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# **AGRICULTURAL RESEARCH POLICY AND ORGANIZATION IN SMALL COUNTRIES**

**Wageningen**

**The Netherlands**

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**Directorate for Agricultural Research, Netherlands Ministry of Agriculture & Fisheries  
Agricultural University Wageningen  
Technical Centre for Agricultural and Rural Cooperation  
International Service for National Agricultural Research**

**Report of a Workshop**

**AGRICULTURAL RESEARCH  
POLICY AND ORGANIZATION  
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**Directorate for Agricultural Research, Netherlands Ministry of Agriculture & Fisheries  
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# SCIENTIFIC LINKAGES OF AGRICULTURAL RESEARCH SYSTEMS FOR SMALL COUNTRIES

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According to the outline prepared by your organizing committee, this subject follows a discussion on national policies determining the agricultural research emphases and make-up of the institutions carrying them out, and it will be followed by a discussion on research-farmer linkages. Although these three aspects of a national agricultural research system are inextricably interrelated, it is useful to look at them separately, so long as we appreciate that the research activity is bounded by policy decisions and that the only justification in the long run is an improvement in agricultural technology that benefits farmers and the society in which they live.

In my discussion, I will be concerned with countries that are not only small in physical dimensions, but relatively non-industrialized and therefore heavily dependent on agriculture as a basis for both subsistence and for foreign exchange. Since my illustrations will be drawn from personal experience in Central America, some basic data on political, demographic, and economic circumstances in the past decade are worth looking at. These countries lie between latitudes of about 8 and 16 degrees north. Mexico lies to the north, Panama to the south. When they separated from the Spanish empire in the period between 1821 and 1828, they attempted to form a single nation called Central America, but decisive political factions, poor communication systems by road and sea, and poverty, resulted in the creation of five separate states: Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica. Political instability reigned in the four northern countries and resulted in military regimes, tending to be dominated by a land-owning oligarchy. Costa Rica, to the south, developed a relatively stable democracy. In the last few years, civil war has dominated two of the other countries, El Salvador and Nicaragua, and at present the latter has become a socialist state.

Table 1 shows some recent statistics on population, dependence on agriculture, gross national product, and dependence on agricultural exports for foreign exchange (1, 2).

The major export crops are coffee, bananas, sugar cane, and cotton. Maize and sorghum are the principal cereals, although some rice and wheat are grown. The common bean is the principal food legume, and white and sweet potato and yuca are the most important root and tuber crops. Each of the five countries has a considerable range of ecological zones associated with different rainfall patterns and with different elevations, which determine the crops best adapted to an area. In addition, there are important differences within the countries in the roads, access to markets, and other infrastructural facilities that favor or limit production of some crops in an area. Thus, the dominant farming system of each area is determined by the interaction of ecological and social factors.

A look at the agricultural research organizations in these five small countries can give some understanding of the linkages that are needed to develop improved agricultural productivity.

The five Central American countries have central planning offices which are responsible to the governments for the formulation of plans that carry out the basic policies of economic development that have been decided upon. Insofar as agriculture is concerned, two kinds of product market are involved: internal and export. Although food crops and animal products may be exported, the major markets are for internal consumption, and the goal of self-sufficiency is a high priority in the national plans of all five countries. Since agricultural exports are the major source of foreign exchange, and economic development depends on a favorable basis of payments, great emphasis is placed on export crops and animal products.

While the annual range in temperature and sunlight is not great in these five tropical countries, there are very significant regional differences in the seasonal cycles of rainfall, and the average temperatures are cooler at high elevations than close to the sea level. Each of the countries has important regional climatic differences which determine the ecological zones best adapted to specific crops. Also, the historical development of each country,

since the Spanish conquest and independence, has influenced both land ownership and land use. The larger, more productive farms have been concentrated in the hands of politically influential owners who dominate the production of export crops. In Guatemala, in addition, there is an important part of the society which is ethnically quite separate, whose greatest concentration of population is on the high west cordillera.

