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Halfway There: Social Science *in* Agricultural Development and the Social Science *of* Agricultural Development

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This chapter examines the contribution of the social sciences to international agricultural development efforts and suggests ways in which this contribution might be enhanced. Although there has been substantial progress involving agricultural economics in the agricultural R&D process, the full value of social research in this realm has still to be recognized. A social science *of* agricultural development has not yet been incorporated into the international agricultural research centers (IARCs), the Collaborative Research Support Programs (CRSPs), USAID, or other similar efforts. While we can praise the efforts of social scientists working in agriculture, I will argue that an effective social science of agricultural research and development is even more important in such settings.

To illustrate, I present a particular case, the history of Mexico's agrarian change, outline how it has been affected by the Mexican Agricultural Program (MAP) established by the Rockefeller Foundation during the early 1940s; by its successors, the National Institute of Agricultural Research (INIFAP) and the International Maize and Wheat Improvement Center (CIMMYT); and by collaborative work between INIFAP and U.S. universities, most recently under the auspices of the International Sorghum/Millet Project (INTSORMIL). This case illustrates that a social science of the agricultural development process has been consistently and explicitly excluded from consideration, and that this has been a small part of the reason why technological modernization of Mexico's agriculture has been accompanied by continuing underdevelopment.[1]

SOCIAL SCIENCES IN AGRICULTURAL DEVELOPMENT

While many early efforts could be cited, the social sciences have only relatively recently been incorporated into international agricultural R&D. Their tardy arrival relates partially to disciplinary concerns within those social sciences most relevant to international agricultural development. Rural sociologists were preoccupied with consolidating their own particular niche in the U.S. land-grant system and thus focused principally on domestic concerns. Anthropologists tended to view "culture as if it were cast in concrete" (Whyte 1984) and often characterized themselves as defenders of traditional cultures. Anthropologists also often adopted an elitist attitude as pure scientists of the study of humans and their culture, seeing agriculture as too basic and mundane for their attention (see Netting 1974, Rhoades 1985:4). Agricultural economics was viewed as more immediately relevant and was incorporated much earlier, but even then there was little consciousness among biological scientists as to what was expected of economists. Ruttan's experiences when he reached the International Rice Research Institute are exemplary.

> When I arrived at IRRI, I was shown to an office in the very attractive new institute complex. The office was conveniently located near the library. It had a brass plate in the door with the label Agricultural Economics. In the weeks that followed, however, neither the director nor the associate director of IRRI conveyed to me a very clear idea of why they needed an agricultural economist or what contribution they expected from the economics unit at IRRI (Ruttan 1982:308-309).

In spite of a slow start, social scientists have gained a toehold in international agricultural development. Perhaps the most important reason behind their incorporation was the Foreign Assistance Act passed by the U.S. Congress in the 1970s. The bill includes legislation that has come to be called the New Directions mandate because it emphasizes considerations of equity rather than economic growth. The mandate highlights the importance of measures to increase income redistribution, the selection of labor-intensive appropriate technologies to help generate employment, participation of beneficiaries in the decision-making process, and adaptation of programs to local social, ecological, and cultural conditions. Further amendments have added an emphasis on helping people meet their "basic needs" of adequate nutrition, shelter, clothing, health care, and education (Hoben 1980:356). A special section on agricultural research in the act states:

> Agricultural research carried out under this Act shall (1) take account of the special needs of small farmers in the determination of research priorities, (2) include research on the interrelationships among technology, institutions, and economic, social, environmental, and cultural factors affecting small farm agriculture, and (3) make extensive use of field testing to adapt basic research to local conditions (Foreign Assistance Act 1979, Section 103(a)).

The passage of this legislation had several impacts favorable to the involvement of social sciences. One was that social soundness analyses of projects within USAID became required in 1975. Second, USAID missions were required to produce Country Development Strategy Statements that included analysis of the socioeconomic conditions of the poor and the reasons for their deprivation. Third, the Title XII amendment, "Famine Prevention and Freedom from Hunger," established U.S. universities as resources for increasing food production and distribution in developing countries. This clause led to the development of the CRSPs. Fourth, the Percy Amendment on Women in Development elevated women and their special concerns into the consciousness of development planners. Fifth, the emphasis on small farms and the extensive use of field testing in agriculture in turn led to an emphasis on farming systems research (FSR). The New Directions mandate thus brought socioeconomic and equity issues to the forefront of USAID and essentially demanded the involvement of social scientists. In terms of anthropology alone, the effects were quite dramatic. The number of anthropologists working in USAID quickly jumped from only one in the early 1970s to 22 by 1977 (Hoben 1980:364).

The currents affecting USAID were also felt in other agricultural R&D settings. One of the most significant concomitants was the creation of the Rockefeller Foundation "Social Science Research Fellowship in Agricultural and Rural Development" in 1974. By 1984, 33 scientists (21 of whom were anthropologists) had been placed in the IARCs (Rhoades 1985:5). Also, increased attention was given to FSR in the international centers (DeWalt 1985b, CGIAR n.d.:Part IV, Chapter 16:13-14). Presently, several have established farming systems types of programs; three (IRRI, ILCA, and CIMMYT) have economics programs; all but one have economists working in some capacity; and two—CIMMYT and CIP—employ anthropologists as senior scientists.[2]

Several recent books have documented the role that the social sciences can play in agricultural research and development. These include *The Role of Anthropologists and Other Social Scientists in Interdisciplinary Teams Developing Improved Food Production Technology* (IRRI 1982), *Coming Full Circle:Farmers' Participation in the Development of Technology* (Matlon et al. 1984), *Breaking New Ground:Agricultural Anthropology* (Rhoades 1985), and *Putting People First:Sociological Variables in Rural Development* (Cernea 1985).[3] Nevertheless, what social science has contributed thus far is only part of what it could conceivably contribute. The vast majority of efforts to date fall under the rubric of what I call social sciences *in* agriculture.[4] What I mean by this is: how social scientists contribute to the improvement of project functioning, usually by providing descriptive information that facilitates the identification, diffusion, and adoption of new technology created by biological scientists.

