

OPPORTUNITIES FOR AGRICULTURAL RESEARCH IN THE TROPICS AND THEIR RELATION TO DEVELOPMENT*

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The tropical zone in this hemisphere has a land area of some six million square miles, roughly twice the area of the United States. The total population of this area is comparable with the United States, and with improved public health it is increasing rapidly. Like other tropical areas in the world, this zone is composed in the main of large areas of underdeveloped lands. A large portion of this is included in the hot, humid or arid tropics, or low lands ranging from sea level to about 2,500 feet elevation. At higher elevations in the Andean areas of South America and the Continental Divide of Central America temperate zone climate prevails and here agriculture is more intensively developed. However, population is outrunning production of food from the limited acreage that is available.

In this temperate zone agriculture has to some extent been improved, especially around the highland cities and adjacent to improved roads. However, we still do not have an alternate crop for the poor man eking out an existence on his eroding hill-side corn patch that barely supports his ever-growing family. Possibly fruit, nut and tree crops will be the solution to this problem. Any advances that have been made in this area have been due to scientific assistance from the Rockefeller Foundation, United States Government agencies such as Point 4 and its replacement A. I. D., Peace Corps., foreign companies and individuals. Changes have been brought about by the broad adaptation of scientific principles of crop production derived from the temperate zone area of developed countries and passed on to the farmers through extension of aid. However, I must emphasize that in these areas a decreasing rate of production per capita is rapidly developing. I can foresee the need of breeding programs and crop management for coffee and other large acreage-consuming crops to bring about increased production per acre in order to release productive land to the cultivation of desperately needed food crops. Further agricultural development in the temperate zone will go forward with relative ease, I believe, because of education and training of the coming generation; so now let us consider the real problem —What to do in the tropical area.

When traveling through tropical Central and South America one can see many results of foreign aid in new roads, schools, factories, dams and industrial development in general. Unfortunately, however, little progress can be seen in the advancement of agriculture as practiced by the vast majority of the people. Rural Latin America remains for the most part poor, ignorant

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and in need of great changes. Unfortunately this need for change may not even be realized by a portion of this rural population though there is increasing evidence that the small farmer of tropical America is ready and waiting for help. Recently Dr. T. W. Schultz, in commenting before the Agriculture Research Institute on the economic behavior of farmers in poor countries, said that contrary to published thoughts, these farmers do have the right motivation, do work hard enough, do save and are not indifferent to economic need. They do have behavior on a par with the farmers in the more forward countries. He found these poor farmers efficient for the resources they have, but unfortunately their return is very low for the effort put into the job. This condition is due partly to the magnitude of the problem and partly to the lack of a coordinated effort by the governments and international agencies involved. Money is provided in small loans to the farmer for livestock and improving his land, but in most cases he does not know how to use the money effectively. There is no large background of information based upon good farming practices resulting from research and trials as in the more advanced countries. Experimental stations are few and far between, and by the time limited funds filter through the various agencies, too little is left for effective research and extension.

I need not tell you in detail that other now considered progressive countries started out in the above fashion. Our own country—these United States—were for the most part in the same situation a little over a century ago. Let us not forget that our progress until today has not been easy, and we were fortunate in not having many of the built-in deterrents to progress such as hot climate all the year, excessive rainfall, and pests and diseases that are the big problems to be overcome by our friends and neighbors to the south.

My experience in living and working for a number of years in the tropical low lands of Central America, Colombia and Ecuador, leads me to believe that the program under consideration is of the utmost importance and should be implemented as soon as possible if we are to truly aid our Latin neighbors.

When asked to review this subject of today's briefing I posed the question to many of my friends and associates living and working in similar tropical areas now under discussion. The replies I have received teemed with excitement that now possibly something was being planned for the aid to and development of agriculture in the American lowland tropics. The suggestions for study covered agricultural development in the very broadest sense—from plant breeding to engineering of irrigation and drainage, road building, farm management, economics and marketing, meteorology, pest control and new crops.