As we might expect, agricultural research developed first as a result of the interest by producers of export crops in improved technology that would alleviate important production and marketing problems. The sponsorship of the research was crop-specific: bananas, coffee, sugar and cotton were the principal export crops and the production of each was the basis for associations of farmers growing them. In the case of bananas, the industry was developed largely with foreign capital, and was dependent on a few American and British shipping companies which plied the waters between the Caribbean and Pacific ports, American and European coastal cities. The production was managed in enclaves of these companies, and the production research was carried on by company personnel and their consultants. In the case of the other export crops, research on production problems was usually carried on by special groups of technologists whose research organization was financed by the governments involved. Thus, in Costa Rica, Guatemala, and El Salvador, separate coffee research institutes carried out the research work on those crops. In some instances, the crop associations supplemented government budgets in order to bring in consultants on specific problems. There was little interest in research on food and fiber crops for national consumption in these countries until after World War II. Then, it became evident that growing population and limited land resources made higher production per unit of land necessary in the less developed countries of the world, including Central America. This recognition was stimulated by the interest of industrialized countries, and resulted in the creation of the Food and Agriculture Organization of the United Nations, the Interamerican Institute of Agricultural Science in the Organization of American States, in formulation of agricultural research groups financed by philanthropic organizations such as the Rockefeller Foundation, and in the emergence of bilateral agricultural development programs financed by industrial nations including the United States (USAID), Canada, Great Britain, and European countries. Initially, these bilateral contracts emphasized the creation and strengthening of extension activities, on the assumption that the appropriate agricultural technologies were already developed, and what was needed was to transfer them to the less developed countries. The assumption proved to be erroneous (3).

In this same period, a long-term cooperative program, in which the Rockefeller Foundation worked with the government of Mexico in establishing a research staff to improve the production of maize and wheat, proved very successful and became the model on which the present international crop and research centers were based. As these international centers were becoming established, however, self-evaluation of their effectiveness in providing technology adapted by farmers were made. It became evident that the new technologies were adopted mostly by large, well-funded farmers, but had little effect on the small farmers who constituted the majority of the rural population (4). As a result of these findings, both the international centers and the bilateral programs for agricultural development have introduced research on the special economic restraints of peasant farmers (5).

One can see the effects of this evolutionary process on the agricultural research organization (7) of the Central American countries. For the purpose of this discussion, I will use the example of ICTA, the Guatemalan Institute of Agricultural Science and Technology, which was created in 1972. The figures given have been taken from a paper presented by Fumagalli and Waugh at a Bellagio conference in 1977. Figure 1 describes the relationships of ICTA to the other principal entities in the public agricultural sector of Guatemala. At the top, the national planning office, at the level of the presidency, specifies the guidelines under which the agriculture sector Planning Office develops. At the level of the Ministry of Agriculture, ICTA is one of six institutions in the public sector. Agricultural Extension is under the responsibility of DIGESA, which not only transmits the research results to the farmers, but also works with BANDESA, the agricultural credit bank, in planning and administering the provision of supervised credit to the farmers. INDICA, the marketing agency, is a separate entity.

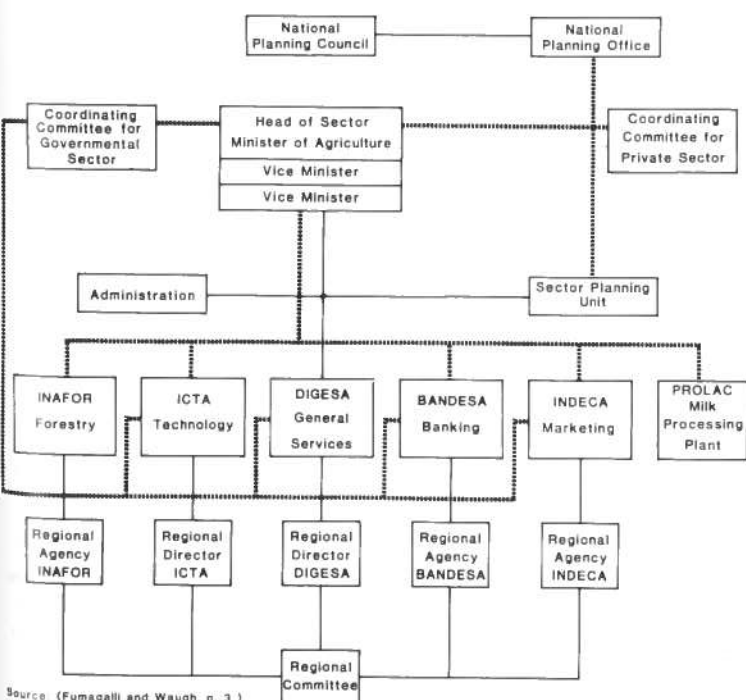
All six of these institutions are organized on a regional basis and their regional agencies are coordinated by a regional committee. The regions are identified in Figure 2. In general, the regions and subregions represent distinct ecological zones, and therefore distinctive crop and marketing constraints that determine the farming systems.

Figure 3 provides information on the internal organization of ICTA. The work is organized under the Technical Unit for Production. Seven crop production units, and one animal production unit, are identified. Soil management and socio-economics are separate disciplines. Training, communication, seeds, experiment stations, and laboratory analysis are separate services.

