

Maize Research Investment in Latin America

ORGANIZATION OF THE MAIZE RESEARCH SYSTEM

Before examining the impacts of maize breeding research in Latin America, it is useful briefly to consider the organization of the region's research system. The improved OPVs and hybrids that eventually make their way into farmers' fields are products of an international breeding system that includes one publicly supported international research center (CIMMYT); dozens of public breeding programs operating at the national, regional, state, or district level; and hundreds of private seed companies, both national companies and multinationals. Information about the organization and performance of this international research system is available elsewhere, so it will not be described in detail here (see López-Pereira, Clancy, and Morris 1992; López-Pereira and Filipello 1994; López-Pereira and Morris 1994).

As a charter member of the Consultative Group on International Agricultural Research (CGIAR), CIMMYT holds a global mandate for maize research and in this capacity plays a leading role in Latin American maize breeding efforts. Working in collaboration with other organizations, both public and private, CIMMYT develops, tests, and distributes improved maize germplasm. Contrary to the widely held view,

CIMMYT's goal is not to produce finished materials; for this reason, CIMMYT does not release named varieties and hybrids intended for direct use by farmers. Instead, CIMMYT distributes intermediate products designed to be used as inputs into public and private breeding programs; typically these consist of improved materials with high yield potential, good agronomic characteristics, resistance to important diseases and pests, and (in the case of inbred lines) good combining ability. CIMMYT's maize breeding efforts thus are concentrated at the "upstream" end of the research continuum.

CIMMYT distributes materials (both materials that have been worked on by CIMMYT breeders as well as materials obtained from external sources) through two main channels. The primary germplasm distribution channel is the system of international trials, which consists of sets of materials sent to local cooperators for evaluation under controlled levels of management; in return for reporting performance data back to CIMMYT, the cooperators are free to incorporate any material selected out of the trials into their own breeding programs. A second germplasm distribution channel consists of seed shipments sent from the Wellhausen-Anderson Plant Genetic Resources Center, a state-of-the-art storage facility in which more than 10,000 maize accessions are permanently maintained.

POLICIES AFFECTING NATIONAL MAIZE SEED INDUSTRIES

Although the basic organization of the international maize breeding system in Latin America dates back to the time when CIMMYT was established in the mid-1960s, the roles of different institutional players have changed over the years. The public research institutes and seed agencies that once dominated maize breeding and seed production have seen their role gradually diminish in the face of fierce competition from the private sector, to the degree that in many countries the public sector no longer participates actively in seed production and/or seed marketing (Table 6). Even indirect regulation of seed industry activities has been relaxed, with the elimination of restrictions on seed trade and the removal of seed price controls (Table 6).

Table 6. Maize seed industry policies, Latin America, late 1990s

	Public-sector maize seed production?	Commercial seed imports permitted?	Mandatory maize seed certification?	Official seed price controls?
Central America				
Costa Rica	N	Y	Y	N
El Salvador	N	Y	Y	N
Guatemala	Y	Y	Y	N
Honduras	N	Y	Y	N
Nicaragua	N	Y	Y	N
Panama	N	Y	Y	N
Caribbean				
Cuba	Y	N	Y	Y
Dominican Republic	Y	Y	N	N
Haiti	Y	Y	Y	N
Mexico	Y	Y	N	N
Andean Zone				
Bolivia	Y	Y	Y	N
Colombia	N	Y	Y	N
Ecuador	Y	Y	Y	N
Peru	Y	Y	N	N
Venezuela	N	Y	Y	N
Southern Cone				
Argentina	N	Y	N	N
Brazil	N	N	Y	N
Chile	-	-	-	-
Paraguay	Y	Y	Y	N
Uruguay	-	-	-	-

Source: CIMMYT maize impacts survey.

The emergence of flourishing private maize seed industries in many Latin American countries can be attributed to a complex set of technical, economic, and institutional factors that will not be examined in detail in this report.² In view of the current heated debate over the role played by intellectual property rights in stimulating private investment in seed research, it seems worth mentioning, however, that only seven countries in Latin America are signatories to the UPOV (International Union for the Protection of New Varieties of Plants) agreement. This suggests that relatively few countries in the region have enacted effective systems of plant varietal protection (Table 7).

Table 7. Intellectual property rights regimes, Latin America, late 1990s

	UPOV signatory?	PVP laws in effect?	Plant patents allowed?	Varietal registration required?
Central America				
Costa Rica	N	N	N	N
El Salvador	N	N	N	N
Guatemala	N	N	N	N
Honduras	N	N	N	N
Nicaragua	N	N	N	N
Panama	N	N	N	N
Caribbean				
Cuba	N	Y	Y	N
Dominican Republic	N	N	N	Y
Haiti	N	N	N	N
Mexico	Y	Y	N	Y
Andean Zone				
Bolivia	N	Y	N	N
Colombia	Y	N	N	N
Ecuador	Y	N	N	N
Peru	N	N	N	Y
Venezuela	N	N	N	N
Southern Cone				
Argentina	Y	Y	Y	N
Brazil	N	Y	N	N
Chile	Y			
Paraguay	Y	Y	N	N
Uruguay	Y			

Source: CIMMYT maize impacts survey.

