Building on Successes in African Agriculture

Maize Breeding in East and Southern Africa, 1900–2000

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During the first half of the 20th century, African farmers transformed maize from a minor imported foodcrop into the continent's principal staple food. In the second half of the century, newly independent governments launched support programs that greatly expanded smallholder production, leading to substantial production surges of 10 to 20 years in duration. Today, after widespread adoption by both commercial farmers and smallholders, farmers now plant 58 percent of all maize area in East and Southern Africa to new high-yielding varieties, which on average outyield traditional varieties by 40–50 percent even without fertilizer.

The sustained domestic breeding programs that underpin this transformation represent impressive technical and political commitments. In 1960 Zimbabwe (then Southern Rhodesia) released its famous SR-52, the first commercially grown single-cross maize hybrid in the world.

Though these maize-breeding efforts were an undeniable technical success, broader efforts to support national production growth proved fiscally unsustainable, and once heavy subsidies were withdrawn, production fell (see table). This qualified success story reveals important lessons about both the strengths and pitfalls of past agricultural development efforts in Africa.

DRIVERS OF CHANGE

• ***Commercial farmer lobby.*** During the 1920s and 1930s settler commercial farmers in Kenya, Zimbabwe, and Zambia successfully lobbied colonial legislatures for government assistance and protection from both world markets and smallholder competitors. Catalyzed by slumping world agricultural markets during the worldwide depression of the 1930s, the colonial governments created parastatal crop-buying stations in European farming areas, offering prices that were typically far above export parity prices. These crop-buying stations and associated price supports were not scaled up to serve smallholder farmers until the post-independence years. In addition, at the urging of the commercial maize farmers, governments established publicly funded maize research programs in 1932 in Zimbabwe and in 1955 in Kenya.

• ***Breeding breakthroughs by national research programs.*** Investments by colonial governments in maize research radically transformed opportunities for maize farmers in Kenya and Zimbabwe. Zimbabwe's maize breeding program, initiated in 1932, was the first outside of the United States to produce double-cross hybrids for commercial use, releasing Southern Rhodesia-1 (SR-1) in 1949. During the 1960s both the Kenyan and Zimbabwean breeding programs launched a stream of highly productive conventional and nonconventional hybrids that fueled steady yield and output gains. From the mid-1970s the Zambian program released an array of hybrids and improved open-pollinated varieties. Some of these, along with the leading hybrids released in Malawi in the early 1990s, were relatively well suited to production by smallholders who process and consume their grain on farm and replant saved seeds.

• ***Collateral support for smallholders.*** At independence, governments in the region expanded the input and marketing support institutions to serve smallholders as well. The expansion of state marketing infrastructure in smallholder areas allowed state agencies to disburse subsidized inputs on credit to smallholders and to recoup loans through farmer sales to the marketing boards. In addition to these direct subsidies, an expanded network of cooperative marketing depots reduced the transport costs that farmers incurred in selling maize in remote areas. Pan-territorial pricing brought smallholders in remote areas into production for the state and shifted production patterns toward maize self-sufficiency at the expense of other crops. At the same time most governments subsidized the retail price of industrial maize meal to consumers, thereby raising the demand for domestic production under a policy of maize self-sufficiency. These systems were not effective, however, in recouping credit. By 1990, for instance, 80 percent of Zimbabwe's smallholder farmers receiving maize inputs on loan were in arrears. Inability to recoup loan losses contributed to the financial drain on the state marketing systems that later exposed them to pressure for reform.

WHY DID THE PRODUCTION SURGES STALL?

• ***Unsustainable financial subsidies withdrawn.*** State subsidies on inputs, producer prices, and consumer prices, combined with limited recovery of input loans, exacerbated fiscal crises in Kenya, Malawi, Zambia, and Zimbabwe. Because governments could not afford to sustain these operations indefinitely, they were forced to scale down their public support and subsidy levels during the 1990s. As input costs rose and state buying stations were withdrawn, farmer incentives collapsed and production fell, particularly in the more remote areas.

• ***National research systems atrophy.*** Public funding for maize research fell in the 1980s and 1990s. The scientific and institutional cooperation that created the maize success story of earlier decades collapsed as governments prioritized other expenditures. The number of new variety releases stalled, as funding dried up and key personnel vacated the research systems.

• ***Drought, poverty, and erratic crisis management policies.*** Spotty rainfall in the 1990s contributed to erratic, crisis-motivated food and agricultural management policies, including greater reliance on food aid and a patchwork of often poorly coordinated operations by nongovernmental organizations (NGOs) and donors.