The lowland area of the tropics has always had less appeal for the colonizers due to health hazards and climate discomforts. However, this is the available land that will have to bear the load of food production in the years to come. This tropical zone is capable of producing foreign exchange earning crops as well as supplying the important food substitutions so badly needed at this point by many Latin American countries to improve their balance of payments situation. Furthermore, it is the logical site to begin technological improvement of tropical Latin food crops such as rice, beans, yucca, corn,

platanos, and dooryard fruit and vegetables, and medicinal plants. Until the needs of human food requirements are met, production operations involving poultry, swine, dairying, and to a certain extent, fattening of beef cattle, will have to compete with humans for carbohydrates —a situation almost the reverse of that existing here in the United States.

The technological up-grading of the tropical zone will also require expensive outlays on the part of many government or private enterprises for reclamation projects such as flood control, drainage, and irrigation. Much of tropical America remains unproductive due to improper handling of impounded water sources. Many areas could double or triple production if existing available water supplies were better handled. Conservation is a problem which must be solved in the very near future. A program must be organized not just for a few but for all. The people have to be shown in some way that their future lies in the protection and preservation of the soil, plants and most important of all, water. Without such a program, the time and effort of reconstruction will be overwhelming and never really complete. Irrigation and drainage competence is generally deficient among Latin technicians but this can be corrected by post graduate training and reorientation of their engineers, who for the most part reside and work at their profession or in politics in the more comfortable highland zone.

One of the real potentials in the tropics lies in the field of improvement and market promotion for export of hot climate fruits, fiber, food and oil products that would find no opposition from the United States farmer. There are many tropical and sub-tropical plants which produce or could produce a saleable item in the world market which can be most easily and economically produced in this region. Some of the better known crops are African Oil Palm, coconuts, oil seed crops, rubber, abaca, kenaf, agave, tobacco, sugar, corn, yucca, cacao, platanos, bananas, teak and bamboo. There is need for intensive study of the economics and management of these crops. The relation of what can be practically spent in up-grading or increasing production of a given crop in relation to the present or improved market value of the crop needs to be known in more precise terms. Research information on these crops is generally in the hands of private enterprise commodity groups widely scattered throughout the region and is generally unavailable for reference, or the information is applicable to only a small region. There is no clearing house for gathering existing information, sorting it and adapting it to local situations and the extension of these techniques to the average farmer. As you are aware, several of the crops mentioned lend themselves to the "plantation system" by large companies, and these are subject to inherent social repercussions which bring these developers under the criticism of nationalistic or extremist groups.

Crops for local consumption, such as rice, beans, yucca, corn, platanos, vegetables and tropical fruits, could be up-graded by varietal improvement and breeding of disease resistance. Crop management, soil improvement, fertilizers and land working, pest control, harvesting, drying and storage facilities would greatly improve the economy of the tropical area. *Helminthosporium* continues to represent a major disease threat on rice, and the dual problem of controlling the insect vector and breeding resistant varieties for the control of Roja Blanca is still far from solution. Even the matter of

treatment of seeds against damping off and other seedling diseases is significantly neglected. We have reasonably adequate methods of controlling pests on these crops under large-scale or commercial acreage, but the means are not economically suitable for crops grown at subsistence levels. There is need for practical agricultural engineering to develop low cost pesticide application equipment. Most pesticides are formulated for use in equipment essentially designed for advanced farming areas, thus pesticide usage is restricted where such equipment is impractical to purchase or to use.

Vast areas in the tropical countries are suitable only for grazing lands, yet there is very little work being done on range management. Only the Rockefeller groups in Mexico and in Brazil have carried out research in this important field. Cattle production could be a major source of income, but little or no research is being done on the forage crops best adapted to the different climate zones. A tropical pasture legume needs to be found. Soils should be surveyed and mapped. Management procedures for growing and handling of forage and rotation programs for economic grazing are needed. For example, under certain conditions, burning of some grasses may increase yields if properly done. Experimentation with selective herbicides to up-grade the carrying capacity on brush infested pasture is badly needed since beef is raised almost exclusively on low yielding pastures because there is no source of inexpensive high protein concentrated feed. Animal nutrition, intestinal parasites and ticks are major causes of low yields of livestock. Information in this area, though available, does not filter through to the small operator and even then the costs of such treatments become a major expense that his limited income can hardly justify. Methods of combatting insect and disease problems based more on livestock management than insecticidal treatment are needed for the tropical farmer. Likewise, breeding and selection of livestock more tolerant of tropical climatic conditions is desirable in order to provide the small farmer with a more dependable and economical supply of food from animal sources.

