

The Rockefeller Foundation Program in the Agricultural Sciences¹

L. M. ROBERTS²

There are valid reasons for man's anxiety about his food supply. To increase the productivity of agriculture in the world, especially in those areas where agriculture is still underdeveloped, is a challenge of great urgency. The agricultural program of The Rockefeller Foundation was designed with this objective in mind.

The agricultural program of the Foundation began in 1943 when the Mexican government and the Foundation inaugurated a cooperative effort initially implemented by a one-man mission. The Foundation has been concerned with problems of human welfare throughout the world since it was founded in 1913, and it had from the beginning given special emphasis to the improvement of public health. Since nutrition plays such a basic role in determining the level of public health, as well as the level of man's productivity and general well-being, it is not surprising that the officials of the Foundation became interested in agriculture as a means of improving nutrition.

The decision to embark on an agricultural improvement program was not taken hastily, however. As a preparatory step, The Rockefeller Foundation in 1941 asked three distinguished scientists to study the situation in Mexico to determine whether it would be desirable and feasible for the Foundation to undertake a program in that country; and if so, to

recommend the type of work that should be attempted. This committee, made up of Dr. E. C. Stakman, Dr. Paul C. Mangelsdorf, and Dr. Richard Bradfield, reported that the opportunity was attractive for the Foundation to sponsor an operating program of agricultural research and training in cooperation with the Mexican government aimed at increasing the production of the basic food crops. Their recommendations also included certain guiding principles for the establishment of such a program.

The Mexican government promptly extended a cordial invitation to the Foundation and a formal agreement between them was signed in February, 1943, officially launching the cooperative program.

From the very modest start in Mexico 18 years ago the present agricultural program of the Foundation has developed. The pattern of cooperation developed in Mexico has since been extended to Colombia, Chile, and India and from it have evolved hemisphere-wide cooperative projects for the improvement of maize, wheat, and potatoes and a world-wide program of rice improvement. Although these cooperative programs are modest in terms of staff and financing, they have proved effective in contributing to the advancement of agriculture far beyond the boundaries of the host countries involved.

As in its earlier work in public health, the Foundation's activities in the agricultural sciences combine operating programs, awards to individuals for specialized training, and grants to institutions. I should perhaps explain that an operating program is one in which the Foundation takes an active part in administering

¹ Presented at Second Annual Symposium of The Society for Economic Botany: *Integrated Research in Economic Botany II. Nutrition for an expanding world population*. Massachusetts Institute of Technology, Cambridge, Mass., May 14, 1961.

² Associate Director for Agricultural Sciences, The Rockefeller Foundation, New York, N. Y.

research and training projects through resident staff members and makes direct contributions to their operating costs. Obviously, training awards and grants are valuable techniques in themselves, and the Foundation is using them in a number of countries where no operating programs exist, especially in Latin America, Asia, and Africa. It is the combination of these with an operating program, however, which best illustrates the Foundation's coordinated approach to improve research and education as basic steps toward increased agricultural productivity.

Since the Mexican program was the first operating program to be started and is the model on which the others have developed, I shall now focus attention on it to give a brief summary of its organization, operations, and some of its accomplishments.

The Mexican program was organized as an integral part of the Ministry of Agriculture, and to insure stability of organization and flexibility of operation, the Mexican government set up an Office of Special Studies with headquarters in Mexico City. As a joint dependency of the Ministry of Agriculture and The Rockefeller Foundation, and with semi-official status, the Office had a much greater degree of freedom of action than if it had operated strictly under official rules and regulations. The Ministry and the Foundation contributed to the operating costs of the Office, and also jointly provided the personnel from their own staffs to man the program. In addition, the Mexican government provided land, labor, office and laboratory space, and a portion of the machinery and supplies. The Office has now been absorbed into a consolidated research branch of the Ministry, as will be described later, but the essential features of the cooperative program continue as before.

From the beginning the program has had two primary functions. One is to conduct research directed toward increasing

the quantity and quality of the basic food crops. The other is to train young agricultural scientists so that they can assume as rapidly as possible the responsibilities for continuing the development of the agricultural sciences and the improvement of agriculture in their country.

When Dr. J. G. Harrar arrived in Mexico in 1943 as the first director of the new venture, he spent the first few months traveling widely to get to know the country, the people, the agricultural institutions of all kinds, and the agricultural potential, problems, and needs. Although the Advisory Committee had set forth in its original report some broad principles and basic guidelines for the development and operation of the program, others had to be worked out in this initial stage by Dr. Harrar. As the program has grown, additional principles have evolved, but the fact that the original ones developed by Dr. Harrar and the committee members have provided the base on which the agricultural activities of the Foundation have been built testifies to their vision and imagination.

