

4 Farmer and Industry Funding of Agricultural Research in Colombia

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Abstract

Introduction

Colombia, like most Latin American countries immediately after the Second World War, used the import-substitution approach to development. In the case of agricultural products for export, production was organized in plantations, using technology imported from abroad. Agronomic and mechanical practices were introduced and adapted, as well as some organizational and managerial methods. A typical example was banana production, managed by multinational companies. Later, during the early sixties, flower production and exports were organized in the same way, adapting foreign technology by investing domestic capital.

Food and raw material production for domestic use was divided among commercial producers who concentrated mainly on grains and cotton, and subsistence producers growing mainly potato, tubers and some horticultural species. Agricultural research for these two groups was largely financed and executed by the public sector. However, from the 1920s, several producer organizations have created special levys or levies on output to finance part of the research, mainly adaptive research. The trend toward farmer financial support to agricultural research, reached a peak around 1980. In 1938 a coffee experimental station was established by the Coffee Growers Association. In 1948, cotton producers began to finance activities related to the introduction and testing of commercial varieties. In 1963, a special rice levy was approved by the Rice Grower Association to finance research and seed multiplication. Following the same model, the sugarcane industry began funding in 1967 a national sugar research station to combat a virus disease that was threatening local production. In 1985, the Cereal Producer Association (maize, wheat, barley) and the oil palm producers took the same approach followed by the flower, grape, and shrimp producers in the early 1990s. Table 1 summarizes information on the levy paid by producers, and the structure of each industry.

This chapter summarizes the most successful of these efforts by Colombian agricultural producers to finance research. Lessons learned from this experience are presented and some implications for the future explored.

The Cases

Coffee

Coffee producers concluded that the only way to capture an emerging international market was the consolidation of marketing in order to reduce transactions and transportation costs. A levy on exports, to be administered jointly by the national government and the producer association, was established in 1934. Revenues from this levy were used to promote production, through credit, to build marketing and export infrastructure, and to finance a coffee research station. The Colombia government delegated all responsibilities related to agricultural research, production promotion, and export market development to the Coffee Producers' Association (FEDECAFE).

The export levy is administered by the National Congress of Coffee Producers. An annual budget is approved, which includes an appropriation for research of around 12% of the revenues collected, although the amount varies from year to year, depending on coffee prices. However, in general, financial resources for research have been stable.

The resources allocated to research are administered by a Board of Directors formed by producer representatives from different coffee regions. Managers of the coffee research program present an annual work plan to the Board built around projects. Since 1990, the annual research program has been discussed and validated with municipal coffee regional committees, in order to respond to local demands.

Coffee research has concentrated on the development of agronomic practices designed to improve product quality, a variable considered as strategic in international markets. Later, producers recognized the risk of rust disease and assigned resources to breeding rust-resistant varieties. In both cases, researchers were successful and coffee research was taken as a model for other industries.

Although no comprehensive evaluation of investment in research by FEDECAFE has been made, the impact of research is demonstrated by the cases of coffee rust and the coffee berry borer. In Colombia, coffee is grown in areas with cool climates that favor rust development, which appeared for the first time in the Americas in 1970 in Brazil. To solve the problem of coffee rust, a resistant variety, 'Colombia', was developed and disseminated. Although rust reduced yields by 10-20% on local varieties, the improved variety 'Colombia' receiving no control yielded the same as local varieties treated with fungicide. The evolution of the disease and the rapid adoption of the improved variety with associated benefits is shown in Table 2 and Figure 1. The internal rate of return to the research investment varied between 12% and 31%, depending on the control method used.

The coffee berry borer, the major insect pest attacking coffee worldwide was detected in the Americas in 1913 in Brazil and has been causing serious problems in Colombia since its appearance in 1988 (Bustillo 1990). In 1999, the borer was found in 400 municipalities, encompassing 380,000 coffee farms

and 715,000 ha (Herrón 1998). The borer, in addition to reducing coffee production by destroying the bean, also causes fruit to fall, increases the proportion of grain broken during processing, and alters beverage flavor. Development of a resistant variety was not possible so FEDECAFE accepted, as policy, to develop and use an integrated pest management system that included the collection of borer-infested beans, spraying coffee trees with the fungus *Beauveria bassiana*, and releasing the beetle *Cephalonomia stephanoderis* to attack the borer. Insecticide applications were to be used according to established infestation levels that are determined through periodic samplings. This program required considerable training of extension workers to disseminate. While the program had considerable impact, adoption was incomplete due to the complex set of practices involved.

