OPINION

# Biotechnology and sustainable agriculture

During the past decades dramatic changes have occurred in rural environments all over the world. The availability of abundant capital, cheap energy, and technological innovation have fueled an unprecedented agricultural growth worldwide. This growth, however, has occurred at a considerable cost of resource depletion and environmental degradation, far outweighing the economic benefits of increased yields. Although the perception that agricultural development has had negative impacts on the quality of life is not new, this concern is slowly permeating mainstream official institutions. Many have begun to raise serious questions regarding the sustainability of global agriculture. For example, a number of task forces, committees and conferences have been organized by several foundations, land-grant universities, and other government institutions to evaluate the complex questions surrounding the interaction between environmental protection and the economic agricultural development process.

Regrettably, scientists who have pioneered in developing ideas and research on alternative agricultural technologies have been purposely or inadvertently excluded from these task forces. Some of these scientists have operated outside of, and in spite of, established national and international institutions that supposedly are responsible for dealing with these matters. This creates a potential for misunderstanding the concept of sustainability and its application in rural development. Almost invariably, official reports identify biotechnology as the crucial scientific branch offering the most promising tools for a more sustainable agriculture. In most cases this biotechnology aims at maximizing profits through yield maximization. The biotechnological approach relies on high energy inputs and large areas under monoculture. The belief that this approach is the way to achieve sustainability can be quite misleading and contradictory, mainly because sustainable agriculture is supposed to be based on resource-conserving and low-cost farming practices that offer stable economic viability, not necessarily large profits. Obviously, this is inconsistent with the interests of private companies, which are unlikely to invest in biotechnology innovations for which the market is not promising. The tendency of most companies is to emphasize seed-chemical "packages," exemplified by biotechnologies that tailor crops to specific inputs, such as herbicide-resistant crops. Such a strategy makes farmers automatically dependent on the chemicals needed to grow the seeds. When farmers lose their autonomy, their production systems become governed by distant institutions and markets over which farmers and rural communities have little control. Loss of production control and increased dependence on external inputs are the roots of an unhealthy and unsustainable agriculture.

The development of agriculture in the Third World, as promoted by the network of International Agricultural Research Centers, focuses on biotechnology. It is reasonable to expect that biotechnologies promoted in debt-burdened developing countries will not be the ones best suited to local ecological and economic environments, but rather those most attractive to the large markets of the industrial countries. Inevitably, progress derived from the application of biotechnologies will not be distributed evenly. Resource-poor farmers confined to marginal, rainfed lands will probably be bypassed, whereas farmers with access to credit, irrigation and markets will benefit disproportionately.

In the industrial countries there has been increased public scrutiny of biotechnology, leading to regulations to protect the people from possible environmental and health problems, as in the case of release of genetically engineered organisms. This might lead transnational companies to manufacture and market their banned products in the Third World (as has already been done with some highly toxic pesticides). This takes advantage of the slowness and inefficiency, and at times the corruption, of local bureaucracies that are supposed to enforce safety.

The development and promotion of appropriate biotechnology must involve a flow between developing and industrial countries, as opposed to the typical one-way "technology transfer." So far, the way this "cooperation" actually works, for example "between those who have the talent and technology and those with the necessary germplasm," is not as mutually beneficial as it may sound. In fact, industrial countries are now benefiting much more, because the progress of biotechnology depends on the availability of crop genetic diversity still preserved in many traditional agroecosystems in the Third World. To have true cooperation and a just exchange, plant breeders from industrial countries can no longer be granted free access to vital native germplasm in the Third World that they later develop into new commercial varieties that are sold back to the Third World at considerable profit.

Although it is commendable that mainstream institutions are beginning to acknowledge the importance of agricultural sustainability, extreme caution should be taken in assuming that biotechnology is the only scientific trajectory available to achieve it. Some of the contradictions and unacceptable costs of neglecting other more ecological approaches have already been experienced in the era of chemical pesticides.

Environmental preservation can become overshadowed by the institutionalized goal of increased production, which maintains the preeminence of American agriculture. The capacity of such agriculture to expand depends on lowering costs of production by mechanical and chemical technologies that exploit economies of scale. As long as these views prevail, agricultural research, including the new biotechnology products, will tend to benefit those individuals with ready capital to invest, that is, large farmers and agribusiness. Meanwhile the general public will apparently have few ways in which to hold public research institutions accountable for assistance to family organic farmers, who are the primary candidates for a truly sustainable agriculture.

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