² For a discussion of the evolutionary growth process that characterizes the development of national seed industries, see Morris and Smale (1997).

CURRENT STRUCTURE OF NATIONAL MAIZE SEED INDUSTRIES

Table 8 presents information on the numbers and types of organizations that conducted maize breeding research, produced maize seed, and/or marketed maize seed in Latin America in 1996. The data appearing in Table 8 almost certainly understate the true size of the regional maize seed industry, because even though a concerted effort was made to identify all relevant organizations, some probably were overlooked. Also, in some cases it was difficult to classify individual organizations (e.g., when a company was registered as a national company but maintained formal links with a multinational corporation); for this reason, the numbers appearing in each category should be considered approximate.

Table 8. Numbers of maize seed organizations, Latin America, 1996

	Public seed agencies	Private seed companies			NGOs
		Domestic producers	Multinational producers	Seed importers	
Central America	8	31	12	25	73
Costa Rica	3	3	1	0	7
El Salvador	1	4	0	5	10
Guatemala	1	11	6	4	22
Honduras	1	4	5	6	16
Nicaragua	1	6	0	6	13
Panama	1	3	0	4	8
Caribbean	5	4	0	6	15
Cuba	2	0	0	1	3
Dominican Republic	1	1	0	3	5
Haiti	2	3	0	2	7
Mexico	4	50	5	52	111
Central America, Caribbean, and Mexico	17	85	17	83	202
Andean Zone	7	61	9	42	119
Bolivia	2	16	1	14	33
Colombia	1	14	3	0	18
Ecuador	2	9	0	3	14
Peru	1	10	0	21	32
Venezuela	1	12	5	4	22
Southern Cone	8	83	13	10	114
Argentina	1	19	7	2	29
Brazil	6	48	5	5	64
Chile					
Paraguay	1	16	1	3	21
Uruguay					
South America	15	144	22	52	233
Latin America	32	229	39	135	432

Source: CIMMYT maize impacts survey.

Despite these caveats, the data appearing in Table 8 are informative, especially when they are compared to the results of an earlier CIMMYT survey conducted in 1993 (López-Pereira and Filipello 1994). Throughout the region, the public sector continues to maintain an active presence in the maize seed industry, although in many countries this presence has been reduced to a single organization. Often this single public organization is a research institute, rather than a seed production agency; as will become evident when commercial seed sales data are discussed, in many countries the public sector no longer participates directly in seed production activities.

Across Latin America, the role of the public sector is now overshadowed by the private sector, which judging from the numbers of seed companies continues to expand rapidly. The number of multinational seed companies has not changed appreciably since the 1993 survey, but the number of national companies more than doubled. In interpreting these figures, it is important to keep in mind that the activities carried out by individual companies can vary. In contrast to multinational seed companies, almost all of which engage in the full range of research, seed production, and seed distribution, many national seed companies do not maintain their own research programs; rather, they restrict themselves to producing and selling seed.

The dramatic expansion of the private seed industry has been matched in the participatory sector, as the proliferation of private seed companies has been accompanied by similar rapid growth in the number of non-governmental seed organizations. Although this category is not always well defined, generally speaking it includes small, not-for-profit organizations dedicated to the production of maize seed at the community level. In many cases these participatory seed organizations are established as part of integrated rural development projects in an attempt to meet localized demand for improved seed. These

participatory organizations virtually never conduct research and almost always restrict themselves to producing seed of public varieties and hybrids.

INVESTMENT IN MAIZE BREEDING RESEARCH

Tables 9 and 10 present information on the numbers and distribution of scientists engaged in maize breeding research in 1996. Marked regional differences are apparent in the relative numbers of maize breeders employed in the public and private

sectors.³ In Mexico, Central America, and the Caribbean, the number of public-sector breeders exceeded that of private-sector breeders, indicating that maize breeding research remained concentrated in the public sector. The situation was quite different in South America, however; both in the Andean Zone and in the Southern Cone, the number of private-sector maize breeders exceeded the number of public-sector breeders. These findings are consistent with the view that private investment flows have been attracted toward more commercial seed markets.

Table 9. Public sector maize research indicators, Latin America, 1996

	Public organizations engaged in maize breeding	Public-sector scientists engaged in maize breeding	Public-sector scientists per million ha planted to maize	Public-sector scientists per million t produced
Central America	7	22.5	13.7	7.8
Costa Rica	1	3.0	225.5	119.9
El Salvador	1	2.0	6.8	3.2
Guatemala	1	7.0	12.2	6.2
Honduras	2	5.0	12.3	7.6
Nicaragua	1	3.0	10.7	9.0
Panama	1	2.5	34.2	22.8
Caribbean	3	6.0	16.1	18.1
Cuba	1	2.0	27.0	23.5
Dominican Republic	1	2.0	46.9	46.7
Haiti	1	2.0	7.8	9.8
Mexico	11	130.6	16.8	7.3
Central America, Caribbean, and Mexico	21	159.1	16.2	7.6
Andean Zone	10	47.25	20.2	11.4
Bolivia	5	6.0	20.9	9.8
Colombia	1	4.0	6.1	3.8
Ecuador	1	6.25	11.0	10.5
Peru	2	16.0	39.9	19.7
Venezuela	1	15.0	34.9	14.3
Southern Cone	8	84.1	5.2	1.9
Argentina	1	25.0	9.6	2.4
Brazil	6	54.6	4.1	1.7
Chile	-	-	-	-
Paraguay	1	4.5	13.9	6.9
Uruguay	-	-	-	-
South America	18	131.3	7.0	2.8
Latin America	39	290.4	10.2	4.3

Source: CIMMYT maize impacts survey.

