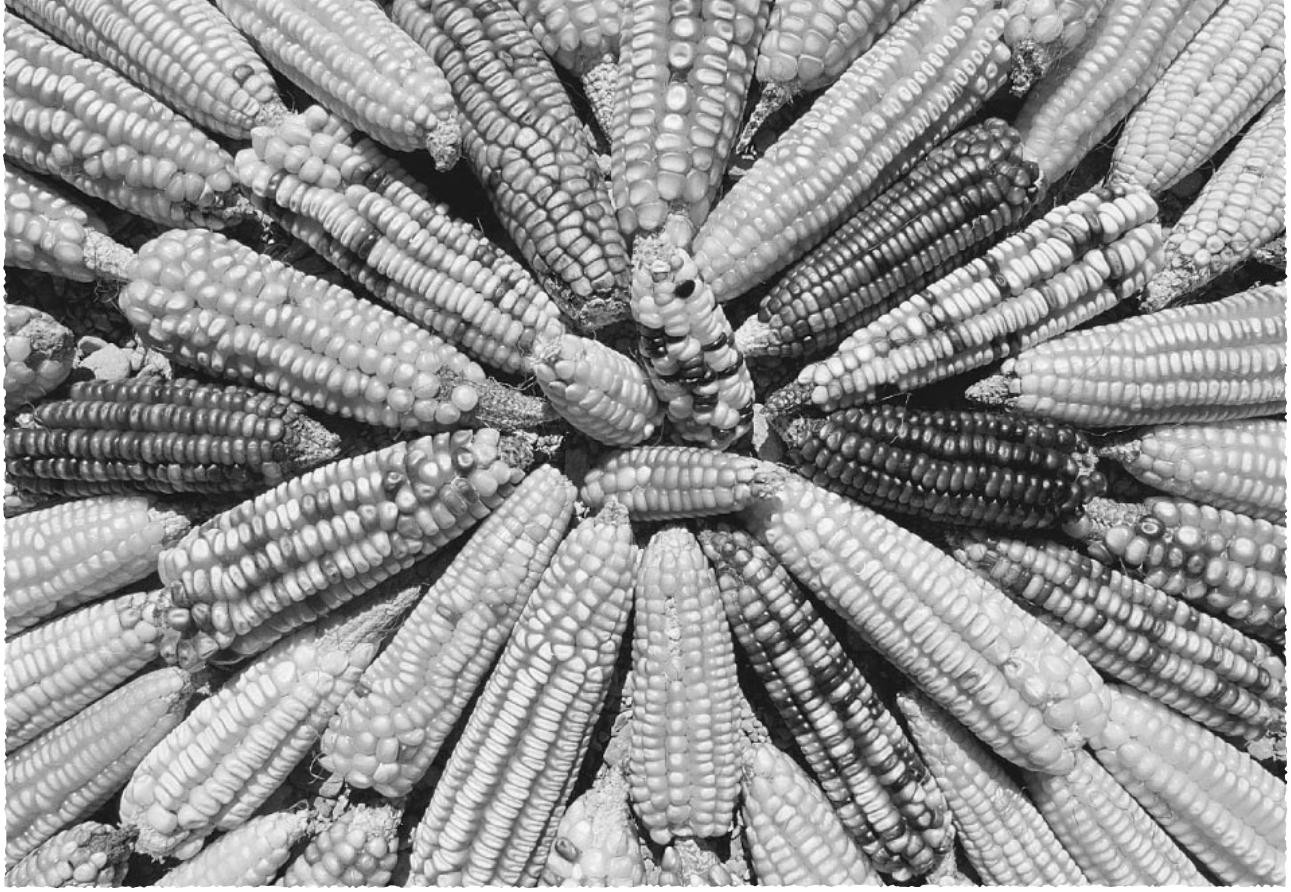

Can we afford to loose this diversity of maize? Photo: Greenpeace

Mexico, centre of diversity for maize, has been contaminated

Doreen Stabinsky and Niccolo' Sarno

The Mexican government, by means of its Intersecretarial Commission for Biosecurity and Genetically Modified Organisms (CIBIOGEM), announced research showing that 15 of 22 communities where maize seeds were tested this year were found to have been contaminated by GE maize. 3 - 10% of the maize seed tested contain genes from GE maize. Two communities showed even higher rates of contamination. Clearly many traditional maize fields in the region have been contaminated but authorities do not yet know the extent of the contamination.

GE varieties are not grown in Mexico but they are imported from the United States for feed and industrial use. The contamination was found in the rural Southern Mexican states of Oaxaca and Puebla, centres of origin and diversity of maize strains grown around the planet.

The magnitude of the problem in Oaxaca is large and the potential for contamination of neighbouring fields is a serious reality. While most maize pollen will fall within 500 meters of the crop field, transport of pollen over longer distances is possible. Bees can disperse pollen up to several miles; under unusual weather conditions, wind may carry pollen up to hundreds of kilometres.

Why care about crop genetic contamination and genetic diversity?

Jack Harlan, the famous botanist, has noted that genetic diversity "stands between us and catastrophic starvation on a scale we cannot imagine." According to the UN Food and Agriculture Organization (FAO), 75% of our crop genetic diversity has been lost within the last one hundred years. Loss of genetic diversity is epidemic worldwide; it is termed genetic erosion.

