Concept of benefits and risks

What are the benefits?

The population of the world is expected to increase by two billion over the next 25 years, mostly in developing countries. Global food production must increase considerably to feed all these people, but there is little, if any, new land that can be used for agriculture. On the contrary, arable land decreases constantly as a consequence of environmental degradation and urbanization. Most of the additional demand must therefore be met by increasing crop productivity.

Agriculture in developing countries is generally characterized by low yields, especially in poor and underdeveloped areas. To improve it requires an integrated approach. Rather than use more chemical inputs in agriculture, we need to develop improved crop management practices and technologies, including improved varieties, that will enable farmers to maintain crop production, while at the same time protecting the environment.

Biotechnology can and should contribute to this effort by improving the production and multiplication of healthy planting material; by improving genetic makeup of crop plants to sustain adverse environmental conditions; and by providing new vehicle for the production and consumption of improvement dietary food. Some of the benefits accruing from applying genetic engineering techniques will be:

- Crops requiring low (or no) chemical inputs (pesticide and fertilizer reduction)
- Crops with resistance to pests and diseases (insect, viruses, fungi and bacteria)
- Crops with resistance to adverse environmental conditions (drought, salinity, acid soil, etc)
- Crops with higher nutritional value (enriched in vitamins and in other beneficial micronutrients)
- Crops with lower levels of natural toxins or allergens
- Crops containing novel useful compounds, such as edible vaccines, or biodegradable plastics
- Crops with improved processing qualities, requiring less energy or producing less chemical waste

But if agriculture in developing countries is to benefit from this technology, it must be applied in such a way as to meet also the particular needs of resource-poor farmers. The technology, often perceived as corporate and profit-driven, can be need-driven provided it is developed by local agricultural research institutions in collaboration with International Agricultural Research Centers and oversea development agencies.

What are the risks?

1. Hypothetical risks

A risk is a real event known to occur at a certain frequency and with known adverse effects. In conventional risk analysis, the risk(s) associated with a particular event can be measured by quantifying both the exposure to the event and the impact of that event. However, the debate over GE crops has tended to confound various types of risks, to the extent that conventional risk analysis is cumbersome. The public, the press, the opponents, confound three types of risks:

2. Perceived risks

These are risks characterized by the absence of scientific evidence that it will not occur. Common examples in transgenic technology are the side effect(s) of a transgene on other genes or gene products and the unknown long-term effect(s) on anything ranging from the host plant to the consumer. Due to the nature of these events, they cannot be tested for frequency of occurrence and adverse effect. Most of these events are simply inherent to any new technology and because they cannot be quantified, they cannot be assessed. It is therefore impossible to include them in any standard regulatory procedure.

3. Identifiable risks
These are the type of risks that strictly meet the genuine definition of a risk. These have been learned from conventional breeding techniques. There are identifiable risks associated with the development of new varieties. Possible events resulting from such developments might include toxicity of new gene product or by-product, allergenic nature of the new gene product, development of higher environmental fitness (weediness and invasiveness), negative impacts on non-target organisms, and cause of rapid development of new pest and pathogen strains. Such risks should always be assessed on a case-by-case basis as it has now been recognized by all regulatory agencies worldwide. Scientific assessment of risks derived from the development of GE crops should take into account several generally accepted principles that will help in formulating recommendations for additional safety research or application of biosafety measures.

A. The familiarity principle states that the more familiar a technology is to us, the more comfortable we are with it. It is in reality just the positive view of the precautionary principle. This familiarity principle has been long recognized as a guiding principle for evaluating the risks associated with GE crops. It is actually already a regulatory principle in the US system known as the generally recognized as safe (GRAS) principle which is based on the long history of the use of new substances in food. The GRAS principle is used routinely by the US Food and Drug Administration to determine whether a substance needs additional risk assessment.

B. The substantial equivalence principle, established by the Organization for Economic Cooperation and Development (OECD) in 1993, is widely used to determine whether a new substance needs additional risk assessment, based on whether the new substance is substantially equivalent to a known substance for which safety measures have already been established. Such principle draw the attention on what is essential for the regulatory body, the product and not the process how and by whom the product was made. The current safety assessment and regulatory systems in developing countries need to be adapted to this new array of products using non-discriminatory principles. Whatever is regarded as an unacceptable or acceptable level of risk for a conventionally bred variety should apply equally to a new transgenic variety.