

Peasant Friendly Plant Breeding and the Early Years of the Green Revolution in Mexico

JONATHAN HARWOOD

Despite their success in boosting cereals production overall, the Green Revolution programs of the 1950s and 1960s were often criticized for failing to achieve their declared aim of alleviating world hunger. Most critics argued that the programs had produced a technology unsuited to the needs of small peasant farmers. This paper explores why such inappropriate technology might have been developed, focusing on the early years of the Rockefeller Foundation's Mexican Agricultural Program (MAP). It shows that some foundation officers as well as agricultural advisors had prior experience of the problems faced by small farmers in the United States and elsewhere. Moreover, the foundation's expressed concern for rural poverty does not appear to have been mere posturing by an organization anxious to be seen as an agent of philanthropy. Furthermore, the program's early work in maize-breeding was well tailored to the conditions of Mexican agriculture. Once the MAP was up and running, however, it became apparent that the task of getting new varieties and cultivation practices to small farmers was going to be difficult. Needing to make some kind of impact quickly, MAP staff chose to concentrate upon projects that were likely to find a rapid uptake. This meant setting aside the needs of peasant farmers to develop high-yielding varieties suited to large commercial farms.

THE AGRICULTURAL DEVELOPMENT PROGRAMS COLLECTIVELY known as the “Green Revolution,” initiated in the 1940s with funding first from the

JONATHAN HARWOOD is recently retired as professor of history of science and technology at the Centre for the History of Science, Technology & Medicine, University of Manchester, UK. He is the author of *Styles of Scientific Thought: the German Genetics Community, 1900–1933* (1993) and *Technology's Dilemma: Agricultural Colleges between Science and Practice in Germany, 1860–1934* (2005). His current project is a study of the movement for peasant friendly plant-breeding in Central Europe, 1890–1945.

Rockefeller Foundation and later from the Ford Foundation, were remarkably successful in some respects but disappointing in others. On the one hand, within a relatively short time various developing countries increased cereals production several fold so that imports were no longer necessary. On the other, after three decades it was clear that the programs' declared aim to alleviate world hunger had not been realized; in some regions where Green Revolution programs had been in operation, rural poverty (effectively synonymous with hunger) actually increased. The explanation for this outcome, advanced by a number of critics during the 1970s, was that the high-yielding plant varieties and intensive cultivation techniques produced by the Green Revolution were adopted primarily by large commercial farmers. Peasant farmers, in contrast, lacked both the capital and the appropriate growing conditions, such as irrigation, necessary to take advantage of the new technology.¹

Why did the Green Revolution's agricultural scientists pursue such an inappropriate—peasant unfriendly—form of plant breeding? Several explanations are conceivable. In view of the sharp decline in small farms in both Western Europe and the United States, especially since the 1950s, some observers might be tempted to conclude that the revolution developed a technology suitable for large commercial farms because there was simply no alternative. That is, there was no advanced technology available in the 1940s and 1950s that could have boosted the productivity of small farms. This explanation is untenable, as technology suitable for peasant farms was developed during the green revolutions that started in Western Europe during the late nineteenth century. For example, in German-speaking Europe several states established plant-breeding stations around 1900 that explicitly aimed to bring the benefits of advanced breeding technology to the peasant farmers who predominated in those regions, and the evidence indicates that these efforts were successful in invigorating regional agricultural economies. One consequence of such policies in Germany was that the only size-category of farms to increase (both in number and in proportion of the total acreage) between the late nineteenth century and the 1960s was that of ten to twenty hectares (twenty-five to fifty acres). During the 1940s and 1950s when the classic foundation-sponsored Green Revolutions for the developing world were being planned, therefore, a successful European model for promoting small-farm productivity was available.²

Were the Green Revolution's designers simply unaware of European policies, perhaps seeing them as irrelevant for American conditions where farms were on average far larger? Or were they familiar with European developments but took the view—sometimes expressed by US secretaries of agriculture during the 1950s and 1960s—that small farms were not worth bothering with since they could never be as efficient as large ones? Were they aware of the European approach but preferred to take the path of least resistance, thinking that it would simply be easier to work with large farmers who tend to embrace new cultivation methods? Or were foundation officials worried that targeting peasant farmers for assistance might be seen by host governments as an unwelcome “political” intervention?³

These questions can be answered by looking at the early history of the MAP, the first of the Green Revolution programs undertaken by the Rockefeller Foundation. Most historians of the MAP tend to emphasize the extent to which the program's advisors and staff relied upon an American model of agricultural development that was largely inappropriate for Mexican conditions or have questioned the MAP's commitment to alleviating rural poverty and hunger. While this is probably an accurate characterization of the program in the 1950s, it does justice neither to the original design of the program in the early 1940s nor to the initial aims of its maize-breeding work. Thus, the program underwent a substantial shift between the 1940s and 1950s.⁴

In fact, the foundation's agricultural officials were almost certainly aware of European developments, and some of them, as well as advisors to the MAP, also had first-hand experience of the problems faced by small farmers in the United States and elsewhere during the interwar period. Furthermore, perhaps surprisingly, the foundation's declared aim of alleviating rural poverty was not just posturing by an organization anxious to be seen as an agent of philanthropy; some foundation officials and advisors appear to have been genuinely concerned to improve rural living standards through increasing the productivity of peasant farms. In addition, the program's early work in maize breeding indicates that rather than just trying to develop American-style hybrid maize varieties for Mexican conditions, the breeders used quicker methods to produce varieties more appropriate for the circumstances of poor farmers. Once the MAP had been running for a few years, however, it became apparent that

the task of getting new varieties and cultivation practices to small farmers, though urgent, was going to be difficult, not least because the MAP possessed neither the facilities nor the formal authority to undertake this task on its own. Faced with the need to make some kind of impact quickly, MAP staff chose to concentrate upon projects that were likely to find a ready audience. This meant setting aside the needs of peasant farmers to develop high-yielding varieties especially suited to large commercial farms. In effect, the program was abandoning its original aim of alleviating rural poverty.