This is what has come to be expected of social scientists in international agricultural R&D. For example, Horton (1984:11) reports that on CIP projects in the Mantaro Valley of Peru, "anthropologists and sociologists proved to be extremely effective in delimiting agroecological zones, classifying farm types, appraising the socioeconomic viability of alternative technologies, and conceptualizing new approaches to research and training." A review of the achievements and potential of the IARCs contains an appraisal of what social scientists have to offer in FSR: "The purpose in such work is to assist in the identification of effective changes to and designs of practices, techniques, enterprises, activities and policies that are acceptable to and appreciated by the target groups in farming systems research" (CGIAR n.d.:Part IV,Chapter 16:14). A very similar list of research problems appropriate to anthropologists and sociologists is found in the IRRI report mentioned above (1982:98).

Because they are first and foremost *technology generation programs*, the IARCs, FSR types of programs, and the CRSPs have created a small but significant role for social science in agriculture. Technical scientists assume that the agricultural technology generated can help solve the problems of small farmers in developing countries. The role of social scientists is thus to further the goals of the biological agricultural scientists in agriculture by acting as, in effect, *cultural brokers* between farmers and researchers. This is made most explicit in Rhoades and Booth's (1982) model for generating "acceptable agricultural technology." In their farmer-back-to-farmer model social scientists should come to an understanding of farmers' perspectives and needs, communicating these to other scientists who use the findings to design better, more appropriate technology. Ideally, the technology is next tested and adapted on farm. Social scientists then observe farmers' reactions and communicate their evaluations to the technical scientists, at which point the cycle can begin again.

In this model, social science provides an important service to both farmers and researchers by brokering the communication between them. Particularly in organizations such as CIP, where social scientists have been thoroughly incorporated into multidisciplinary teams to address technological problems, the model works very well (DeWalt 1983, Rhoades 1985). This service-oriented research, however, is only a part of what social science has to offer. In my view, equally and perhaps more important is a social science *of* agriculture.

THE SOCIAL SCIENCE OF AGRICULTURE

Several important issues are being only minimally addressed by social sciences in agriculture. First, issues of equity are being partially addressed through attention to the special technological needs of small farmers. Yet, there is very little effort to monitor the benefits of new technology to small farmers versus other elements of the population. While much is made of paying attention to the small farmer, it is still not clear that the technology being generated is in fact small-farmer biased.

Second the New Directions mandate and other statements have stressed the need to promote labor-intensive technology to generate employment. However, indications are that jobs in the agricultural sector are being lost rather than generated (e.g., DeWalt 1985a, 1985c). Does this have to do with the technology being generated, with government policies that run counter to the goals of agricultural R&D, or with other trends that are unrelated to agriculture? Much more research is needed regarding the interrelationships of technology with the institutional structures and the economic, social, and cultural settings within which it will be used – as the Foreign Assistance Act mandated.

Finally, minimal attention has been paid to assessing the social and ecological soundness of new technology and programs. Those social soundness analyses that have been done are often largely pro forma; questions have been raised about whether ecological analyses have any impact on the kinds of projects funded (Rich 1986). In any case, such analyses have seldom been carried out by social scientists affiliated with any of the major agricultural R&D institutions. Instead, they are typically done by outside consultants hired by USAID, the World Bank, and other donor organizations specifically to satisfy the legislated requirement.

These are the sorts of issues that can be meaningfully addressed only by a social science *of* agricultural development. What I mean by this is the study of the interaction of the natural environment, sociocultural patterns, market conditions, government policy, and technological systems in order to identify agricultural research and/or extension priorities, to determine appropriate institutional structures and responsibilities for research and extension, to predict the consequences of agricultural change, and to identify government, agency, and institutional policies that will facilitate the development of more just and equitable social systems. Rather than performing a service-oriented role within a system in which policies have already been established, a social science of agriculture should provide an ongoing critique (both positive and negative) of R&D programs; it should also be a key element in the *formulation of policies* that will guide and direct them.

This focus explicitly recognizes that research itself is fundamentally a political process (Busch 1986). This process applies both to social and non-social agricultural research. Therefore, a major purpose of a social science *of* agriculture should be to examine the larger structure within which agricultural technology is generated and used, and explicitly to address issues of who is likely to gain or lose from the technologies being developed.

Unfortunately, this kind of research is viewed with suspicion by many biological scientists in agricultural development, most of whom still see themselves as doing "pure" research for its own sake and/or for the good of humankind. What is not recognized is that an "apolitical" stance is itself a very powerful political statement. In dismissing much of social research as "too political" and, in effect, suppressing a social science of agriculture, the research system has made some very clear political choices.

This can be demonstrated with data from Mexico, the country in which institutional efforts to apply agricultural research and technology to the solution of food and agriculture problems were first made. This case is especially interesting because we can see a consistent pattern of choices about issues of equity and social science involvement in research, starting with the Rockefeller Foundation's Mexican Agricultural Program in the 1940s and 1950s, carrying through CIMMYT's efforts beginning in the 1960s, and affecting the work of the INTSORMIL in the 1980s. A failure to incorporate social understanding, planning, and monitoring into the technology-generation program may have exacerbated, rather than alleviated, the problems of rural Mexico.

