RESEARCH AT A GLANCE

Biotechnology and Genetic Resource Policies

What Is a Genebank Worth?

Brief 9

The Marginal Value of an Accession

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Ascribing productivity gains to specific genes or accessions is difficult because of the nature of the research process in genetic enhancement, the relationship among genes within a genome, and the interaction of genes with the environment of the crop. Even in commercialized agriculture, the value of unimproved material used for genetic enhancement cannot be measured directly because only finished (or nearly finished) crop varieties are traded in markets (Brief 7).

What is the expected benefit from using an additional, unimproved genebank accession in crop breeding? Typically, plant breeders can deduce little about what these accessions have to offer from the existing data describing them. This study answers this question by combining search theory with a maximum entropy approach, which is particularly suitable for analysis with sparse data. The study estimates the marginal value of utilizing prebreeding materials contained in the U.S. National Plant Germplasm System. Data were drawn from trials to screen 573 recently acquired accessions that test for susceptibility to soybean cyst nematode. The present discounted value of benefit streams in the United States was estimated with areas planted to soybean and its prices.

The present value of the expected gross research benefits is estimated at about $36,000 to $61,000, which implies that the benefit-cost ratio for investing in an additional accession to prevent losses from a single pest is in the range of 36 to 61. The size of benefits is sensitive to changes in area planted to the crop and to the discount rate because of the time lag between investment in the research and the stream of earnings. The magnitude is also affected by the economic value of the crop, the severity of damage caused by the disease, and the likelihood of future outbreaks requiring a new search.

The findings of this study indicate that the lower-bound benefits from utilizing a marginal accession are higher than the upper-bound costs of acquiring and conserving it, justifying the expansion of the U.S. soybean collection. The calculation of the upper-bound costs were based on the costs of screening, the collection costs estimated by the U.S. Plant Introduction Office, and the costs of conserving more expensive crops (Pardey et al. 2001). It should be noted that the estimated benefit reflects the search for a single trait, although any single accession has the potential to be searched for more than one trait. The option value of the accession and other non-use benefits were omitted, as in the cases reported by Evenson and Gollin (1997) and Gollin, Smale, and Skovmand (2000, Brief 8).

How can such a favorable economic return exist in economic equilibrium? Explanations are related to the public-good nature of genetic resources. Even in the publicly funded collection of a rich country, the budget constraint is severe, and much of the budget is consumed as fixed costs with little left over for screening. What about private interests? Despite the fact that private firms are the dominant provider of soybean varieties in some countries, they invest little in the screening and incorporation of

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unimproved genetic resources because incorporating genes from these sources is a long-term, risky prospect. Finally, the benefits reported here include total benefits to both consumers and producers. In fact, suppliers of soybean seed are likely to be able to appropriate less than half of the total benefits through sales (Falck-Zepeda, Traxler, and Nelson 2000).

References

Evenson, R.E., and D. Gollin. 1997. Genetic resources, international organizations, and improvement in rice varieties. *Economic Development and Cultural Change* 45 (3): 417–500.

Falck-Zepeda, J.B., G. Traxler, and R.G. Nelson. 2000. Surplus distribution from the introduction of a biotechnology innovation. *American Journal of Agricultural Economics* 82: 360–69.

Gollin, D., M. Smale, and B. Skovmand. 2000. Searching an *ex situ* collection of wheat genetic resources. *American Journal of Agricultural Economics* 82 (4): 812–27.

Pardey, P.G., B. Koo, B.D. Wright, M.E. Van Dusen, B. Skovmand, and S. Taba. 2001. Costing the conservation of genetic resources: CIMMYT's *ex situ* maize and wheat collection. *Crop Science* 41:1286–99.

For a more detailed version of this summary, see the following:

Zohrabian, A., G. Traxler, S. Caudill, and M. Smale. 2003.Valuing pre-commercial genetic resources: A maximum entropy approach. *American Journal of Agricultural Economics* 85 (2): 430–37.

Zohrabian, A. 2000. Valuing crop genetic resources: The case of the U.S. soybean collection and soybean cyst nematode. Ph.D. diss., Auburn University.

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This work was made possible in part by support from the Swedish International Development Agency (SIDA), System-wide Genetic Resources Program of the CGIAR, European Commission, and the U. S. Agency for International Development (USAID).

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