Acid-Tolerant Maize: Promoting Sustainable Farming on Acid Savannas

Background

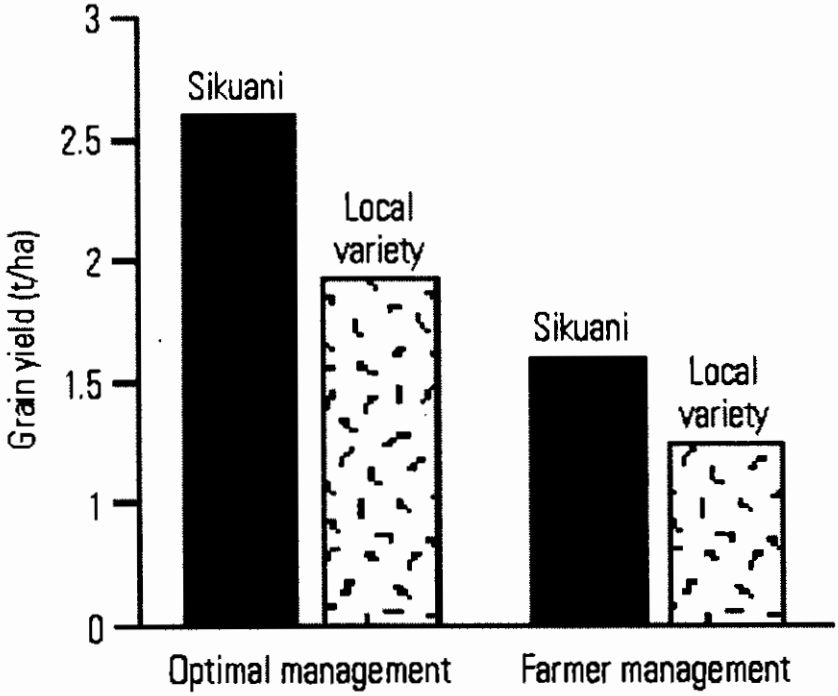
Acid soils account for some four-fifths of agricultural lands in South America and two-fifths — more than 183 million hectares — in Brazil alone. Normal maize varieties yield as little as 0.5 t/ha of grain on even moderately acidic soils, as compared with the average in developing countries of just over 2.0 t/ha. Despite the relative unsuitability of acidic conditions for crop farming, the demand for food from rising populations has led to the increased use of acid soil areas for agriculture. By the year 2000, for example, some 50 million hectares of acidic savannas in Brazil will be under cultivation. The continued migration of rural populations to the cities is placing heavy pressure on maize producers, and demand for maize in the region is expected to grow 3.5-4.0% *each year*. Those who stand to be most affected by the fate of maize in Latin America are the poor: poverty characterizes an estimated 40% of the region's population and more than 60 million people are malnourished or at serious nutritional risk. Increased maize production would provide more grain at the farm level and in urban centers, reducing the price of food for the poorest. It would also help relieve pressure to bring environmentally fragile lands under the plow and, by improving the fortune of farmers, lessen migration to urban centers.

CIMMYT Activities

Through its South American Regional Program based at CIAT, CIMMYT began developing maize that possessed tolerance to acidic and aluminum toxic soils in the late 1970s, demonstrating the possibility of improving the genetic tolerance of maize to these constraints. In the mid-1980s, researchers assembled sets of maize materials with high yield potential, tolerance to acid soils, and resistance or tolerance to other key constraints, either singly or in combination. Subsequent work involved recurrent selection and crossing thousands of superior genotypes within each population at our regional experiment station in Colombia, as well as in acid soils of Brazil, Indonesia, Peru, the Philippines, Thailand, Venezuela, and Vietnam, with help from research programs in each nation. In the early 1990s, experimental varieties from these populations were evaluated on acidic and normal soils in Latin America, Africa, and Asia, in comparison with selected varieties submitted by national research programs. A strong indication of success was that the CIMMYT genotypes out-yielded checks by an average 33%, and an experimental variety from this work gave the highest yields across all environments. In subsequent tests, products of this research — all open-pollinated varieties — yielded as much as 0.7 t/ha more than a Brazilian hybrid under non-acid conditions in Colombia, showing that the acid-tolerant maize is also productive in normal soils. In 1992 CIMMYT also initiated a four-year project with support from the Inter-American Development Bank (IDB) to study technical problems associated with maize production on acid soils. A panel of international experts praised this IDB-CIMMYT partnership, saying that the project had achieved all of its objectives and more.

Impacts

The most celebrated output to date is the maize variety, ICA-Sikuani V-110, developed by the Colombian Agricultural Research Corporation (CORPOICA) using acid-tolerant maize generated through the collaborative research described above. The variety is already sown on thousands of hectares in its native Colombia and is being tested for use in neighboring countries. In trials in farmers' fields in acid soil areas of Ecuador and Peru, Sikuani consistently outyielded the best local varieties both under optimal and farmer management (see Figure). Based on these results, Peruvian authorities are increasing seed of Sikuani for release in that country. In similar trials in Bolivia, Sikuani yielded as much as the best local variety, but caught farmers' eyes due to its outstanding plant and grain type. Acid soil-tolerant hybrids derived more recently from CIMMYT's research produce as much as 70% more grain than Sikuani and should be of special interest in Brazil, where many maize farmers sow hybrids.



Sikuani outyields local varieties in farmer's fields in Peru.

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