THE MEXICAN CASE: TECHNOLOGICAL MODERNIZATION WITHOUT DEVELOPMENT

During the early 1940s, the Rockefeller Foundation began discussions with the Mexican government about sponsoring a new research program to raise agricultural productivity and improve human nutrition in Mexico by applying modern technology. The foundation established the Mexican Agricultural Program (MAP) to work with an Office of Special Studies (OSS) within the Ministry of Agriculture in 1943. The purpose of the OSS

> was to increase the production of varieties, the improvement of the soil and the control of insect pests and plant diseases. A corollary goal was to train young men and women in agricultural research and in the development of techniques for promoting the rapid adoption of the new technology (Wellhausen 1976:128-129).

Because maize and wheat together accounted for over 70% of Mexico's cultivated land and were the most important food crops, primary emphasis was placed on them. The MAP, OSS, and their successors are very important in the annals of agricultural research. They mark the beginning of attempts to apply research breakthroughs made in U.S. and other Western agriculture to less developed parts of the world, thereby establishing the precedent for the IARC system (Plucknett and Smith 1982).

For this reason, it is important to understand the positive and negative aspects of the development of the Mexican Agricultural Program. Jennings (n.d.) has produced an interesting and controversial history of MAP. He points out that only a few individuals questioned the directions that the Rockefeller Foundation program was taking soon after its establishment. Two criticisms of this program, however, were quite prophetic.

First, during the early 1940s when MAP was just beginning, an outstanding cultural geographer of Latin America, Carl Sauer, recommended that agricultural research be directed toward the rural poor. He noted that the nutritional and agricultural practices of small Mexican farmers were quite sound, and that their main problems were economic rather than cultural. Sauer cautioned against attempts to recreate the model of U.S. commercial agriculture in Mexico.

> A good aggressive bunch of American agronomists and plant breeders could ruin the native resources for good and all by pushing their American commercial stocks. . . . And Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly. The example of Iowa is about the most dangerous of all for Mexico. Unless the Americans understand that, they'd better keep out of this country entirely. This must be approached from an appreciation of native economies as being basically sound (quoted in Oasa and Jennings 1982:34).

However, influential people in the Rockefeller Foundation dismissed Sauer's warnings as merely an appreciation of the quaint customs of the Mexican peasantry and a resentment of any attempt to change them.

A second question arose concerning the political, economic, and social effects of the new technologies being developed by MAP. A report prepared in 1949 by John Dickey (then president of Dartmouth College) noted:

> For example, I can imagine that this program before long might begin to have a considerable impact upon the whole land use policies of Mexico, and I am perfectly sure that within three to five years the program will raise some very acute problems with respect to the political control of these benefits. . . . These very benefits may introduce fresh economic disparities within the Mexican economy, which will present political problems not now even dimly perceived by many Mexicans (cited in Oasa and Jennings 1982:36).

Rather than suggesting research and other measures to cope with such potential problems, Dickey's recommendation was to avoid the issue: "it would be unfortunate for all concerned, especially for the program itself, if the foundation is heavily in the picture when this growth in social tensions takes place" (cited in Oasa and Jennings 1982:36). Dickey recommended that the foundation confine its responsibility to scientific experiments so that it would not be identified with any problems arising from the effects of the new technologies.

The posture adopted by Dickey and the Rockefeller Foundation in Mexico is similar to that taken later by the IARCs. Some of the most thoughtful individuals in the CGIAR centers are very careful to indicate that they deal in intermediate goods (germplasm, training, and other expertise) that national programs then use to produce the final results that are disseminated to farmers within their countries. Given the difficult political contexts and funding constraints under which the IARCs operate, this is an understandable position. In this way also, the centers can deflect potential criticisms concerning the political, economic, and social effects of the new technology they create. But this posture leads agricultural science to continue to treat rural underdevelopment as a *technical problem* rather than one stemming from a combination of factors of which technology is only one aspect.

Thus, just as the warnings of people such as Sauer went unheeded, and just as the agricultural research system tried to dissociate itself from the socioeconomic and political problems that Dickey identified, and just as the Rockefeller Foundation's Program continually ignored calls for the involvement of social scientists in MAP, so the social science *of* agriculture was ignored when CIMMYT and the other IARCs were established. The "image of neutrality" (Jennings n.d.) that agricultural scientists in Mexico in the 1940s and 1950s cultivated as assiduously as their experimental plots continues to the present day. Although Mexico has achieved some remarkable success in modernizing its agriculture, the process has led to substantial social, economic, and political problems. These issues are addressed more fully elsewhere (Barkin and DeWalt 1985; DeWalt 1985a; DeWalt and Barkin 1986, Hewitt de Alcántara 1976), but some of the main concerns are summarized here.

Mexico's First Green Revolution: Wheat

There is little question that MAP succeeded in increasing the productivity of some of Mexico's crops. As Figure 2.1 demonstrates, average wheat yields have more than quadrupled since MAP's establishment in 1943. Production increased from an average of only 425,000 tons per year in the early 1940s to over 4,500,000 tons in 1984. A large part of this increase was due to two plant-breeding breakthroughs applied by the Rockefeller Foundation and the OSS—the creation of semidwarf spring wheats and of varieties insensitive to differing day lengths (Borlaug 1983).