Rice

In 1963, rice producers followed the coffee model when a rice levy, collected at the mill gate, was established. A large percentage of the levy revenues was used to promote the use of improved varieties for irrigated rice, developed by the national research institution, now called CORPOICA, and the application of a technical package, based on the intensive use of fertilizers and other agrochemicals, to control emerging pests and diseases. Multinationals firms protected by import licenses and controls, assembled the technical package.

The rice levy is managed under a National Council which has equal representation from producers and government officials. The producer representatives are appointed by the Rice Producer Association and the government representatives are officials from the Ministry of Agriculture, the National Planning Agency and the National Treasury. The revenues from this levy are distributed among research, transfer of technology, and marketing. The Rice Producer Association must present an annual program and budget that allocates resources across activities according to the relative severity of technical problems at the farm level and marketing bottlenecks.

The Rice Producer Association has experimental sites in all the main producing regions. Local farmers are invited to identify the major local constraints and problems and to evaluate the results. Consequently, the rice research agenda is no longer structured to meet a single national objective, but to confront local problems.

The rice levy for research have been used to address three interrelated objectives. First, they financed an extensive network of trials to adapt and evaluate advanced lines developed in the public national rice program. This program was aimed at obtaining high yielding varieties, as well as incorporating resistance to major pests and diseases. Second, the rice levy financed the development of a technological package, based on the use of agrochemicals to control weeds, a major constraint to rice production in tropical areas. Third, it financed the establishment of a seed multiplication and distribution network.

The increased R&D made possible by the levy was a success story. Rice production increased threefold from 1963 to 1983, and the domestic market was satisfied with cheaper, high quality rice. Rice agronomic practices, irrigation and harvesting were mechanized. An input market developed to meet the

increasing demand for commercial inputs. National average yields jumped from 2.4 t/ha in 1963 to 4.2 t/ha in 1983. However, when domestic production exceeded domestic consumption, the national government was forced to implement subsidized market interventions, and domestic prices were tied to production costs. Since 1983 rice production in Colombia has been stable, with an annual growth rate similar to human population growth. Colombian rice producers have been able to compete in the national market, but not in the international markets.

With the collapse of the public-sector rice research program in the late 1980s, it was necessary to use part of the rice levy to finance more upstream research, in collaboration with several international rice research programs. In 1995, Colombia promoted the creation of a Latin American Irrigated Rice Research Fund (FLAR). This fund has allowed the continuation and strengthening of the irrigated rice research in the region. Nine Latin American countries make annual contributions to the fund, on the basis of their national rice production to inspect the operation of Colombia, through the FLAR Administrative Committee and an Administrative Council. The fund is based at the International Center for Tropical Agriculture (CIAT). This Alliance allows FLAR to raise resources to the international series and to use the research facilities at CIAT headquarters.

After five years of operation FLAR is showing concrete results. In most countries new varieties have been delivered. These varieties are adapted to the biological and physical constraints of each country. Also, training has been a very important instrument to improve the managerial efficiency of all producers.

The impacts of the Colombian rice research program have been evaluated several times and in all cases the results have been positive. Indicators such as the internal rate of return showed that the investment was profitable both from the private and social points of view. These evaluations have also shown that both producers and consumers received positive benefits from the rapid technical change. However, subsistence-oriented upland rice producers, that were not able to adopt the new technology, suffered losses due to lower prices.

Sugar

The Colombian Sugarcane Research Center (CENICAÑA) was founded in 1977 to contribute to the development of the Colombian sugar industry. This center is financed through levy funds paid by the eleven sugar mills and 1,400 individual sugar producers who form the Colombian Association of Sugar Producers (ASOCAÑA). The annual budget allocated to CENICAÑA represents 0.55% of total sugar sales and has averaged about US\$ 2.5 million per year during the 1977-97 year period. This budget has been increasing during the last five years as a result of the expansion in planted area (Table 3 and Figure 2). In addition, the percentage of total sales allocated to CENICAÑA is expected to increase to 0.70% during the next three years (CENICAÑA 1998).

The research agenda has been historically established by the owners of the sugar industry, represented by a board of trustees of 12 members (one for each of the eleven sugar mills and one representing the sugar producers). The backbone of the research agenda has been the development of improved varieties with increasing sugar content, earlier maturity, and resistance to economically important diseases. During the last 10 years, emphasis has also been placed on the development of varieties which defoliate and that are erect in order to facilitate mechanical harvesting (CENICAÑA 1998).

This research agenda has resulted in the introduction, validation, and development of several improved varieties which have significantly improved the performance of the sugar industry during the past 21 years, increasing productivity by 71%, reducing harvest time by 43%, and increasing sucrose content in

employment. In addition, the systematic reduction in real incomes of most producers implies they are not able to allocate resources to co-finance this modernization process.

