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Progress made across regions in rice breeding in Latin America and the Caribbean: A success story of partnership.

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Rice represents one of the main staple crops in household diets in Latin America and the Caribbean (LAC). In 2008, rice production was around 20% of the total cereals production in South America. Rice provides an important share of the total calories intake by households in the region except for Central America and the Southern Cone Countries where its share is smaller. Rice consumption has increased in Latin America by almost 25% per decade(FAO, 2010) since 1960. In addition, during the last decade, consumption has reached an average of almost 40 kilos per capita per year, growing at 6% per decade since 1960 (FAO, 2009). Higher consumption levels are reached mainly in Caribbean countries with up to 70 kg per capita and in some South American countries with 50 kilos per capita per year. This important role of rice trough the region represents an important window to improve household diets by increasing rice availability especially for urban poor.

Considering a scenario without extreme shocks for rice consumption per capita (10% more consumption in the next 40 years), rice consumers in LAC will demand in 2050 between 22 and 23 million tons in rice compared to 18 million that are consumed nowadays (estimation based on consumption data from USDA and UN population data). This scenario requires an increase in rice production of almost 30% during the next 40 years (equivalent to 32 million tons) to satisfy future demand related to population growth. According to FAO historic data rice production since 1960 grew by 2.4% annually, considering that total production growth could be more than 90% to 2050 if current momentum is maintained. This can only be achieved by improving rice production systems in eco-efficient ways, to bring down production costs and increasing its competitiveness. The result might be about 50 million tons with a larger surplus of paddy rice against a current deficit of 1.5 million tons of white rice in 2010. The region has become largely self sufficient in some countries but other regions like the Caribbean and Central America still face negative trade balances.

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Since 1960 gains from improved productivity almost triple yields (growth at 2.32% per year since 1960, and 2.39% in terms of total rice production). From 1995 to 2008 gains in production and yield were 2.18 and 2.83%, respectively. These higher yields are attributed to a shift to increased irrigation, adoption of improved varieties and better crop management by farmers. However, gains were clearly non- homogeneous in terms of periods and regions. In order to get an idea about the influence of the breeding program, the whole period from 1960 to 2008 and two different periods (Table 1) were considered. Data indicates that gains in the Southern Cone are much higher compared to the whole region (LAC), and specially compared to Central America and the Caribbean, and Colombia. This means that in terms of regional research priorities this region should have greater priority and more efficient ways to bring this region up to speed need to be considered. FLAR is already engaged in the implementation of best agronomic practices in this region in collaboration with different organizations. In general, gains shown in Table 1 represent a success story of partnership due to the close collaboration between CIAT and NARES over time. Our database shows that out of the 380 varieties released by our partners in LAC, 52% carry at least one parent originated from CIAT.

A study, lead by Sanint and Correa in 1998-99, was carried out to estimate genetic gains realized by the irrigated rice breeding program run by CIAT. Twelve rice cultivars representative of five decade of breeding (50s, 60s, 70s, 80s and 90s) were planted in a split plot design with main plots arranged in a completely randomized layout with four replications in Palmira(irrigated conditions),and three reps. in Santa Rosa(rain-fed conditions). Four levels of nitrogen (0, 60,120, and 180kg/ha) were applied to estimate response of genotypes to nitrogen, and used as main plots. Decades of breeding were the subplots. Pesticide applications were used to protect experimental plots from insect and disease damage. Data were taken on grain yield and yield components, flowering, plant vigor and height, and grain quality. Most relevant finding indicates that in both locations the effect of breeding in increasing yield potential by decade was significant. Varieties released in the 80s and 90s had higher 1000grain weight than those released in the 60s and 70s. In Santa Rosa, nitrogen fertilization is a requirement and varieties released in the 80s and 90s required les nitrogen than those released in the 70s and60s. Progress made in other agronomic traits such as plant vigor and height, flowering, grain quality, and disease and insect resistance will be presented.

Table 1. Estimates of gains (%) in several regions measured at two different time periods.*

	1960 - 2008		1960 - 1994		1995 - 2008	
	Product	Yield	Product	Yield	Product	Yield
LAC	2.39	2.32	2.68	1.75	2.18	2.83
Southern come	4.67	2.39	5.08	2.39	5.25	3.95
Central Amer. And Caribbean	1.95	1.74	2.74	2.44	-	-
Colombia	3.01	1.89	3.93	2.59	5.54	1.97

$Y = Ae^{bt}$ Exponencial model to estimate % of growth was utilized; b is % of growth over time. The significance of b is given by R^2 (% of total variance explained by the univariate model). $0.7<R^2<0.97$

__ : Not significant