However, these "miracle seeds" were only part of the story. As Wellhausen (1976) and Hewitt de Alcántara (1976) have emphasized, the

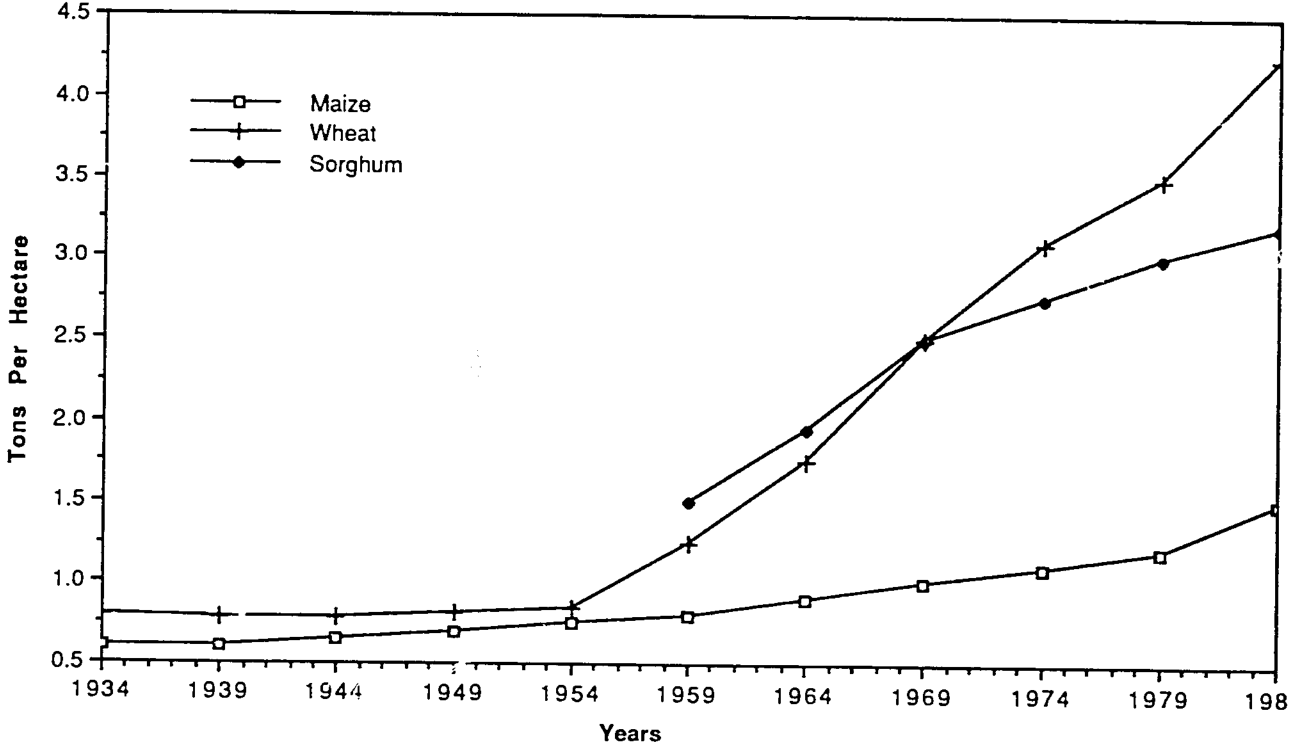

FIGURE 2.1. YIELDS OF MAIZE, WHEAT, SORGHUM 1934-1984

seeds also required irrigation, more fertilizer, more effective control of weeds and insects, mechanization, and better land management. These were often subsidized by the Mexican government. The government also invested in other infrastructure, most notably roads, railroads, and storage facilities necessary to effectively market the new wheat varieties. Finally, wheat production did not substantially increase until the government established a guaranteed price that was considerably above the world market price for wheat at the time. This subsidy, which lasted from 1954 to 1964, amounted to about 250 million pesos per year (Hewitt de Alcántara 1976:308-309). Thus, the first green revolution was to a considerable extent subsidized by a drain on the Mexican treasury.[5]

As one might expect, given the extensive hydrological, technological, and chemical inputs required, wheat was and is generally grown by larger, commercial farmers or by those small farmers or *ejidatarios* with access to credit. In 1977, 82% of the land in wheat was irrigated, 98% was fertilized, and improved seeds were used on about 91% of the hectares (ha) planted (Barkin and Suárez 1983:84). Larger landowners generally benefited most from the miracle wheat (Hewitt de Alcántara 1976).

While average yields continued to increase (Figure 2.1), the first green revolution sputtered during the 1960s and 1970s. Land planted in wheat peaked in the subsidy years of the late 1950s (Figure 2.2). Over 950,000 ha were planted in 1957, but an average of fewer than 750,000 were planted between 1975 and 1980. It was only in the early 1980s, with substantial increases in guaranteed prices, that this figure began to rise again. Because of ever-expanding demand, the country has had to import large quantities of wheat in almost every year since 1970.

The maize program of MAP and its successors never achieved the same level of technological and genetic improvements as did the wheat program. Average yields of maize have not increased nearly as rapidly as those of wheat (Figure 2.1). Consequently, maize production has followed a rather bumpy trajectory; the amount of land planted in maize has never again reached 1966 levels (Figure 2.2). Principally because maize yields remain low, farmers have turned to other crops that are economically more competitive. Maize continues to be grown mainly by small farmers using rudimentary techniques, few inputs, and traditional varieties of seed. The result is that between 1980 and 1984, maize imports represented almost one-quarter of national production, rising as high as 35% in 1980 and 1983 (Barkin and Suárez 1986:Table 19).