Table 10. Private sector maize research indicators, Latin America, 1996

	Private organizations engaged in maize breeding	Private-sector scientists engaged in maize breeding	Private-sector scientists per million ha planted to maize	Private-sector scientists per million t produced
Central America	9	9.3	5.6	3.2
Costa Rica	1	0.6	45.1	24.0
El Salvador	1	0.3	0.9	0.4
Guatemala	3	7.5	13.04	6.6
Honduras	3	0.7	1.72	1.1
Nicaragua	0	0.0	0.0	0.0
Panama	1	0.2	2.9	1.9
Caribbean	1	3.5	9.4	10.6
Cuba	0	0.0	0.0	0.0
Dominican Republic	0	0.0	0.0	0.0
Haiti	1	3.5	13.6	17.2
Mexico	24	43.0	5.5	2.4
Central America, Caribbean, and Mexico	34	55.7	5.7	2.7
Andean Zone	23	51.9	22.2	12.6
Bolivia	5	5.3	18.5	8.6
Colombia	7	17.5	26.8	16.6
Ecuador	2	2.6	4.6	4.4
Peru	2	6.9	17.1	8.5
Venezuela	7	19.7	45.7	18.7
Southern Cone	35	101.9	6.3	2.4
Argentina	16	35.5	13.7	3.4
Brazil	19	66.4	5.0	2.1
Chile	-	-	-	-
Paraguay	0	0.0	0.0	0.0
Uruguay	-	-	-	-
South America	58	153.8	8.3	3.3
Latin America	92	209.5	7.4	3.1

Source: CIMMYT maize impacts survey.

3 The category referred to here as *maize breeders* includes not only breeders but also other scientists engaged in germplasm improvement research, such as physiologists, pathologists, and entomologists.

Simply comparing the numbers of maize breeders employed in the public and private sectors may provide a misleading measure of the relative strength of investment if the cost of supporting a breeder differs significantly between the two sectors. Table 11 shows the estimated cost of supporting a senior maize breeder in 1996. The data have been broken into two components: (1) salary and benefits, and (2) operating budget. Survey respondents (especially those working in public organizations) often had difficulty estimating all of the relevant overhead expenses associated with supporting public research personnel, so these figures should be considered conservative. Also, they may not be directly comparable with other published series on research costs. Despite these limitations, however, the data in Table 11 suggest that in every region the cost of supporting a senior maize breeder was considerably higher in the private sector than in the public sector. While the salary-and-benefits estimates for public-sector breeders may have failed to capture some administrative expenses, there is no reason to believe that the operating budgets would have been estimated differently between the two categories. The data thus suggest that public-sector scientists lack operating resources compared to their counterparts in the private sector.

Table 11. Cost of supporting a senior maize breeder, Latin America, 1996 (US\$)

	Public sector		Private sector	
	Salary and benefits	Operating budget	Salary and benefits	Operating budget
Central America	12,250	8,341	25,173	19,233
Costa Rica	16,800	16,800	100,000	66,667
El Salvador	10,360	4,455	11,422	13,706
Guatemala	7,924	4,132	15,951	10,781
Honduras	12,000	11,656	21,220	20,804
Nicaragua	7,222	8,000	-	-
Panama	19,200	5,000	16,800	4,853
Caribbean	7,899	5,550	13,000	8,750
Cuba	4,071	4,071	-	-
Dominican Republic	11,325	5,082	-	-
Haiti	8,300	7,500	13,000	8,750
Mexico	16,081	11,867	37,125	42,652
Central America, Caribbean, and Mexico	11,328	7,856	30,706	33,030
Andean Zone	15,411	17,957	25,989	22,990
Bolivia	13,500	30,000	40,400	38,000
Colombia	21,945	21,945	30,886	25,374
Ecuador	12,541	7,838	16,723	12,090
Peru	11,100	20,000	14,833	12,750
Venezuela	19,971	10,000	24,700	23,257
Southern Cone	27,057	25,000	75,236	101,479
Argentina	35,500	40,000	67,923	99,769
Brazil	36,000	20,000	83,159	103,331
Chile	-	-	-	-
Paraguay	9,670	15,000	-	-
Uruguay	-	-	-	-
South America	19,978	20,598	48,374	58,667
Latin America	15,084	13,520	42,414	49,343

Source: CIMMYT maize impacts survey.