Corn, wheat, and beans were the first three crops chosen for investigation. The Foundation soon assigned other agricultural scientists to the program and projects were begun to produce better varieties of these crops by selection and breeding techniques, to improve the soils and cultural practices which would increase their yields, and to investigate and control pests and diseases that limit their production. The plant breeders, the soil scientists, the entomologists, and the pathologists worked as a team to improve the production of these crops, with excellent results. This spirit of interdisciplinary cooperation continued as the program grew and other crops were added for investigation and improvement. In addition to corn, wheat, and beans, the program now includes improvement projects on potatoes, vegetable crops, sorghums, soybeans, rice, barley, and for-

age grasses and legumes. In 1955 a poultry specialist was added to the staff and soon afterwards a veterinarian was also added to work in animal pathology, emphasizing at first poultry diseases. Sections on agricultural economics and agricultural information have also been inaugurated, and a reference library has provided a necessary service practically from the beginning of the program.

In conducting the research projects, the program collaborates closely with the Ministry of Agriculture in developing and operating experiment stations. The cooperative program has had responsibility for developing a chain of four regional stations tied into the Central Research Center located on land of the National College of Agriculture at Chapingo, near Mexico City. The program also collaborates with different state governments and agricultural colleges in the establishment and operation of other experiment stations, and in addition experimental plantings are made on a large number of private farms.

The research and training activities developed hand-in-hand from the very beginning of the cooperative program. During the past 18 years over 500 young Mexican agricultural scientists have received in-service training in the cooperative program. They have been commissioned by the Ministry of Agriculture to serve internships for periods of a year or more under the direction of Foundation staff members. Practically all the former interns have continued in some phase of agricultural development work, and many now have important positions in one of the official or semi-official organizations involved in teaching, research, extension, and seed increase and distribution.

The outstanding trainees are awarded Foundation fellowships to take postgraduate studies in the United States, where to date 80 have earned a Master's degree and 18 have completed the requirements for the Ph.D. degree. These young sci-

entists who have trained in the cooperative program and have had advanced training abroad are providing most of the leadership in professional agriculture today in Mexico.

The Mexican program also serves as an international training center. More than 75 young agricultural scientists from other countries of Latin America have spent a year as trainees working and studying side by side with the Mexican interns. These men have been selected under the Foundation's scholarship plan from candidates who hold responsible positions in agricultural institutions in the different countries, and on completion of the training in Mexico, they have returned to their homelands to apply their new knowledge and skills to local problems. In addition, several hundred distinguished agricultural scientists from many parts of the world, some on Foundation travel grants and many on their own, have visited the program for shorter periods of time.

Although research and training are its two primary functions, the operating program makes important contributions to agricultural development in Mexico through several collateral activities. It collaborates closely with the colleges of agriculture, the federal and state extension services, and the agencies responsible for the increase and distribution of improved seeds. Perhaps the most valuable contribution that the program makes to these and other allied institutions is to provide them with qualified personnel through its training activity. Fellowships and travel grants are also used to help train a significant number of their staff members.

Assistance to the four colleges of agriculture in Mexico is given a high priority by the program. Over the years grants for increasing and strengthening faculties and for equipment and libraries have been made to these colleges by the Foundation.

Two years ago a Graduate School was

inaugurated at the National College of Agriculture at Chapingo. Several of the Foundation's staff were invited to help plan and develop this school and some have been given honorary professorships to enable them to participate in its teaching and research activities. Graduate students from several countries in Latin America are already enrolled. Since it is no longer advisable or feasible to send all of the qualified young agricultural scientists in Latin America to the United States for advanced training, the Foundation is especially interested in the new Graduate School and has recently made a substantial grant to assist further in its development.

The program helps to promote extension work in Mexico in several ways. It has had for several years an information service whose function is to put research results into terms which can be easily conveyed to the farmers by the extension agents. The information is adapted for dissemination through all the principal media—bulletins, circulars, newspapers, radio, television, and movies. Although the cooperative program is not directly involved in extension, many of its research activities serve as demonstrations for the public, especially the numerous regional adaptation trials made on private farms. In addition, each experiment station has one or more field days each year for farmers, and it is not uncommon for more than a thousand people to attend one of these.

In 1952 the State of Mexico launched the first state extension service in Mexico. In 1953 the Ministry of Agriculture reorganized and enlarged the National Extension Service. The cooperative program has provided trained personnel, improved varieties, information, and technical consultation to these. In addition, the Foundation has supported them through grants to provide equipment and visual aids.

Benefits of the research results are also

extended to the farmers through the work of the agencies within the general structure of the Ministry of Agriculture responsible for increasing and distributing the seeds of improved varieties. The program furnishes these agencies with basic seed stocks of new varieties, counsels them on technical problems, and helps to train the personnel for their staffs.

Time will not permit a comprehensive review of the principal results and benefits that have come from the Mexican program, so only a few general comments will be made about these. When the program started, Mexico imported over 50 per cent of the wheat that was consumed annually and usually had to import some of the corn it needed. Now Mexico produces all it requires of both crops even though the population has increased approximately 13 million or 60 per cent in the past 18 years. The Food and Agriculture Organization of the United Nations recently reported that Mexico has had a 7 per cent annual increase in agricultural production during the past ten years, incidentally among the highest in the world, while the population was growing at an annual rate of 3 per cent, also one of the highest anywhere. Such an achievement is due, of course, to contributory factors from many different sources, but the improved varieties and better farming methods, and the significant number of trained agronomists developed by the cooperative program, have had an important role in making it possible.