Two of the main architects of MAP and CIMMYT have admitted that, in retrospect, much more attention should have been paid to breeding maize varieties that would meet the needs of the resource-poor small farmers who grow the crop in rainfed areas (Borlaug 1983:691; Wellhausen 1976:150).[6] However, the point is that there were many calls for just such programs

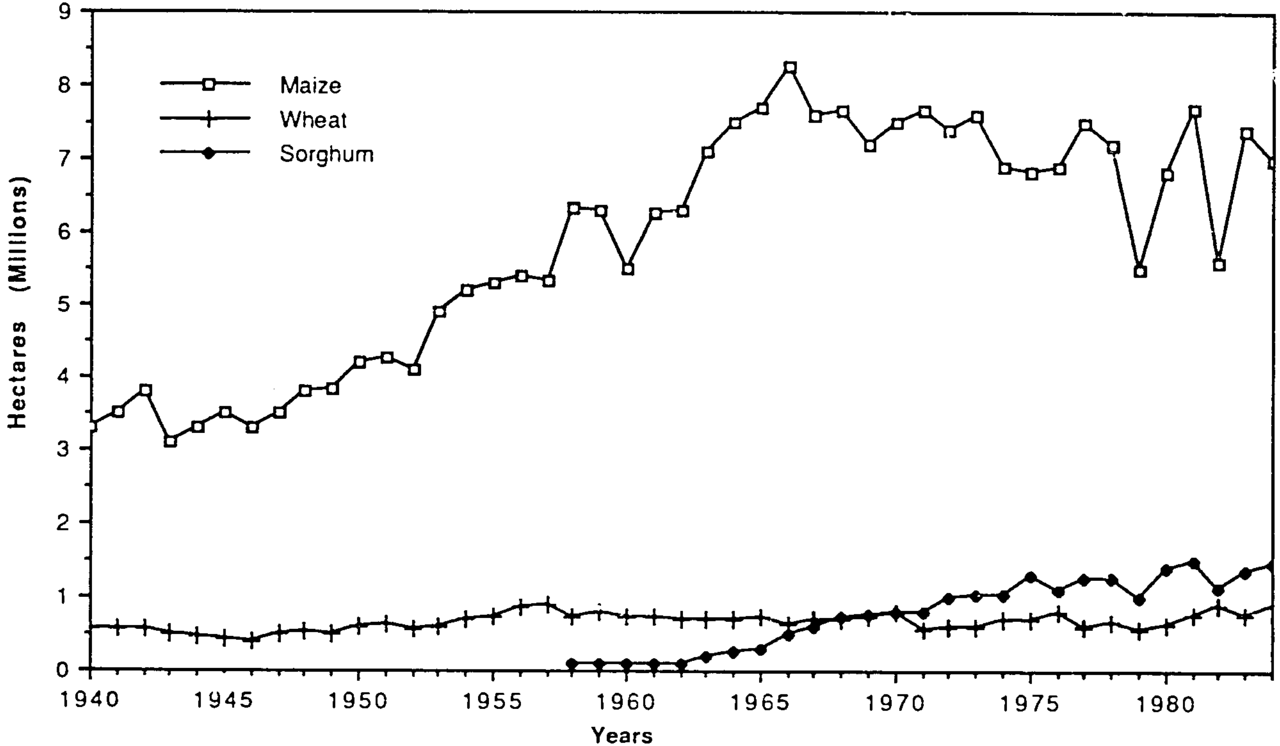

FIGURE 2.2. LAND SOWN IN MAIZE, WHEAT, SORGHUM 1940-1984

during the 1940s and 1950s by both social and non-social scientists; calls that were largely ignored until recently. Perhaps the greatest irony for MAP and its successors is that their major impact has been with a crop only belatedly included in their work—sorghum.

Mexico's Second Green Revolution: Sorghum

Sorghum, an important food crop in Africa, was unknown in the traditional agriculture of Mexico. Aside from a few unsuccessful experiments during the first half of the century, it was not cultivated systematically. In 1944, however, OSS agronomists began experimental work with the crop. They hoped that a drought-tolerant sorghum would help areas marginal for maize, those in which rainfall was either limited or poorly distributed (Pitner et al. 1954:1).

Although sorghum did not figure in the Mexican diet, promoters of sorghum research did not consider this a problem. They pointed out that the grain could be used by livestock, as it was in the United States. Still, a few doubts were raised about the wisdom and appropriateness of sorghum research for Mexico. For example, during program discussions in 1956, the head of MAP's poultry project noted that if MAP's objective was improved nutrition, then putting animals into the food chain between plants and people might be an inefficient use of grains. Even then, poultry was competing for grains with people, and he wondered "whether this is sound in Mexico" (quoted in Jennings n.d.:108). The question was raised, but like other questions dealing with the social goals and objectives of the research program, it was largely ignored. In 1957, the Rockefeller Foundation's annual report on MAP noted:

> Interest in sorghums has grown considerably during the last year principally because of the rapid expansion of the livestock industry, especially pork and poultry production. As a result of recent heavy demand, the price of sorghum grain in Mexico City has increased (Rockefeller Foundation 1957:77).

In short, as the demand for sorghum grew, MAP's emphasis on food grains was lost, along with its original goal of creating sorghum varieties for marginal, rainfed areas of the country.

In 1958, the government began to collect statistics on sorghum for the first time. The crop's history since then is nothing short of spectacular (Figure 2.2). Between 1965 and 1980, when the land under cultivation in Mexico was growing at a rate of 1.5% per year, the area planted in sorghum was increasing by 13% per year. By 1984, sorghum occupied over 1.6 million hectares—about one fourth the area of maize, and about 50% more than the area of wheat, the miracle crop of the first green revolution (Figure

2.2). In 1986, sorghum occupied the second largest area of any crop sown in Mexico, and the country has become the fifth largest producer in the world. Despite this, Mexico is not self-sufficient in sorghum. In some recent years, there has been a demand for 50% more sorghum than is produced nationally. Moreover, Mexico has become the second largest importer of sorghum from the United States.

Two principal factors fueled this second green revolution (DeWalt 1985a). First, sorghum production in Mexico benefited technologically from hybrids developed in Texas in the 1950s (Quinby 1971:17-19), which MAP worked to adapt to local conditions. Mexican farmers quickly recognized these hybrids' productivity and began replacing maize with sorghum or introducing sorghum into newly opened areas. As Figure 2.1 shows, the average yields of sorghum are about 80% higher than those of maize. Where the two crops have been directly compared under similar technological circumstances, sorghum yields were 40% higher on irrigated lands and 89% higher on rainfed lands (Montañez and Aburto 1979:145).

