Chapter 7

Assessment of Human Health Effects

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Abstract

This chapter deals with the nutritional implications of gene flow from transgenic varieties in Mexico. Nutrition is more than food and food is more than nutrients; food provides intellectual, emotional, esthetic and socio-cultural satisfactions that are indispensable for a full and enjoyable life. Thus, nutrition is a very complex bio-psycho-social phenomenon.

Between maize and Mexicans there is an intimate emotional, intellectual, ceremonial, religious, artistic, nutritional and cultural relationship established through 5000 years. Mesoamericans domesticated maize and diversified it genetically; Mexico is considered a site of origin and genetic diversity of maize and Mexicans consider it one of the most appreciated achievements of their civilization.

Besides this unique cultural value for Mexicans, which may not be easily understood by other cultures, maize is the main agricultural product in the country, the base of hundreds of dishes and the nutritional center of the Mexican diet. It is so familiar for Mexicans that they blindly believe in it as a totally harmless food. Conditions are totally different in Canada and the United States where maize is mainly directed to animal feeding and enters the human diet as highly refined ingredients.

Transgenic technology, as all technologies, should be used ethically, responsibly and with extreme care, for good reasons, and avoiding unnecessary risks. In this respect, so far, no harmful effect has been observed with first generation transgenic maize varieties, although there is a remarkable scarcity of published reports of experimental studies, especially in the conditions of Mexico. On the other hand, the benefits of first generation transgenic maize for the poor *campesinos* in Mexico are not clear. In addition, for some proteins such as the pesticidal proteins from *Bacillus thuringiensis* (Bt), there is little information of prolonged human exposure; thus the question of their allergenicity has arisen. Although novel proteins in these first-generation varieties as major food allergens are unlikely—in that they are screened to exclude those molecules with properties of known food allergens—they are also expressed at very low levels, generally much lower than that of most major food allergens. However, more definitive criteria are required and certainly such assessments should and will improve as our knowledge of food allergens increases.

Up to now it seems that the allergen assessment of novel proteins appear to be working reasonably well. However there is no experience regarding the possibility to produce novel proteins due to introgression in landraces where seeds are kept from one season to the next. The total effect of this introgression is not entirely clear. As an example of one health-effect concern, the assessment of potential allergenicity of genetically modified crops, as

well as the studies of corn allergens, has been reviewed. The evidence to date suggests that corn does not appear to be a major food allergen in different parts of the developed world where it has been investigated.

The second generation of transgenic maize with compositional changes is a useful alternative for some groups but is far from being a need because similar results may often be achieved with regular foods. Maize is increasingly being used essentially as a factory to produce proteins for nonfood uses, such as industrial oils, pharmaceutical proteins and human proteins for treatment of different diseases. As gene flow occurs to the landraces present throughout Mexico, the possibility of hybridization between crops engineered to produce certain nonfood molecules, which may be toxic, is of a great concern.

Therefore, the use of transgenic maize in Mexico, being an open-pollinated variety, is highly controversial since there is a great deal of studies that need to be conducted about the possible side effects in plants that inherit transgenes season after season.

The so-called third generation of transgenic maize varieties oriented toward industrial production are potentially risky if they contaminate Mexican hybrids since maize is massively consumed as such by most Mexicans and especially by the poorest sectors and by Indian communities that are particularly unaware of the possible risk. Furthermore, there are other unresolved issues regarding possible unexpected effects on human and animal health due to genetic modifications of maize that require much study.

If the goal is to improve Mexican nutrition, the introduction of transgenic maize won't solve the problem since nutrition is best improved by diversifying food sources. While we should neither inhibit research nor limit human creativity related to the use of transgenic maize, it should not be used prematurely in a way that may harm people and affect the credibility and prestige of biotechnology.