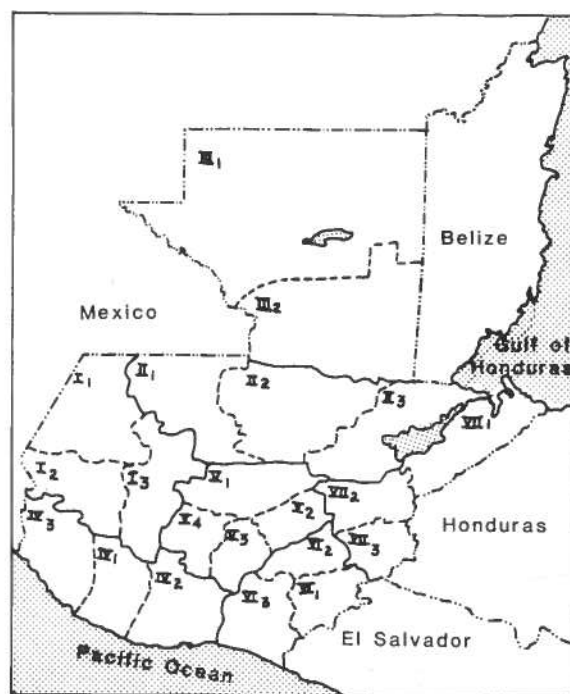
**Table 1: Some Statistics Relevant to Agricultural Development of the Five Central American Countries** (See references 1 and 2 for sources)

	Honduras	Guatemala	El Salvador	Costa Rica	Nicaragua
Population 1979 millions	3.1	6.8	4.5	2.2	2.5
Area in square miles	43.3	42.0	8.1	19.7	57.1
Populations in Agriculture % 1979	64.0	57.0	52.0	37.0	45.0
GNP per capita	400.0	700.0	530.0	1130.0	770.0
Economic land in crops 1976 (% total)	9.0	21.0	42.0	11.0	13.0
Fertilizer consumption kg/ha 1976	29.0	50.0	153.0	114.0	30.0
Tractor density (no ha/1,000)	1.2	2.2	4.5	12.0	0.9
GDP (% of 1970-77)* Agriculture	32.1	—	27.9	20.6	23.2
Exports (food) (% total 1977)	72.0	—	—	74.4	56.0

\* GDP is GNP less income from abroad.



**Figure 1: Public Agricultural Sector**



**Figure 2: Regionalization of the Public Agricultural Sector, Guatemala**

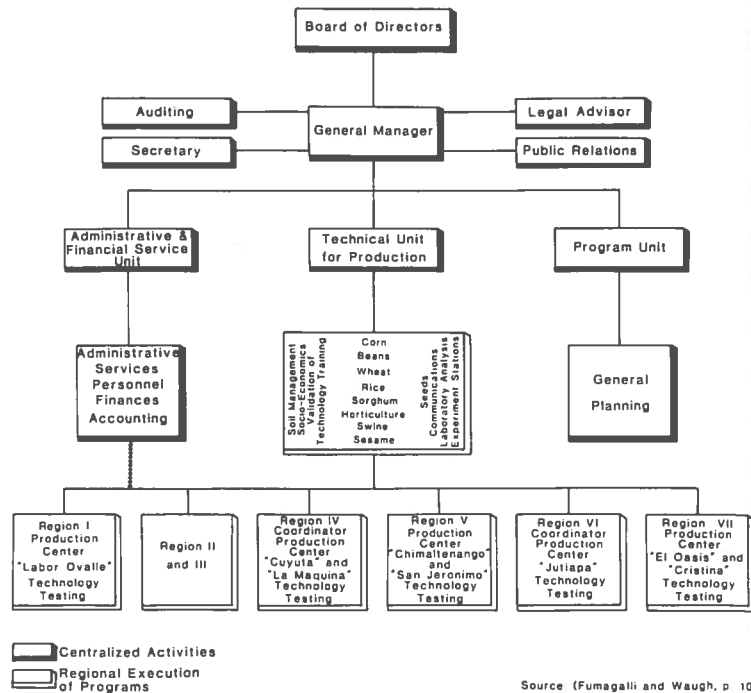


Figure 3: Organization of ICTA

Centralized Activities  
 Regional Execution of Programs

Source (Fumagalli and Waugh, p. 10)

Figure 4 shows the linkages of organizations outside the national agricultural sector, to the entities within it, in terms of the generation, validation, and transfer of new technology. The principal international agricultural centers operating directly in Guatemala are the Center for Improvement of Maize and Wheat in Mexico, and the International Center for Tropical Agriculture in Colombia. Both the Food and Agriculture Organization of

the United Nations, and the International Institute of Agricultural Sciences of the OAS, support several research and development programs in Guatemala. In addition, there are a number of bilateral contract programs supported by the United States, Canada, and European countries. Within Guatemala, there are important linkages with the University of San Carlos, in training engineers and agronomists with other governmental ministries and