The second reason why sorghum is so popular among Mexican farmers is that it requires much less labor than does maize. The biggest advantage is that sorghum harvesting is mechanized; combines replace the many workers that still hand-pick maize in most of Mexico. The sorghum goes directly from the combine into trucks that haul it to markets where it is purchased—usually by one of the multinational livestock feed producers. Mechanized planting and cultivating of sorghum (or maize) reduces labor requirements by approximately 50%. Combine harvesting of sorghum reduces the remaining need for labor by roughly another 50% (DeWalt and Barkin 1986). Mechanization and sorghum cultivation have had a substantial effect on farming and employment in rural Mexico. Both large and small farmers have found mechanization attractive because of the decreased wages they have to pay. Unfortunately, the result is declining rural employment opportunities and rising rural out-migration.

To give just a small indication of the magnitude of this process, Tables 2.1 and 2.2 present data from research in four sorghum-producing areas in Mexico.[7] Out-migration in search of work has been substantial in all four; 66% to 95% of household heads in the communities have at one time or another left the village to work; many have joined the flow of illegal migrants to the United States. In the case of these four communities, more people have gone to work in the United States than to Mexico City. The same is true of their sons and daughters. As Table 2.2 demonstrates, 37% to 56% of the children over the age of 15 have had to leave their communities to live and work elsewhere. The favorite destination in every community but one (El Porvenir) is the United States. Such patterns may have developed anyway, but mechanized production of sorghum has certainly exacerbated them.

TABLE 2.1. OUTSIDE WORK EXPERIENCE FOR HOUSEHOLD HEADS FROM FOUR COMMUNITIES IN RURAL MEXICO

	Las Bateas, Michoacan (N = 83)		Derramaderos, S.L. Potosi (N = 60)		El Porvenir, Tamaulipas (N = 75)		Quebrantadero, Morelos (N = 97)	
	N	%	N	%	N	%	N	%
Have worked outside community	55	66	57	35	51	68	59	61
WHERE[a]								
Mexico, rural	31	37	39	65	48	64	12	12
Nearby city	12	14	22	37	24	32	20	21
Mexico City	8	10	3	5	1	1	14	14
U.S., rural	21	25	48	80	17	23	6	6
U.S. city	14	17	27	45	6	8	15	15

[a]Percentages sum to more than 100% because several people have worked in multiple locations.

TABLE 2.2. PRESENT RESIDENCES OF CHILDREN AGE 15 BORN TO HOUSEHOLD HEADS IN FOUR RURAL COMMUNITIES

Place of Residence	Las Bateas, Michoacan		Derramaderos, S.L. Potosi		El Porvenir, Tamaulipas		Quebrantadero, Morelos	
	N	%	N	%	N	%	N	%
Home community	116	51	98	44	101	63	142	55
Nearby city	24	11	7	3	17	11	5	2
Same state	22	10	11	5	20	13	23	9
Other states	12	5	28	12	12	8	27	11
Mexico City	9	4	6	3	0	0	30	12
U.S.	44	19	71	32	9	6	30	12

With the technological changes that occurred in Mexican agriculture, grain production in Mexico by 1980 was approximately eight times greater than in 1940, while population only trebled during this period (DeWalt 1985a: 44–45). Given such data, one would have predicted in 1940 that Mexico would have solved its food availability problems.

Such is not the case, however. The modernization of Mexican agriculture, especially since 1965, has been characterized by phenomenal growth in the livestock sector, especially among pigs, chickens, and cattle (Table 2.3). This expansion has taken place through increasingly "industrialized" production. As part of this process, growing numbers of animals have been inserted into the food chain between grains and people—just as the head of the MAP poultry program warned in the 1950s. The expansion of sorghum production must be evaluated in this context because sorghum accounts for approximately 74% of all industrialized livestock feed sold in Mexico (DeWalt 1985a:43).

Land use in Mexico has been changing even more rapidly than Dickey might have expected; the fastest-growing sectors of Mexican agriculture have been feed grains and oil seeds (Yates 1981). The basic grains for direct human consumption (i.e., maize, beans, and wheat) have been increasingly displaced by soy, alfalfa, sorghum, oats, and other cultivars intimately related to "modern" agricultural and livestock production (Table 2.3).

Enormous quantities of natural resources are now devoted to meat production. The proportion of cropland devoted to livestock production rose from about 5% in 1960 to over 23% in 1980 (Barkin 1982:66-67); and 64% of the national territory reportedly is used to produce only 3,140,000 tons of meat, a yield of only 24 kg per hectare (García Sordo 1985:8). The proportion of grain fed to animals has increased from 4.8% in 1960 (Meissner 1981) to over 32% in 1980 (DeWalt 1985a). More recently the Programa Nacional de Alimentación estimated the proportion of feed grain to be as high as 48% of the total apparent grain consumption (*UnoMasUno* 10 January 1985:1). Mexican nutritionist Chávez has likened this use of grain to the miracle that Christ performed with the loaves and the fishes, but in reverse (Chávez 1982:9).