Efficiency in the allocation of resources

The level of long-term international competitiveness is based on the capacity of the productive system to incorporate new technologies and to allocate reserve funds to withstand low price cycles and climatic adversity. In addition, the private sector needs to consider the externalities caused by the effects of their production systems and detect those areas where marginal investment in natural resource management will contribute to maintain long-term competitiveness.

Small producers are not able to make this change by themselves and require the support of other sectors of society to help them in the efficient administration of these resources through strategic alliances.

This will require research to identify the best-bet opportunities and to obtain the greatest benefit from available resources.

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Table 1. Summary information of levy paid by producers, mean farm size of producers, the decision-making process of establishing a research agenda, and their effectiveness compared to the public sector.

Attribute	Coffee	Rice	Sugar	Oil palm
Mean farm size of producers (ha)	2	10	98	580**
Levy on producers (% of output value)	*	0.50	0.55	0.5
Who makes decision on research priorities? ¹	BOT and MCRC	BOT	BOT	BOT and RC
Proportion of research agenda contracted out (%)	< 10	<10	< 10	<10
Effectiveness of research compared to public sector ²	Higher	Higher	Higher	Higher

¹ BOT = Board of Trustees; MCRC = Municipal Coffee Regional Committees; RC = Research Committee.
² Defined as the effectiveness of the assistance in the implementation and feedback mechanisms from export growers. Annual budget for research is negotiated each year based on the export price for coffee. Based on 250 members of US\$5/ha. ALMA.

Table 2. Area affected by rust and area planted to the rust-resistant, improved coffee variety 'Colombia'

Year	Rust-infected area (ha)	Percentage of nation's crop	Area planted to improved variety 'Colombia' (ha)
1982/83	5,383	0.5	207
1983/84	30,462	3.0	863
1984/85	331,703	32.9	2,756
1985/86	523,000	51.8	5,059
1986/87	688,000	68.2	11,383
1987/88	800,000	79.2	21,055
1988/89	869,517	80.1	54,282
1996/97	300,543	25.8	215,036

Source: FEDECAFE, cited by Farfán (1999).

Table 3. Changes in productivity of sugarcane due to research in the development of new varieties during the period 1977-97 in Colombia

Variable	1977	1997
% of planted area to varieties introduced and evaluated by CENICAÑA	0	61
% of planted area to varieties developed by CENICAÑA	0	22
Yield (mt sugar/ha/yr)	7	12
Harvest age (months)	18	12.6
Sugar yield (%)	11.0	11.8
Area (ha)	122,000	188,000

Source: CENICAÑA (1998)

Table 4. Returns to research in the Colombian Oil palm industry during the period 1990-1999

Indicator	
Investment in research (million US\$ of 1999)	
- Oilpalm industry	10.8
- Other investors	1.7
Yield (mt/ha)	
- 1990	13
- 1999	17
Oil extraction rate (%)	
- 1990	18
- 1999	21
Planted Area (ha)	
- 1990	86,000
- 1999	150,000
Economic Surplus due to Research	
- Agriculture	29.0
- Industry	6.8
- Total	35.8
Generation of employment due to research (man-days in 1999)	
- Agriculture	7,779
- Industry	3,182
- Total	10,961

Source: Estimated by authors from CENIPALMA (2000).

Source: Jaramillo and de Angel (1999).

