AGRICULTURAL DEVELOPMENT

'Twixt cup and lip—biotechnology and resource-poor farmers

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Although there seems no doubt that transgenic crops will find many applications in developing countries, their potential contribution to poverty reduction is not well understood. Many observers have correctly pointed to biotechnology's capacity for offering productivity gains to meet increasing food demand. What they discuss less frequently, however, are the challenges in allowing those gains to be realized by resource-poor farmers.

One of the most frequent points of comparison is the Green Revolution. It led to the widespread adoption of productive new varieties, but the impact was greatest in relatively favored environments, where markets were well established and inputs were available. Transgenic crops could circumvent such requirements. Engineered resistance to pests and disease could eliminate the need for expensive chemicals; changes in crop physiology could address limitations of poor soils or climate; nutritional enhancement can address dietary deficiencies caused by inadequate crop production. Transgenic crops could deliver benefits to resource-poor farmers within the seed. But real value will only accrue to such farmers if a number of largely nontechnical barriers can be overcome.

At least two infrastructural problems may significantly limit the poverty relevance of transgenic crops.

If biotechnology is to be directed toward poverty reduction, then public biotechnology research will have to address crops and areas that are unattractive to the private sector. Such research requires a significant investment of public resources. There is a natural tendency to direct such investments toward areas with high expected returns or where political pressure on the research system is most effective. The poorest farmers are usually without much political influence. In endeavoring to fulfill an intention to develop "pro-poor" technology, the significant countervailing forces against targeting marginalized farmers, especially by underfunded public research systems, need to be acknowledged and addressed.

A second infrastructural barrier is the seed industry in many developing countries. In many instances, liberalization has brought an end to inefficient public seed production without providing the incentives for an adequate private sector replacement. Where a commercial seed industry is in place this offers an obvious pathway, but many farmers (such as those in most of sub-Saharan Africa) do not have access to such markets. Even where a commercial seed industry exists, its ability to serve resource-poor farmers depends on responsible and well-informed input retailers and some degree of consumer awareness. In the case of publicly developed varieties, there may be additional options for seed distribution including government-sponsored multiplication and distribution (relying on subsequent farmer-to-farmer diffusion), or small-scale seed projects. However, the larger programs may entail considerable expense, and the experience to date with small seed projects has not been encouraging.

There is a third factor, too: the adequacy of farmers' access to information about production problems and alternatives. This challenge is certainly not confined to biotechnology. However, the nature of many transgenic varieties exacerbates it.

Briefly, the problem is this. Many modern varieties, including those of the Green Revolution, rapidly diffuse to farmers. Such varieties often succeed because they offer radically different and easily distinguishable characteristics. Farmers learn about the management requirements of new varieties and their advantages and disadvantages, often through trial and error. They build a body of knowledge that guides them in choosing particular varieties to suit particular circumstances, and then managing them appropriately. However, in many areas where modern varieties are widely grown it is not uncommon to find that farmers are uncertain about the identities of "second-generation" modern varieties (many of which offer precisely the disease or pest resistance envisioned for transgenic varieties). This identity confusion erodes the value of the associated knowledge, and it is directly relevant for the prospects of biotechnology.

The precision of genetic engineering, avoiding the trade-offs characteristic of conventional plant breeding by providing, for instance, disease resistance without any other changes in a variety's appearance or performance, is a double-edged sword. If a new transgenic variety is not immediately distinguishable from conventional varieties, what are the chances that farmers will recognize and demand it? The answer in this case depends on the distribution and severity of the particular disease, but farmers may not be able to draw causal inferences from the variety's performance in fields where many other yield-limiting factors are probably in evidence.

Nutritionally enhanced transgenic crops may be similarly difficult to recognize. Even in cases of severe nutritional deficiency, farmers are unlikely to make a connection between the consumption of a particular variety and health status. If the new variety cannot be easily identified, then accompanying nutrition education is necessary to help farmers (and other consumers) recognize the appropriate variety and use it properly.

In those cases where a nutritionally superior variety can be recognized (as in the case of yellow, vitamin A-enriched rice), there may be the problem that the variety is seen as a low-status product, aimed at the poor. (For instance, any campaign to convince people who grow and consume white maize to switch to more nutritious yellow varieties would face tremendous opposition.)

There are thus several factors that suggest caution in making predictions about the poverty impact of transgenic crops. My purpose here is not to be unduly pessimistic, but to ask researchers to be realistic in their approach to biotechnology's potential contribution to agricultural development and poverty reduction. Biotechnology will only be effective if it is part of a package of broader changes that include the provision of adequate information and the development of seed delivery systems. First, public agricultural research must be better supported. Investments in biotechnology laboratories, without concomitant attention to developing researchers' capacities to interact with farmers, will be ineffective. Second, a clearer division of labor and better collaboration between public and private research is in order. Third, policies must be in place to strengthen the agricultural sector, to support a domestic seed industry and to develop adequate markets.

These tasks are the responsibility of national governments, donor agencies, and private industry (which must contribute more to poverty reduction). They require a long-term commitment to building the institutions that support a productive and equitable agriculture. ///

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