The social benefits of the use of cropland, grains, and the 74 million hectares of pasture (DeWalt 1985a:51) devoted to producing livestock are very poorly distributed. Although per capita consumption of meat is about 42 kg per year (DGEA 1982a:16), the government itself reported that in 1980 over 25 million Mexicans (more than 35% of the population) *never* eat meat, and less than 30 million drink milk regularly (see also Redclift 1981:13-14). Although many occasionally consume eggs and milk, it is clear that the distribution of animal products is sharply skewed toward the upper- and middle-income groups (González Casanova 1980). Malnutrition is widely accepted as one of the country's gravest public health problems. When in

TABLE 2.3. ANNUAL RATES OF GROWTH OF SOME IMPORTANT INDICATORS FOR UNDERSTANDING THE AGRICULTURAL SITUATION IN MEXICO

	Hectares	Hectares	Annual Percent
Basic Grains (1,2)	1965	1982	
Maize	7,718,371	5,744,249	-1.7
Beans	2,116,858	1,581,000	-1.7
Wheat	858,259	1,017,359	1.0
Rice	138,065	156,317	0.7
Feeds (1,2)			
Alfalfa	106,252	242,379	5.0
Oats (feed)[a]	16,550	251,716	28.1
Grain sorghum	314,373	1,275,212	8.6
Cultivated pastures		2,044,527	39.7
Oilseeds (1,2)			
Safflower	58,805	189,045	7.1
Sesame	267,234	91,013	-6.5
Soy	27,466	375,238	16.6
Animals (3)[b]	(tons)	(tons)	
Pigs	572,894	1,365,414	8.2
Chickens	215,485	482,491	8.4
Cattle	624,956	1,200,544	6.1
	1940	1982	
Cultivated Area (4)	5,900,000	16,000,000	2.4
Irrigated Area (4)	1,700,000	16,000,000	2.4
Population	19,763,000	71,464,000	3.1

Source: (1) DGEA 1981, (2) DGEA 1983a, (3) DGEA 1982b, (4) DGEA 1983b.

[a]These figures date from 1971, the year in which data on oats for feed began to be collected.

[b]These figures date from 1972, when the DGEA first began collecting data on animal production.

1980 the Mexican government launched its short-lived drive for food self-sufficiency, the Sistema Alimentario Mexicano (Austin and Esteva 1987), it estimated the daily calorie and protein intake of 19 million Mexicans (more than 27% of the population) fell below that required for physical well-being (summarized in Redclift 1981:13-14). Another source reported that about 40 million Mexicans (more than half of the population) are seriously undernourished (Universidad Nacional Autónoma de México/Instituto Nacional de Nutrición study cited in 18 August 1984 issue of *UnoMasUno*).

Thus, the modernization of Mexican agriculture has not been accompanied by an improvement in the conditions of life for most rural Mexicans. There is substantial unemployment or underemployment in rural areas; many Mexicans migrate to cities or to the United States to try to earn a livelihood; and widespread undernutrition and malnutrition exist despite the huge increases in grain production in the country.

CONCLUSIONS

I should emphasize that MAP and its successors were not the major causes of the problems plaguing Mexico's agriculture and food systems. Government policies and priorities have been the principal factors in creating what is widely recognized as one of the most unequal societies in the world (González Casanova 1980). Yet MAP and its successors continually skirted the crucial agrarian and social issues that were evolving contemporaneously with their agricultural research. The MAP research program created new technology that fit into a Mexican agricultural system in which small farmers became increasingly unable to compete. Social scientists and others warned the agricultural research establishment of the dangers inherent in such efforts. But rather than heed these warnings and employ social scientists to identify appropriate technology for small- and medium-size farmers so as to avoid potential pitfalls in new technology, program decisionmakers and biological scientists considered social research irrelevant or simply dismissed it. When, in the late 1950s and early 1960s, a MAP agricultural economist began to advocate more attention to the needs of small farmers, he was replaced by other investigators less prone to raise such issues (Jennings n.d.).

Some social science research was initiated within CIMMYT in 1970, although the Economics Program was not established until 1979. However, the individuals staffing this program have never focused on the potential social and economic consequences of technology as part of their research mandate. Instead, most of their efforts have centered on identifying appropriate technologies for defined sets of farmers and on devising methods to disseminate technologies developed at CIMMYT (Oasa and Jennings 1982:38–39). CIMMYT's Economics Program today clearly follows the tradition of social science *in* agriculture, as a service-oriented appendage to the maize and wheat programs. In this, they have been quite successful. Their work in on-farm research and FSR methodologies is outstanding (Byerlee et al. 1980; Byerlee et al. 1982; Collinson 1983). A good indication of their status within the system is that the former director of the Economics Program has now become director general of CIMMYT. A social science *of* agriculture, however, is excluded from this and other programs in the IARCs.[8]

The situation in the IARCs carries over to the CRSPs. When I presented some of the data in this chapter to a 1984 meeting at CIMMYT on Sorghum in Latin American Farming Systems, a meeting I co-organized (Paul and DeWalt 1985), the reaction of my INTSORMIL colleagues and their Mexican collaborators was very hostile. The response was quite surprising because, from my perspective, my recommendations resulting from this work were relatively innocuous. I recommended that research focus on sorghums that could be used for direct human consumption and on drought-tolerant varieties for marginal, rainfed areas of the country (DeWalt and Barkin 1985). These were the original goals of OSS and MAP scientists—to increase food availability in the country and to cultivate sorghums for the marginal areas where maize was not viable. Instead, the vast majority of the research on sorghum in Mexico focuses on hybrid sorghums, which are suitable only for animal feed and irrigated zones of the country.[9]

U.S. and Mexican biological scientists at the INTSORMIL conference at CIMMYT were proud of their accomplishments and of the success of sorghum in the country; they viewed my research as a direct attack on them and their work. Given these kinds of reactions, it may not be possible for anthropologists and sociologists to do both social science *in* and *of* agriculture simultaneously. The sometimes critical perspective of the latter may preclude the acceptance of social researchers by their biological, agricultural scientist colleagues involved in technology creation. This is unfortunate because there should be room for a self-critical perspective within the IARCs, the CRSPs, and other such organizations. When criticism comes from outside the system, it is often destructive and leads to vituperative and unproductive debate.