Because of the continued need of modern breeding programmes for new characteristics and genes, crop genetic conservationists concern themselves with preserving wild relatives of crop plants, as well as those local varieties of crops that small-scale agriculturalists grow in the many diverse cropping system habitats found throughout the world. Often these wild relatives and landraces, as local varieties are often called, are found in small populations, making conservation difficult.

Crop diversity is essential to the future of our agricultural systems. But it is also an essential component of our cultures. Consider the many varieties of potatoes grown by peoples living in the Andes, or the wide variety of eggplants, squashes and gourds used throughout Asia. Preservation of crop diversity is also a means of preserving elements of cultural diversity.

Maize under threat

Lack of genetic diversity can be linked to many of the major crop epidemics in human history. For example, in 1970, the maize crop in the southern United States was attacked by a disease called Southern cornleaf blight. Because of genetic uniformity among the maize varieties grown across the US, the loss to this disease was great – in total the US lost 15% of its harvest – at the time worth around US$1 billion. Loss of genetic diversity due to loss of cultivated varieties – genetic erosion – is happening in maize as well as in all our other major and minor crop plants. According to Genetic Resources Action International "only 20% of local maize varieties reported in Mexico in 1930 are still known."

Currently maize resources are under threat in two primary ways: the displacement of local varieties and the contamination of teosinte (see Box next page) by hybrid maizes. These threats are likely to increase in magnitude with genetically engineered maize.

Consequences of transgene contamination for the teosintes

Because crop plants and their wild relatives are closely related evolutionarily, they are often able to interbreed. This means that there is the potential for genetically engineered crops to hybridise with wild relatives and for the offspring to be viable. Most scientists agree that teosintes and cultivated maize interbreed. The offspring of a maize-teosinte cross may be more or less successful than the wild parent; either result could have negative long-term consequences for diversity conservation.

One problematic result of a maize-teosinte cross would be if the crop-wild relative hybrids were more successful in some way. Certainly crops engineered to be tolerant to pests and their offspring would have an advantage over wild relatives that had no such novel gene. Scientists have raised the concern that such hybrids could become problem weeds, creating a nuisance for farmers and also out-competing the wild relatives in the non-agricultural environment.

A second concern raised by scientists is the potential for crop-to-wild gene flow to lead to the extinction of rare species. This extinction can happen in two ways – through processes known as swamping and outbreeding depression. In swamping, the population of wild plants is continually exposed to the crop, and hybrids are continually forming. If the hybrids are viable and continue to mate with the wild relative, eventually the genetic integrity of the wild relative is swamped by the continual influx of genes from the cultivated plant. Small populations and rare species can be lost. The second process is known as outbreeding depression, where there is detrimental gene flow, resulting in offspring that are less fit. Eventually the population disappears. According to Ellstrand et al. (1999), "both phenomena can lead to extinction rapidly."

Most of the small populations of wild teosintes are already under serious threat. Contamination from an escaped transgene could push them over the edge.

GE maize poses broader ecological threats as well

Most probably, the contaminating gene found in Mexican landraces is a form of the Bt gene, which produces a pesticide toxic to many species of lepidopteran insects. There has been a huge controversy in the United States and other countries over the use of Bt genes primarily because of the potential ecological impacts associated with plants producing the pesticide. These impacts include harm to non-target organisms, including species such as the monarch butterfly and the green lacewing, a beneficial predatory insect; and impacts on soil biota through discharge of Bt from maize roots.

The diverse ecological risks associated with Bt maize are troubling if one considers that the contamination of maize landraces could be long lasting. As noted above, the gene will almost certainly transfer to the landraces it contaminates; farmers and natural selection forces will help to maintain populations containing the gene. If the gene becomes widespread in landrace populations, as it appears to be currently, the ecological damage will be impossible to prevent or mitigate.

Greenpeace believes that the only way ahead is for the Mexican government to implement an emergency plan that should include the following steps:

- Undertake immediately a rapid assessment of the scope and magnitude of the contamination in Mexico and the GE varieties involved.
- Determine the source of the contamination.
- Declare an immediate halt to the importation of GE maize.
- Develop and implement immediately a de-contamination plan.
- Establish quickly national legislation and regulations to guarantee that this contamination will not occur again.
- Investigate the legal responsibilities of the governmental authorities that allowed the contamination to take place.
- File legal action on behalf of the affected communities against the companies responsible for production and dissemination of GE maize.

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In Mexico, teosinte, the closest wild relative of cultivated maize, is found growing from Chihuahua to Oaxaca. In addition to teosinte, a large store of maize diversity exists in the multitude of landraces – local cultivated varieties – grown throughout Mexico and other maize growing countries in Central and South America. In Mexico, the thousands of landraces of maize are called criollo maize.

The many varieties have different growing characteristics suited for changing climate conditions. In Chihuahua, Mexico, the fast growing variety Apachito is planted when the rains are delayed. Coloured varieties correlate with varying maturation periods. Blue and red pigments in maize stalks help maize varieties warm up quickly on cool mornings. This makes them especially suitable to be planted earlier in the year. A fast maturing variety in Colombia was given the name matahambre, which translates as 'hunger killer'.

Many small farmers depend on maize for food and money. Photo: Bert Lof