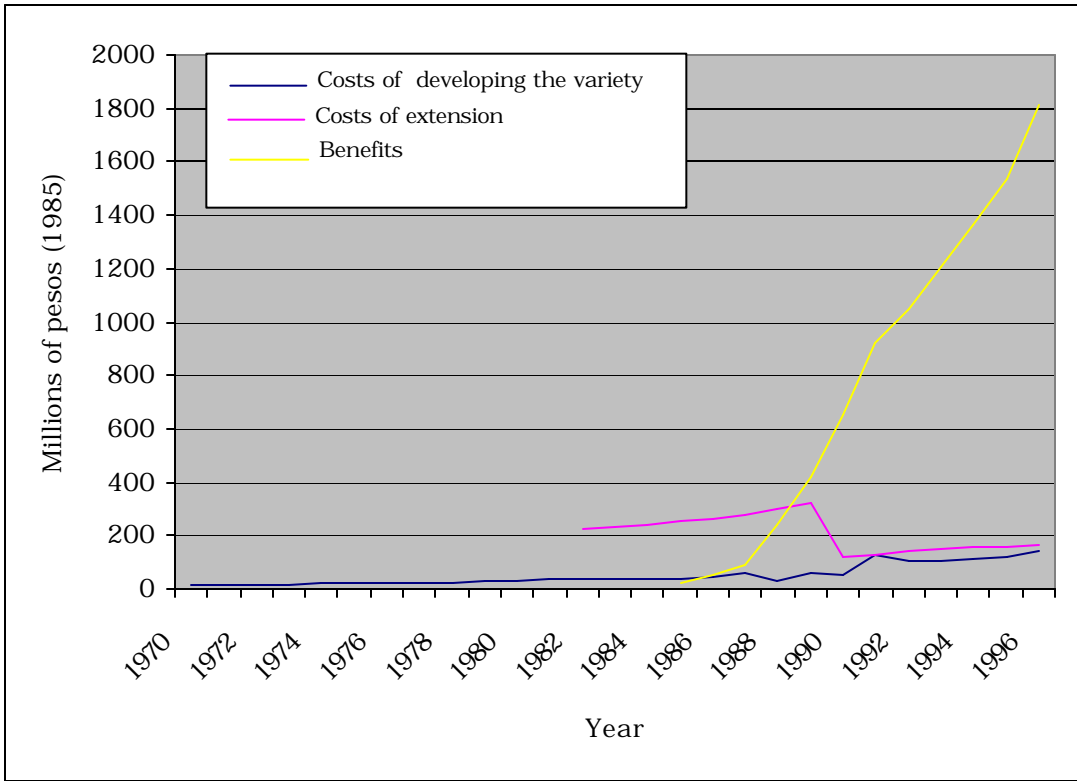


Figure 1. Costs and benefits of developing and transferring the coffee rust-resistant variety 'Colombia'

Source: Farfán (1999).

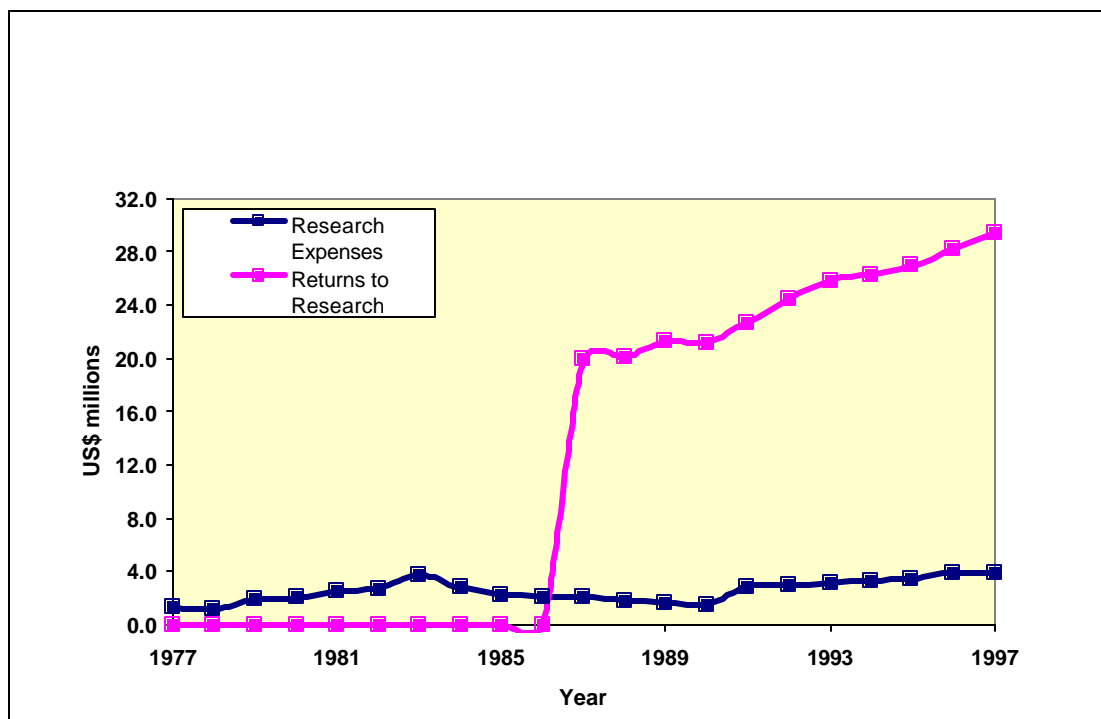


Figure 2. Annual budget of CENICAÑA and estimated returns to research from increased productivity (in constant US million dollars of 1995)

Source: CENICAÑA (1998).

¹ Dr. Nestor Gutierrez, CEO, National Rice Federation of Colombia (personal communication).