A good example is the literature on the green revolution worldwide. IARC social scientists who studied the effects of the green revolution were primarily concerned with documenting its spread and benefits. (An excellent recent example is the work of Herdt and Capule 1983.) Criticisms of its impacts had to come from outside the system, and these were quite stinging in their indictments (e.g., Griffin 1974; Hewitt de Alcántara 1976; Lappe and Collins 1979; Pearse 1980). For more than a decade, unproductive debate has centered on whether the green revolution was "good" or "bad." Evenhanded assessments that point out the very substantial positive benefits of the green revolution while also indicating some of its unintended negative effects are still difficult to find (see Lipton with Longhurst 1985 for the best attempt to date).

Thus, while much good work in the social science of agricultural research and development has been carried out both domestically (e.g. Busch 1980; Busch and Lacy 1983; Friedland, Barton, and Thomas 1981) and internationally (e.g., Griffin 1974; Hewitt de Alcántara 1976), it seems that most of this work will have to occur outside the agricultural establishment.

There is a very unfortunate lack of explicit recognition that socioeconomic and political issues within and among nations are the principal problems of developing countries. The attitude should not be that agricultural R&D cannot do anything about these issues. Such an attitude only perpetuates and promotes the present emphasis on a "technological fix" that will solve some problems in the absence of a better socioeconomic or political situation. Because it chooses to ignore social science *of* agriculture issues, the agricultural technology being created often exacerbates existing socioeconomic and political difficulties. Biological agricultural scientists must acknowledge that social science expertise can be useful in directing R&D programs, identifying appropriate organizational forms for research and extension systems, anticipating some of the potential problems arising from technological change, and assisting governments to design workable agricultural, food, and nutrition policies. Collaboration and teamwork among biological scientists and social scientists to reach their shared humanitarian goals is sorely needed.

Thus, I return to the title of this chapter. The social sciences are perhaps only halfway to making a real contribution to true agricultural development. Social researchers must be involved not only as service-oriented appendages of biological research programs, but also as leaders in identifying technologies and policies to implement positive programs and mitigate negative consequences of agricultural change. Such efforts can help engender the more just and equitable social systems envisioned in the New Directions legislation of the 1970s.

NOTES

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1. When I refer to social sciences here, I am focusing principally on sociology and anthropology, though much of my argument also applies to agricultural economics.

2. Despite the progress that has been made, there are still relatively few social scientists among the large number of agricultural scientists. Van Dusseldorp has estimated that for every thousand scientists in agricultural research centers, only one is an anthropologist or sociologist (1977). More recently, Rhoades reported that of 736 senior scientists employed by the CGIAR system, only three are anthropologists (1985:50). To my knowledge, no sociologists are employed as senior scientists in any of the IARCs.

3. The large number of anthropologists who have conducted applied

social research in agricultural R&D settings has made a significant impact. There is now a recognized subdiscipline of agricultural anthropology, and an organization known as the Anthropological Study Group on Agrarian Systems publishes a bulletin titled *Culture and Agriculture.*

4. The *in* and *of* distinction is borrowed from Straus's (1957) discussions of sociology in and of medicine.

5. It is important to emphasize that the results of the OSS wheat-breeding program changed the face of world agriculture through what became known as the green revolution. However, it was largely left to social scientists and others outside the Rockefeller Foundation (and later the CGIAR structure) to question the socioeconomic effects of the green revolution. In recent years, social scientists associated with the CGIAR system have begun a couterattack with a new revisionist view of the green revolution. These individuals, justifiably, want to demonstrate results from the CGIAR system so as to assure continuing donor support (Buttel 1986). More evenhanded analyses of the positive and negative aspects of agricultural research are just now beginning to appear, some of which have been undertaken at the behest of the CGIAR system (de Janvry and Dethier 1985; Lipton with Longhurst 1985).

6. Wellhausen was one of the first agricultural scientists to recognize the disparities MAP was creating. He persuaded the Rockefeller Foundation to establish what has become known as the Puebla Project to try to determine how new technologies could be spread to resource-poor farmers. In a 1986 personal communication, Wellhausen stated: "We urgently need to come up with some special strategies for gaining a more rapid adoption of adequate technologies by small- and medium-size farmers especially in the rainfed, more unfavorable agricultural areas. The International Centers are beginning to realize this and are emphasizing, more than ever before, the development of varieties of food crops with greater stability under conditions of drought and problem soils." He went on to indicate also that "your work is fundamental to getting on with Mexico's second step in agricultural development."

7. These data were collected as part of a collaborative project between INTSORMIL and the Universidad Autónoma Metripolitana-Xochimilco in 1984. Four sorghum-growing farming communities (*ejidos*) were selected in different ecological regions of the country. Farm families were interviewed concerning their work histories, farming practices, nutritional strategies, household characteristics, income sources, and other topics. A full analysis of these data in book form is in process. More details concerning sampling procedures and other data on the communities may be found in DeWalt and Barkin (1986) and in the case-studies report issued by the Universidad Autónoma Metropolitana Unidad Xochimilco (1986).

8. A few CIMMYT researchers have recently begun to conduct "farm-based policy research" (Martínez 1986). However, the starting point of their analysis is clearly the farm, so it does not (and probably cannot) stray far into more political kinds of analysis.

9. Some food-quality varieties that are adapted to high, arid valleys are now being bred in Mexico, by researchers from ICRISAT in collaboration with researchers in INIA. It is ironic that, although much of this research was carried out under the auspices of INTSORMIL, the findings and ideas have had little effect on INTSORMIL work in Mexico; but they have been quite influential with ICRISAT researchers (Guiragossian 1986:320–334).

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