

FEATURES

During the past 45 years, the genetic improvement programs of IITA and its partners have made spectacular progress in developing high-yielding crop varieties that offered best-bet solutions to major production constraints, such as, cassava mosaic, maize streak, *Striga*, soybean rust, insect pests, and even drought. These have led to dramatic increases in the production of cassava, maize, soybean, cowpea, and yam in sub-Saharan Africa that have directly contributed to increases in food availability and indirectly to improvements in national economies. This section presents the status, progress, and achievements, and also outlines future work on crop improvement by genetic enhancement in IITA's six crops.

Maize genetic improvement for enhanced productivity gains in West and Central Africa

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Maize is an important food security and income-generating crop for millions of people in West and Central Africa (WCA). Maize breeding at IITA was initiated around 1970. Using as base materials two composites created from diverse sources in Nigeria under a West African project supported by the Scientific and Technical Research Committee of the

Organization for African Unity, breeders at IITA formed several broad-based populations and improved them through recurrent selection. The main research focus at that time was the development of open-pollinated maize varieties (OPVs) with resistance to diseases, and adapted to the humid forest and moist savannas of WCA. The products generated from this research were

channelled to research and development partners for further testing, multiplication, and dissemination in various countries in the subregion.

The widespread outbreak of the maize streak virus (MSV) disease in the late 1970s prompted IITA to develop two resistant populations. These were crossed to high-yielding

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and broad-based germplasm from the International Maize and Wheat Improvement Center, eastern and southern Africa, the temperate zone, central and south America, Thailand, DECALB, and other sources to create populations and varieties resistant to MSV. IITA has supplied MSV-resistant inbred lines, OPVs, hybrids, and populations to partners within and outside WCA through diverse delivery pathways for more than 25 years. Direct use of MSV-resistant maize germplasm that also had resistance to southern leaf rust, southern leaf blight, downy mildew, and leaf spot has been recorded in several countries in Africa.

The significant breakthrough in the development and release of high-yielding extra-early, early, intermediate, and late-maturing varieties with resistance to leaf rust, leaf blight, and leaf spot has caused a phenomenal increase in maize production in WCA, notably in Bénin, Burkina Faso, Cameroon, Chad, The Gambia, Guinea, Ghana, Mali, Nigeria, Senegal, and Togo. Further expansion in

production has also occurred in many countries in this subregion because of the adoption of extra-early maturing improved varieties identified from regional trials coordinated by the Semi-Arid Food Grain Research and Development (SAFGRAD) and the West and Central Africa Collaborative

Maize Research Network (WECAMAN).

The development of extra-early maturing varieties enabled production to expand into new areas, especially to the Sudan savannas where the short rainy season hitherto had precluded maize cultivation. The highest growth in maize area, yield, and



Maize streak virus disease causes severe stunting and extreme yield reduction in maize. Creating Maize streak virus-resistant varieties is one of the major successes of IITA's maize breeding program. Source: L. Kumar.

production in sub-Saharan Africa since 1961 occurred in WCA. These productivity gains, achieved through farmers' adoption of improved varieties in the 1980s, were driven by the suitability of the cultivars to the major production environments, the availability of inexpensive fertilizer and extension services, as well as favorable government policies that encouraged the use of these technologies.

In a recent impact assessment study conducted in nine countries, the number of varieties annually released in WCA had increased from fewer than one in 1970s to 12 in the late 1990s. The availability of such high-yielding and adapted varieties resulted in a 2% annual increase in land area planted to maize and a 3.5% annual increase in grain yield from 1971 to 2005. Among the varieties released from 1998 to 2005 in the nine

countries, 67% were derived from IITA's maize germplasm. Of the 4 million ha planted to improved maize in these countries, about 43% of the area was planted to varieties derived from IITA's germplasm. The joint IITA-NARS investment in maize research in the nine countries had lifted an average of 1.6 million people out of poverty annually from 1980 to 2004.

While working with diverse partners to promote the



IITA maize breeders in action, maize breeding program. Source: L. Kumar.

dissemination of maize varieties in the various countries, IITA realized that the major constraint to the adoption of improved varieties in WCA was the absence of an effective seed production and delivery system. To promote the establishment of indigenous private seed companies, IITA embarked on the development of hybrids in 1979 with financial support from the Federal Government of Nigeria and the active participation of Nigerian scientists. This led to the release of the first generation of hybrids in 1983, with a spill-over effect of the establishment of seed companies in Nigeria for marketing hybrid maize seeds. The official announcement of IITA's maize OPVs and hybrids in the catalogs of indigenous seed companies in Nigeria provide further evidence of the adoption, deployment, and commercialization of IITA-bred varieties and hybrids.

In recent years, IITA has also made significant progress in the development of a large number of maize inbred lines, OPVs and hybrids with resistance to *Striga*



Maize production in Saminaka area in Kaduna State, Nigeria. Photo by A. Menkir.

hermonthica, stem borers, and aflatoxin contamination, with tolerance for drought, efficient nitrogen use, and enhanced contents of lysine, tryptophan, and pro-vitamin A. We have the first generation of extra-early, early, intermediate, and late-maturing OPVs and hybrids that combine drought tolerance with resistance to *S. hermonthica* developed under the Drought Tolerant Maize for Africa Project and supplied to partners for testing through regional trials. The number of drought-tolerant OPVs identified from these trials and released for production since 2007 were 7 in Bénin Republic, 5 in Ghana, 3 in Mali, and 13 in Nigeria.

On the other hand, only one drought-tolerant hybrid selected in Mali and six drought-tolerant hybrids selected in Nigeria were released for production. Furthermore, three varieties with high lysine and tryptophan content, two varieties resistant to *S. hermonthica*, two varieties that are nitrogen use efficient, a stem borer-resistant variety, two yellow and two white hybrids were released from 2008 to 2011 in Nigeria.

To accelerate the release and commercialization of hybrids with different maturity classes, high yield potential, combining resistance to *Striga* and drought tolerance, and other

desirable traits in different countries in WCA, IITA has supplied parental lines of promising hybrids to private seed companies for further testing, production, and commercialization. The institute has also trained technical and management staff of seed companies to strengthen their human capacity to produce and market hybrid maize.

In addition, IITA has promoted community-based seed production schemes through its work with WECAMAN and more recently with diverse partners to make improved seeds

available to farmers in countries where the private sector is less developed and in areas with limited access to markets.

Despite the impressive strides that have been made so far, continued investment in maize productivity research still remains critical to sustain agricultural growth, food security, improved nutritional quality, and safe harvests. Considering the predominance of the crop in diverse farming systems, heterogeneous landscapes, and the diets of millions of people in WCA, enhanced yield gains

have the potential to further expand production in WCA, thus contributing to bridging the gap between food supply and demand in the region, because research has led to and will continue to deliver excellent results.

Increased investment not only in research but also in strengthening the private seed sector will still be needed to promote the rapid turnover of maize hybrids on farmers' fields that help to achieve higher yield gains to support improved farming in WCA.



IITA maize breeding trial. Photo by IITA.