CIAT Impact Highlights 1998

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Improving Food Security

Rice Improvement for Latin America and the Caribbean

The challenge: In this century rice has gradually become the most important food grain in tropical America. The region's per capita consumption of this staple rose from 10 kilograms in the 1920s to about 30 in the 1990s. The displacement by rice of traditional staples, such as cassava and plantain, which are bulkier and more perishable, has been driven largely by rapid urbanization throughout the region. Rice is clearly a more convenient food for the approximately 70 percent of the population who now live in cities. Sustained improvement in the production of this crop is thus critical for food security in tropical America.

It is also vital for alleviating poverty in the region. About half of the people in Latin America and the Caribbean live below the poverty line, as defined by FAO. Food accounts for half of poor people's total expenditures, and 15 percent of what they spend on food is for rice. More efficient rice production in lowland irrigated areas offers the further advantage of reducing the pressure to expand cultivation of upland rice and other crops onto ecologically fragile land in the savannas and forest margins.

The product: In the mid-1960s, Latin America's entire rice area was planted to tall traditional varieties. Throughout the 1970s farmers rapidly adopted new semidwarf varieties developed by national programs and international centers. This was merely the beginning of a process that continues to the present. Over the last 25 years, national programs across the region have released, on average, a total of 10 new lowland rice varieties each year. A total of about 275 new varieties have been released, 90 percent of them targeted to flooded environments. About 39 percent of the varieties have come from crosses made at CIAT and 12 percent from IRRI crosses; some of the rest have progenitors from the international centers in their parentage. In general, each new variety represents significant improvement for at least one key trait, on top of the gains already achieved.

The impact: Modern semidwarf varieties now account for 93 percent of all flooded rice production, which represents 80 percent of Latin America's total output of this crop. In the irrigated rice areas, average yield increased from 3.3 tons per hectare in the mid-1960s to 4.6 tons in 1995. As a result, total rice production doubled during that period to about 20 million tons of paddy, making the region largely self-sufficient in rice. More efficient production has brought down the price of this staple by about 50 percent in real terms over the last three decades.

According to recent results from an ongoing study, consumers have been the main beneficiaries of technological change, receiving US$518 million per year since 1966. Producers in irrigated areas have also captured large benefits, amounting to $437 million per year. These gains have been offset somewhat by losses in other rice production environments, mainly upland, rainfed areas.

Reducing Poverty

Cassava Starch Processing in Colombia

The challenge: Cassava provides food and a livelihood for roughly 120 million people in tropical America, where the starchy root crop originated. Traditionally, it has been considered a "poor man's crop," grown mainly for subsistence by small farmers in marginal environments. In recent years, though, the image of cassava has begun to change with the advent of new uses and markets. In addition to being consumed in fresh form, the crop has also become a component of animal feeds and a source of starch for a wide range of industrial products. As such cassava now offers small farmers, not just their next meal, but a reliable option for increasing their incomes.

The product: In the 1980s, CIAT and various national partners embarked on a search for ways to enable farmers to make a better living from cassava. This work was aimed particularly at farmers in marginal areas (characterized by poor soils and drought) where cassava is often one of the few crops that will grow. The product of this work was an integrated approach to cassava research and development, in which partner institutions work toward sustainable crop production in a given area, while simultaneously creating new or improved cassava products and markets.

One such project was established in Colombia's Cauca department, focusing on small-scale extraction of cassava starch for local markets. In 1989 various NGOs in that region joined CIAT and CIRAD, with financing from the French government, in an integrated project aimed at speeding the development of Colombia's cassava starch industry. Specifically, the project sought ways to improve the quality of the final product and to increase the efficiency of processing by improving equipment and procedures and by introducing and testing improved cassava varieties.

The impact: A recent study divided the 208 starch processing operations in Cauca into three groups--low, medium, and high--according to their level of processing technology. Just over 15 percent of the units had adopted all or part of the improved technology introduced by institutions. The majority of processors (67 percent) were using technologies improved locally with institutional support. About 26 percent were processing roots of an improved variety with high dry matter content. Another 20 percent were mixing this variety with the best local variety.

Analysis of economic impact showed that from 1988 to 1996 the new technology had generated benefits valued at about US$25 million. Producers profited from the higher demand and somewhat better price for cassava roots, with benefits amounting to $6.4 million. Processors took an approximately equal share of the gains through reduced processing costs. The rest of the economic benefits accrued to industries that consume starch, because they were able to buy it at a lower cost. All these gains in turn benefited Colombian society by injecting cash into the economy and by generating employment. Given that the project cost about $8.9 million, its net benefits of $16.4 million represent an 80 percent internal rate of return.

Improving Food Security

Adoption of Climbing Beans in Rwanda

The challenge: Beans are grown on more than 3.5 million hectares in Africa, cultivated for subsistence and, increasingly, as a cash crop by poor farmers, mainly women. In Rwanda alone, 95 percent of all farmers grow beans, which provide 32 percent of all calories and 65 percent of all protein consumed in the country.

During recent decades high population density and land scarcity in Rwanda have given rise to extremely intensive production of beans and other crops on small plots. In the absence of sufficient organic and inorganic fertilizers, soil quality appears to be declining, and this poses a major threat to the country's food security. One warning sign of the problem was the emergence in the 1980s of a complex of bean diseases referred to collectively as "root rots." Serious outbreaks occur only in areas, like Rwanda as well as southwestern Uganda and western Kenya, where circumstances force farmers to exhaust the soil through ever more intensive cultivation.