Soils and climate vary tremendously often within a few miles, yet the adaptability of varieties of the major food crops —corn, bean, rice— to the local environment and its pathogenic flora and fauna has been determined for very few localities, usually around the capital or major cities. Not only do the best varieties have to be found or bred, they must be grown beside the local selection and the results shown to the small farmer. This is a continuous process, as new varieties are continually being developed even though few are adapted to the tropics.

There is little or no research underway on citrus, mangoes, avocados and numerous other fruit crops, yet small factories for processing fruit are being built. These produce high cost, fair to low quality products mainly because the raw products are high in cost and low in quality. Fruit production varies tremendously with the climate changes of altitude; thus, trials need to be carried out in the major altitude zones of the area. The same procedures also apply to vegetables.

Forestry is closely associated with agriculture in many parts of Latin America. Improved forest utilization in relation to agricultural practices needs to be studied. How to obtain maximum returns from the large areas where

cut over forests, grazing land, and cultivated fields exist together requires considerably more research in management of land and economic crop utilization. The farmer who has agriculturally unproductive pine lands bordering the low land area must be shown by research how these could be made productive for lumber, pulp, and resins, or cleared and planted to productive crops.

Conservation of timber resources at all altitude levels is rapidly becoming a major problem in Latin America and if something is not done soon to limit the wholesale destruction of the forest then conservation of soil and water will become an even greater problem. Water shed management techniques must be developed for the mixed forests of Latin America. The forests must be managed scientifically and correctly to provide maximum effectiveness for soil storage of existing rainfall and regulation of stream flow for downstream irrigation and drainage projects. Rapid destruction is being made in the present forests by lumbering increases and the Milpa system of agriculture. The Milpa system of cut-burn-plant-harvest, then move to new area to repeat the process is one of the oldest and yet the most inefficient systems of agriculture in our modern time. However, what can the small, poor farmer substitute for this system and how can he do it on steep slopes and with the small area of land available to him? The solution to this problem will require a vast research effort as the climatic conditions accentuate fertility, soil structure and erosion problems. An early solution to this is a matter of high priority and then the farmers have to be shown conclusively how it can be done.

Another area for aid development of basic food for survival as well as for foreign trade is in the fisheries industry for those countries having ocean boundaries or suitable lakes or rivers. Fish and shrimp farming is a practical possibility and with relatively little time lapse sizeable economic returns could be realized.

There are many more problems associated with agricultural development of the Latin American areas than just what crops to grow and how best to grow them. Governments must see the need to regulate import duties and influence developing industries in these countries so that agricultural equipment and supplies —fertilizers, pest control chemicals, seeds, etc.— are available at a reasonable cost commensurate with the value of the end use. Roads must be improved and maintained so that travel and transportation of goods out of isolated villages is possible and so that the small farmer can see what is in store for him if he works to improve his agriculture. The level of education must be raised and incentives added for those people indigenous to the area to become dedicated to helping solve the problems of advancing agriculture, and the individual illiterate farmer must be taught to use the research results. All of the effort which might be directed toward the desired improvements is futile if it is projected into a vacuum. Can some of this education problem be solved by placing research units in many different locales —each station concentrating on the problems of a relatively small area? These stations must be staffed by scientists who are devoted to the advancement of the area and who are willing to spend the greater part of their active scientific lives at this task.

If we could see in these tropical areas a new class of people, farmers who were reasonably prosperous and who could produce a little more than the needs of their families, I believe we would see a corresponding industrial and economic growth in these countries.