IMPACT

• ***Production.*** Today, farmers in East and Southern Africa plant 58 percent of maize area in improved varieties. A large part of the 40 percent yield gain currently experienced over local varieties can be attributed to improved hybrid cultivars, although extension messages, improved management practices, and the input and marketing subsidies fueling intensification of fertilizer use are also responsible for the yield gains.

• ***Equity.*** During the post-independence period of rapid smallholder production growth, nearly all small farmers in Zimbabwe used improved varieties, while 87 percent did so in Kenya, 65 percent in Zambia, and 43 percent in Malawi.

• ***Sustainability.*** The highly subsidized input supply and marketing systems proved financially unsustainable, accounting for as much as 5 percent of gross domestic product (GDP) in Kenya and Zambia. Following withdrawal of these subsidies, the artificially inflated production booms of the prior period led to output contractions of 10–20 percent in the cases of Kenya, Zambia, and Zimbabwe (see table). Ecologically, poor soil fertility management under continuous fertilized maize production has led to soil acidification, fertility loss, and plow and hoe pan buildup in some locations.

KEY LESSONS FOR BUILDING FUTURE SUCCESSES

• ***Sustained investments in agricultural research.*** Seed genetic change is a necessary but not a sufficient condition for improving the welfare of African smallholders. Maize successes in the future will continue to depend not only on strategic breeding improvements to relieve specific environmental and disease problems and enhance the stability of net returns to farmers, but also on enabling these advances to release land for alternative uses and diversify the income sources for farmers, regions, and nations. Continued development of improved seeds and seed markets and a realistic understanding of farmers' needs remain critical. Patience and the commitment to steady funding are crucial. Lead times for plant breeding average roughly a decade, while new livestock technologies may demand 15 to 20 years. Long-term commitment to agricultural research remains essential.

• ***Financially viable input and credit delivery systems for smallholders.*** In the past decade necessary investments in germplasm research have declined and investments in institutions that can translate germplasm advances into improved income, including seed and grain markets, have faltered. The public investments in state-controlled, coordinated input and output markets were not fiscally sustainable. In many instances, the cost of generating additional maize in remote areas exceeded the value of the output. The policy focus on maize also directed public resources to maize production in areas where farmers may have been better off with a different set of crop production and marketing investments. The current environment, however, is characterized by great policy instability. On the one hand there is ostensible commitment to a more market-oriented input and commodity pricing and distribution system. In Kenya, Malawi, Zambia, and Zimbabwe, however, the state retains a major presence in maize marketing and stockholding. Government programs distributing subsidized inputs in Malawi, Zambia, and Zimbabwe continue to cause uncertainty in input markets and limit the incentives for private actors to invest more aggressively. As a result, rural input and credit markets remain highly fragmented. In the future, governments and their partners must ensure policy stability and find financially sustainable models for delivering inputs and credit to smallholders.

• ***Political pressure and responsiveness.*** Can a local constituency be formed to successfully stake a claim on public resources over the long run to support agricultural research, marketing institutions, and other kinds of growth-promoting public goods? The experiences with maize in the four case study countries underscore the strong connection between agricultural development and governance. The early success of the maize industry in Kenya and Zimbabwe can be attributed largely to the strength of the institutions built by settler farmers, which provided a constituency to encourage sustained public and private support for the sector. Today farm lobbies are uniformly weaker and smallholder farmers continue to be poorly represented in the political process. A crucial issue is how the key growth- and equity-promoting investments in agricultural research, infrastructure, and market institutions can be financed. Perhaps most important, from where will the domestic political pressure for these public investments come? ■

Maize production growth (compound annual growth rates)

	BOOM PERIOD		PERIOD OF UNCERTAINTY	
COUNTRY	Years	Growth (%)	Years	Growth (%)
Kenya	1965–80	3.3	1990–2000	-1.5
Malawi	1983–93	3.1	1994–2000	4.4
Zambia	1970–89	1.9	1990–2000	-2.4
Zimbabwe	1980–89	1.8	1990–2000	-0.2

For further reading see M. Smale and T. S. Jayne, "Maize in Eastern and Southern Africa: Seeds of Success in Retrospect," Environment and Production Technology Division Discussion Paper No. 97 (Washington, DC: International Food Policy Research Institute, 2002); C. Eicher, "Zimbabwe's Maize-Based Green Revolution: Preconditions for Replication," *World Development* 23, no. 5 (1995): 805–818.

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