The product: In the early 1980s, CIAT began working with Rwanda's national bean program to test and improve experimental germplasm introduced from tropical America. The work has been funded by the Canadian, US, and Swiss governments. A prominent feature of this program was the participation of Rwanda's women bean farmers in the improvement scheme. Since the women tend to grow complex mixtures of beans, their early involvement in selection was considered essential for achieving wide adoption of new varieties.

One important finding of this work was that climbing beans of Mexican origin show marked advantages over bush beans and local climbing varieties, especially in terms of yield and root rot resistance. They proved to be the ideal technology for a country where producing more food on less land is of the utmost urgency. Eventually, more than 20 climbing bean varieties were released. At first farmers complained about the need to use tall stakes, but with help from local NGOs they found a number of environmentally sound ways to obtain them.

The impact: During recent years CIAT staff have carried out a series of studies on the adoption of climbing varieties in Rwanda. In 1990, for example, six growing seasons after release of the variety Umubano, scientists observed an adoption rate of about 70 percent. The mean yields of Umubano were 1.4 to 1.6 tons per hectare, compared to 0.8 to 1.0 tons for local climbing bean mixtures.

Then, in 1993 a nationwide survey showed that about 43 percent of Rwandan families were growing improved climbing beans introduced 5 years earlier. It was estimated that up to 20 percent of Rwanda's total bean area was sown to the new varieties. The study concluded that the use of improved climbing beans increased production by as much as 66,000 tons per year, generating extra income of about US$15 million.

In late 1995 a survey was conducted to monitor the impact of seed aid in Rwanda (under the Seeds of Hope project) after the genocide of 1994. Remarkably, the study found that, despite the violence, improved climbers were being grown by 48 percent of the bean farmers surveyed and accounted for a third of the bean seed sown.

Improving Food Security

Adoption of Improved Beans in Peru

The challenge: For many centuries common bean has been an essential part of the Andean zone's diet and culture. Here and throughout tropical America, the crop offers a protein-rich food that low-income families can afford. Beans are the fourth most important source of protein in tropical America, and as a source of calories, they surpass both potato and cassava. Beans also provide a livelihood for millions of small farmers, whose best hope for overcoming poverty is to produce food efficiently for expanding urban markets at home and abroad.

Until the early 1990s, production of this staple in the Andean zone as a whole was essentially stagnant, with rates of growth in yield and production lagging well behind population growth. The outlook for beans in the region was bleak, with trends in supply and demand pointing to large deficits by the year 2000.

The product: CIAT responded to this challenge in two ways: first, through an international bean improvement scheme that channeled improved germplasm to national programs around the world and, second, through bean networks in key production regions. These have provided national programs with a mechanism for sharing research results and responsibilities, and they have notably strengthened local capacity to solve problems in bean production. PROFIZA, the regional network for the Andean zone, was set up in 1988, with funding from the Swiss government.

As of 1996 the countries taking part in the network--Bolivia, Colombia, Ecuador, and Peru--had released 31 improved varieties. In addition to offering higher, more stable yields and good local adaptation, most of these varieties supplied genetic solutions to important disease problems in specific environments.

The impact: By 1995 bean production in the Andean zone had risen sharply, mostly as a result of higher yields. The annual rate of increase in production now exceeds the pace of population growth, with a resulting increase in per capita bean consumption.

A growing body of evidence from adoption studies in the Andean zone suggests that improved varieties have contributed importantly to those increases. For example, a 1996-97 study, in Peru's Cuzco department examined the adoption and impact of five new varieties that had been developed in the late 1980s through farmer participatory schemes. According to the study, 94 percent of farmers were growing new varieties. Moreover, these constituted 52 percent of the bean germplasm available, and they accounted for 64 percent of the total bean area. The study further determined that the combination of improved germplasm and higher plant densities boosted average yields by 110 percent from 1985 to 1996.

Protecting the Environment

Reducing Pesticide Use on Beans in Colombia

The challenge: In parts of Colombia, farmers have raised their incomes during the last two decades through intensive production of beans and other vegetables for urban markets. They have done so by adopting new varieties and practices, including pesticide application.

Unfortunately, though, a dangerous "chemical culture" has arisen in many rural communities. For fear of yield losses, farmers spray frequently and habitually, without accurate knowledge or assessments of the economic threat from insect pests. Indiscriminate use of chemicals has come to pose a serious threat to the environment and human health. And, ironically, it has made pest problems worse by destroying the natural balance between them and their natural enemies.

In the late 1980s, problems arising from total dependence on chemical controls became evident in the Sumapaz region, which supplies snap beans and other vegetables to markets in the nation's capital. Farmers were spraying snap beans about a dozen times during a growing season, roughly once a week.

The product: During the early 1990s, a pilot project supported by CIAT and financed by IDRC began searching for ways to put chemical use on a more rational basis in Sumapaz. Through farmer participatory research, the project developed an integrated pest management strategy for snap beans in the area, which consisted of six technologies, involving cultural, mechanical, and chemical controls.

The impact: In 1992 an adoption study showed high levels of adoption for at least some of the component technologies. Very few farmers accepted the entire IPM package. The most popular innovations were the cultural practices. Together with other measures, these enabled farmers to lower pesticide use by about 33 percent.

In 1996 a second showed that, although parts of the package were still in use, many farmers had abandoned them, and the average number of sprays per growing season had returned almost to its 1988 level.

The study put forward various explanations for this. For example, because snap bean prices vary greatly, farmers have a strong incentive to spray as a defensive measure to reduce the risk to their income. Another key consideration is that snap beans account for only 22 percent of farmers' total pesticide use in Sumapaz. Apparently, any effort to change the chemical culture there will have to deal with the whole farming system rather than a single crop.