In 1960 the officials of the Ministry and the Foundation mutually decided that the point had been reached at which it would be desirable to place more of the responsibilities for the direction, administration, and execution of the research program on the Mexican scientists who have been trained in considerable numbers to shoulder them. As a consequence, a new organization, the National Institute of Agricultural Research, has been established recently in the Ministry to consolidate all

federal agricultural research in a single administrative branch. With the creation of this institute, the Office of Special Studies has been discontinued and its functions are being integrated with those of the new organization. The staff of the Foundation will now retire more into the background as regards administrative matters and will gradually withdraw to advisory roles in the research projects. This move is an important milestone along the road to the ultimate goal, eventual withdrawal, set for the cooperative program when it began in 1943.

Four new international programs, all less than two years old, have evolved from the operating programs.

One is the inter-American corn improvement project. Since 1954 the Foundation has sponsored a regional corn improvement project in Central America. Its success prompted the next step, to extend this type of assistance to all of the countries of the Western Hemisphere. The Foundation provides a staff member to coordinate the activities which basically consist of regional cooperative trials, exchange of genetic stocks and information between the cooperators in the different countries, regional meetings of the corn breeders, and training programs. The improved varieties and lines from the Mexican and Colombian programs are made freely available to the cooperators. The vast reservoir of indigenous races of maize in the corn germ plasm banks in Mexico and Colombia are being studied and evaluated on an international scale with the help of some of the leading United States scientists and the corn breeders of Latin America.

The international wheat improvement project is operating along the same general lines throughout the Americas and in addition is collaborating with FAO of the United Nations in wheat improvement in the Near and Middle East. The project already has uniform yield experiments planted in 15 different countries.

At the present time seven young wheat breeders from the Near and Middle East are training in the operating program in Mexico. The inter-American potato improvement project was launched within the past few months.

The International Rice Research Institute is in the initial stage of development at Los Baños in the Philippines. The Ford Foundation has appropriated approximately \$7,000,000 for buildings and equipment, the College of Agriculture of the Philippines provided the land, and The Rockefeller Foundation is providing technical direction and administration of the Institute and funds for operating expenses. The Institute is governed by an autonomous Board of Directors composed mainly of representatives from countries of the "rice bowl" of Southeast Asia. Both basic and applied research will be conducted on the rice plant and on all of the factors having to do with its yield and quality.

The use of fellowships, scholarships, and travel grants to complement the training activities in the operating programs has been described. Similar awards are also employed in practically all the countries of Latin America, several in the Orient, and more recently in some of the African nations. Approximately 500 fellowships have been awarded to agricultural scientists from some 50 countries, and over 350 scholarships have been given to representatives of 25 countries since the beginning of the program. The travel grant is another technique used to broaden the experience of mature, senior scientists. These are not limited to individuals from underdeveloped countries as are the fellowships and scholarships.

A grants program to support research and education is the third major area of activity in the Foundation's program in the agricultural sciences. The grants to institutions in the underdeveloped areas are primarily for developmental purposes, while those in the United States and Eu-

rope support very fundamental types of research.

Eighteen years of experience have shown that the pattern of activities of the Foundation's agricultural program is a useful one in helping to improve the world's agriculture. The program is relatively small both in staff and finances. The staff in Mexico at its maximum size numbered only 18. At present fewer than 50 staff members work in the whole program. In 1960 the total budget for Agricultural Sciences was approximately \$6,700,000. Limitation in size has been an advantage for it has tended to stimulate an intensification of effort with emphasis on quality. In this regard, the care which has gone into the selection of the field staff must be mentioned. This has been a major factor in determining the success of the program. The individuals chosen to work in a technical assistance program must have not only technical competence but also a broad spectrum of personal qualities that will permit them to work effectively and happily in a foreign environment. The fact that positions with the Foundation offer permanent career opportunities with reasonable assurances of stability, advancement, and agreeable conditions for family life makes it possible to attract individuals of high caliber.

The program has had other important advantages. From the beginning it has operated under a stable policy backed by stable support. The program in Mexico, and other operating programs likewise, was started with the understanding that it would be self-liquidating but also with the equally important understanding that a rather long and indefinite period would

be required before the Foundation would be able to withdraw completely from the task. The Foundation has gladly given increasing support to this operation over the past 18 years as it has grown in response to opportunities, keeping in sight all the while the ultimate goal of eventual withdrawal.

The program has had the good fortune of receiving warm acceptance, understanding, and support from government officials, collaborating scientists, and the general public in the different countries where it has activities. This is very important, for technical assistance can be effective only where there is a strong local desire to receive and make use of it. Also the collaboration which the program has received from institutions in the United States, especially the United States Department of Agriculture, the different colleges and universities, and the National Research Council, has been of great assistance.

Under the most favorable circumstances the process of extending technical knowledge and modernizing agriculture in the underdeveloped areas of the world is a relatively slow one in comparison with the present rate of increase in population. The social, economic, and political problems involved are numerous and complex and the progress on any single front such as agriculture cannot proceed much faster than the rate of general advance on the other closely related fronts such as general education, total economic productivity, health, political stability, and general social progress.