

# Plenary Address: Alleviating Global Hunger and Rural Poverty—Challenges and Opportunities

Speaker:

**Gary Toenniessen**  
The Rockefeller Foundation  
New York, New York

Reporter:

**Mary Donnelly**  
*The Journal of Experimental Medicine*  
New York, New York

More than a billion people subsist on less than a dollar a day, mostly in rural Asia and Africa. As Gary Toenniessen, director of food security for the Rockefeller Foundation, noted, for the world's poorest people "the root cause of poverty is low crop productivity and lack of income from small-scale farming." The answer to global poverty, he believes, lies in agricultural technology and innovation that increases production in marginal land areas. However, battling poverty on the two continents requires different approaches.

In the 1960s, Asia benefited from the Green Revolution, an agricultural-development program sponsored by the Rockefeller Foundation and other organizations that increased crop yields through improved strains (high-yielding varieties), irrigation, chemical fertilizers, and other innovations. Green Revolution technologies benefited farmers, laborers, seed and fertilizer providers, cereal processors, consumers, and the economy as a whole. As Toenniessen said, "Without the Green Revolution, you wouldn't see China or India having the economic growth they do today."

In Asia, conventional plant and agricultural programs already exist. Biotechnology should build on them to help those who didn't benefit—mainly those with rain-fed

farms growing lower-yielding but drought-tolerant traditional crops. Those farmers would profit from modern breeding techniques to produce new drought-tolerant varieties that give high yields with good rainfall.

Africa, however, was not part of the Green Revolution. Farmers' basic needs are the same (increased productivity and greater economic return), but their situation requires a more comprehensive program. The continent suffers from a lack of irrigation and a desperate need for fertilizer. In contrast with Asia, Africa has no dominant crop like rice. The farmers themselves must be involved in "an agroecology-based breeding program tailored to regional crops and niche breeding".

Biotechnology can help breed for tough traits, such as drought and pest resistance, that limit yield losses. One example is the "strigaway" seed—a type of maize resistant to an herbicide used to control the parasitic plant "Striga". With labor becoming increasingly scarce in Africa because of the HIV/AIDS epidemic, innovations like this that reduce weeding are especially valuable. This labor-saving advancement also allows for no-till farming, which helps prevent the erosion of nutrients from the soil.

Despite agricultural improvements, poor roads in many rural areas—for which Toenniessen believes donors need to concentrate more funding—make input (seeds and fertilizer) and output (cereal) distribution difficult. Large seed companies don't do niche breeding, so seed production must go through local companies.

As in Asia, African farmers won't care about increasing crop yield if it doesn't result in increased income. "There is very little subsistence farming nowadays, so

farmers are interested not just in increasing productivity but in converting that increase to profit." Cell-phone access to market information and cereal banks that allow for bulk storage until prices go up will both result in increased profit.

Bioengineered crops have the potential to increase nutritional quality. Despite supplementation programs, life-threatening vitamin deficiency is still rife in remote rural communities. As one of the original architects of the Rockefeller Foundation Rice Biotechnology Research Program, Toenniessen helped to develop Golden Rice, a  $\beta$ -carotene-fortified variety that combats vitamin A deficiency. He and his health colleagues at the foundation are now promoting production of soybeans—a nutritious crop that adds much-needed nitrogen to the soil—and, in Uganda, fortification of matoke, a regional banana with low nutrient yield.

Infectious disease is another major concern in Africa. HIV/AIDS affects not just the number of laborers but also researchers, and increased training is vital. Traditional scourges, such as malaria, may be spread more easily by some crops; crops and agronomic practices that attract fewer mosquitoes are needed.

Toenniessen concluded by emphasizing the need to involve the people most affected. Although public research programs can build on progress made by the Green Revolution in Asia or institute more comprehensive plant-breeding programs in Africa, "Africa's problems are only going to be solved by Africans . . . [and this is] certainly true in the case of Asia as well." 