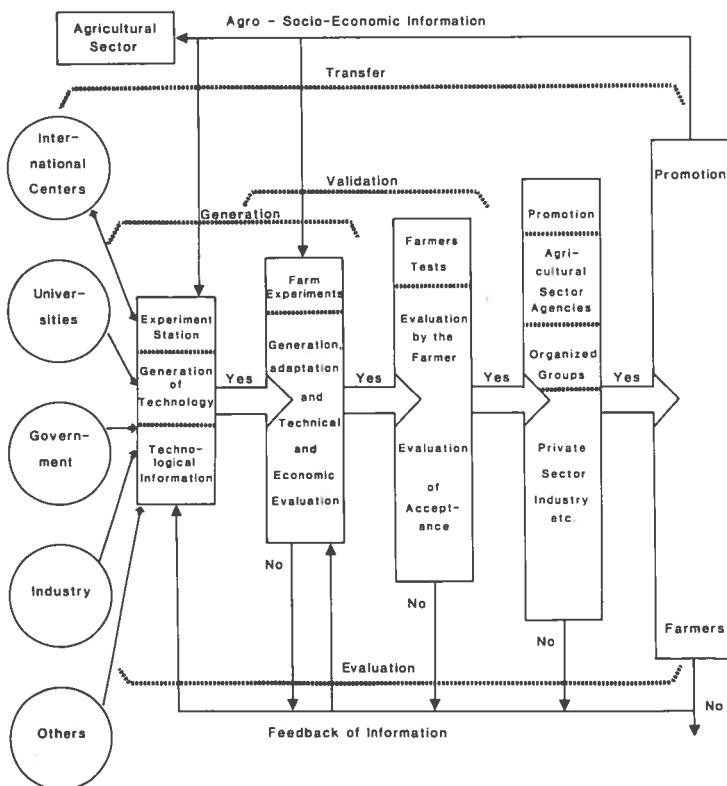


Figure 4: Technological System for Agriculture

Source (Fumagalli and Waugh, p. 14)

agencies, and with industrial organizations. Figure 4 also introduces the concept of feedback as a necessary process in the agricultural research program. I am sure that Dr. Hildebrand will deal with this in his discussion of linkages with farmers. ICTA was a pioneer in organizing its research with small farmers on the basis of socio-economic studies made in the communities to be served, and in the intense and exemplary conduct of the research, so that there would be interaction not only between agronomists and socio-economists, but also a continuous communication with farmers themselves.

## SUMMARY

The key scientific linkages basic to the success of ICTA's system are as follows:

1. Between the ICTA Technical Unit for Production, and external international and national institutions, whose programs of research and training can contribute to the capability of ICTA to generate useful technological information;
2. Between the ICTA Technical Unit for Production, and DIGESA and BANDESA, in the promotion and financing of production research technology and in the training of DIGESA and BANDESA technical personnel;
3. Linkages within the ICTA Technical Unit for Production of the agronomic and socio-economic units, both at the level of planning and in extension of the research activities.

In view of the relative instability and limited resources of the national institutions involved, dependance on international centers for generation of much of the fundamental research needed must be expected. The help of other international institutions and bilateral programs of agricultural development of industrialized countries can provide support for essential national research programs. The national agricultural research programs need to be oriented toward the most important practical problems limiting production of the basic food and export crops. A few carefully chosen experimental field stations representing the major ecological zones should concentrate on application of promising new technology to local problems. The major field research should concentrate on adoption of improvements at the farm level. These should be carried on with the combined participation of the research and extension personnel, in active cooperation with the farmers involved.

Although the organizational framework for ICTA

provides the opportunities to achieve these goals, its success in doing so depends on the development and retention of a core of well-trained professional staff members working as interdisciplinary teams within a relatively stable agricultural research system.

The other four Central American countries have agricultural research programs that are organized with variations on the above pattern. That of Honduras is modeled after Guatemala's. That in El Salvador is somewhat more centralized and has less linkage with small farmers than the others. Nicaragua was attempting to make clear linkages with the small farmers at the end of the Somoza regime. Costa Rica's was rather strongly regionalized and their personnel was the best trained and distributed. All five countries rely very heavily on assistance from international centers, international agencies, foundations, and foreign agricultural development programs for complementary help.

Subjects for further detailed study are the coordination of external assistance programs in the strengthening of agricultural research in small developing countries, and a centralized data bank using standardized methodology to provide information on ecological and socio-economic factors influencing agricultural development of small countries.

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