# Harvard development expert: Agricultural innovation offers only path to feed Africa and the world

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Juma's influential 2011 book, "The New Harvest," said Africa could feed itself within a generation, outlining ways to transform agriculture and its economy in the process. Credit: Eva Siegel, Harvard Kennedy School Belfer Center for Science and International Affairs

The world can only meet its future food needs through innovation,

including the use of agricultural biotechnology, a Harvard development specialist said today.

Since their commercial debut in the mid-1990s, genetically-designed crops have added about $100 billion to world crop output, avoided massive pesticide use and greenhouse gas emissions, spared vast tracts of land and fed millions of additional people worldwide, said Professor Calestous Juma of the Harvard Kennedy School's Belfer Center for Science and International Affairs.

Speaking to graduates of McGill University, Montreal, Juma asked youth to embrace innovative sciences that alone will make it possible to feed the billions who will swell world population in decades ahead, especially in developing countries.

And he described the importance of developing more productive or nutritious and insect-resistant crops.

"As the world's food challenges increase, so must humanity enlarge its toolbox to include genetic modification and other technologies such as satellites for monitoring land resources," Juma said. "But these techniques are not silver bullets. They must be part of a wider system of innovation that includes improving interactions between academia, government, business and farmers."

From 1996 to 2011, he said, transgenic crops "saved nearly 473 million kg (1 billion pounds) of active pesticide ingredients. It also reduced 23.1 billion kg (51 billion pounds) of carbon dioxide, the equivalent of taking 10.2 million cars off the road. Without transgenic crops, the world would have needed another 108.7 million hectares of land (420,000 square miles—roughly the area of Ethiopia) for the same level of output," he said.

"The benefits to biological diversity from the technology have therefore been invaluable. On the economic front, nearly 15 million farmers and their families, estimated at 50 million people, have benefited from the adoption of transgenic crops."

However, of the 28 countries today growing transgenic crops, only four (South Africa, Burkina Faso, Egypt, and Sudan) are in Africa, said Juma, a national of Kenya who is professor of the practice of international development and director of the Kennedy School's Science, Technology and Globalization Project.

Cited as examples of important transgenic plant science innovations in Africa to date:

- A moth-like insect, *Maruca vitrata*, destroys nearly US$300 million worth of black-eyed pea crops every year, despite the annual use of US$500 million in imported pesticides. Not only are the hearty, drought-resistant black-eyed peas important in local diets, they're a major export—Africa grows 96% of the 5.4 million tons consumed worldwide each year.
- Scientists at Nigeria's Ahmadu Bello University have developed a transgenic black-eyed pea variety using insecticide genes from a bacteria, *Bacillus thuringiensis*.
- In Uganda, meanwhile, scientists are deploying biotechnology against the problem of *Xanthomonas* wilt, a bacterial disease that ruins bananas and costs Africa's Great Lakes Region an estimated US$500 million annually, largely in Uganda.Using genes from a species of sweet pepper, Ugandan researchers are developing a transgenic banana that resists the disease.
- Other scientists in Uganda have developed Golden Bananas that offer enhanced content of Vitamin A, important for growth and development, a healthy immune system and vision.
- Kenyan scientists, meanwhile, are also enhancing the

micronutrient content of bananas as well as two other staples—sorghum and cassava.

"The techniques mastered in these proof-of-concept states can be extended to a wide range of indigenous African crops," said Juma. "This would not only help Africa broaden its food base using improved indigenous crops, but it would have the potential to contribute to global nutritional requirements."

Delays in subjecting these products for testing and approval for commercial use is due in part to "technological intolerance," he said, "much of which has been handed down by European anti-biotechnology activism. This opposition, however vexatious, amounts to petty political mischief."

Juma cited the 1878 essay by Robert Louis Stevenson, A Plea for Gas Lamps, in which the author of The Strange Case of Dr Jekyll and Mr Hyde demonized electricity, saying that the "urban star now shines out nightly, horrible, unearthly, obnoxious to the human eye; a lamp for a nightmare! Such a light as this should shine only on murders and public crime or along the corridors of lunatic asylums, a horror to heighten horror."

The same sort of misguided opposition today confronts biotechnology, Juma said.

Today, "given the growing human population, the problem is to feed people. However, opposition to new technologies may cast a dark shadow over the prospects of feeding the world."

Citing Africa's weak systems of agricultural innovation are characterized by separation of research, teaching, extension, and commercialization, Juma called for:

- Greater research functions at agricultural universities and strengthened linkages to farming communities; and
- National agricultural research institutions (NARIs) to teach the full value chains of specific commodities. "Connecting NARIs to farmers in the private sector through extension services and commercialization projects would result in agricultural entrepreneurship."

In 2011, Juma published an influential book, The New Harvest in which he proposes a route by which Africa could feed itself within a generation—a clear prescription for transforming Sub-Saharan Africa's agriculture and, by doing so, its economy.

The strategy calls on governments to make African agricultural expansion central to decision making about infrastructure (energy, transportation, irrigation and telecommunications), technical education, entrepreneurship and regional economic integration.

Provided by Harvard University

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