The Rockefeller Foundation's interest in agricultural development did not begin with Mexico nor were its agricultural advisors unaware of the problems of peasant agriculture. Before the First World War, for example, the General Education Board (GEB) had funded extension programs in the American South, and during the 1920s the International Education Board's (IEB) support for European higher education had included agriculture. Among the agricultural experts associated with the IEB the most important was A. R. Mann. Dean of Cornell University's School of Agriculture, Mann was the board's director of agriculture from 1924 to 1926; and during the 1920s he visited the major European experiment stations on its behalf, alert to the possibility that American agriculturists might have something to learn from them. Among the sites he visited were German plant-breeding stations, and although his diaries do not single out their peasant-friendly orientation for comment, he seems to have been aware that European peasants had different needs from most American farmers.⁵

Unlike some of the IEB's other advisors, Mann was not single-mindedly in favor of supporting "fundamental research" in the agricultural sciences. Foundations, in his view, could pursue two quite different paths toward improving production. One of these was to fund work aimed at longer-term improvement, the other was to support "practical measures" that would convey best practice to farmers, as the GEB had done before 1914.⁶

This practical emphasis was also evident in the foundation's support for agricultural development in China. In 1924, for example, Mann agreed to provide IEB funding to support a "Cooperative Plant Improvement Program," which would send breeders from Cornell University to the University of Nanking. The program was tailored in a number of respects

to the needs of small farmers. The Cornellians, for example, ignored the requests of Chinese cotton-mill owners and chose to focus instead on the major staple crops, among them sorghum because of its ability to withstand drought. And they chose to use selection rather than hybridization because it was cheaper and faster. Part of the program entailed funding Chinese students to study plant breeding, but an American agricultural scientist advised the board that it would be a bad idea to send young Chinese to study in the United States because they would come back with “an American training that doesn’t fit Chinese conditions.” The conditions in question included the fact that average farm size was only 3.5 acres, and the breeders realized that this made Chinese peasants necessarily cautious about adopting new varieties (unlike their American counterparts who had land to spare for risky trials). This meant that extension was crucial—a point that the breeders eventually recognized. Though the program’s breeding work managed to acknowledge peasant needs, however, in one historian’s view breeders never fully solved the dilemma of extension. To what extent Rockefeller agricultural advisors learned a lesson from this experience is not clear, but it is interesting that in its subsequent China Program between 1935 and 1937 the foundation took the view that the program’s agricultural work should focus upon the application of existing knowledge and its dissemination rather than upon research.⁷

This emphasis upon “practical measures” and extension may have characterized the GEB’s Southern Agriculture Program, which Mann directed from 1936. Before he took over the program, it was concerned with public education, “negro education,” and (from 1933) with southern white colleges and universities. In 1936, however, the program’s declared aim was to strengthen those areas of education and research that dealt with the economic and social problems of rural areas.⁸

After the end of the IEB in the late 1920s, Mann continued to play a major role in Rockefeller agricultural programs, initially as director of the Southern Agriculture Program and then as vice-president of the foundation. It was natural, therefore, that he was consulted on the design of the Mexican program, and from 1946 he served as part-time officer in the Division of Natural Sciences with responsibility for the MAP. It is thus largely through him that the foundation’s pre-war experience in agriculture was brought to bear upon the MAP. As planning for the new

program got underway, a Survey Committee (later the Advisory Committee for Mexican Agriculture) was also set up late in 1941—consisting of a plant pathologist (Elvin Stakman), a plant breeder (Paul Mangelsdorf), and a soil scientist (Richard Bradfield). These three, along with Mann, effectively designed the MAP.⁹

Although the publicly declared aim of the MAP was to alleviate poverty and hunger, this does not mean that it was necessarily prompted by humanitarian concerns. Indeed, officers and advisors on occasion attributed a strategic political significance to the program:

Communism makes attractive promises to underfed peoples; democracy must not only promise as much, but must deliver more. . . . Asiatic and other underprivileged people attribute their present plight to the domination of the capitalist colonial system. . . . In this struggle for the minds of men the side that best helps satisfy man's primary needs for food, clothing and shelter is likely to win. . . . Appropriate action now may help [people of developing nations] to attain by evolution the improvements, including those in agriculture, which otherwise may have to come by revolution.

Additionally, foundation officials were aware that the early 1940s was a good time in which to launch an aid program in Mexico since the newly elected Mexican government appeared more interested in cooperating with the United States than its predecessor (which had nationalized the oil industry without compensation).¹⁰

But how serious were officials and advisors about reducing rural poverty and hunger in Mexico? Considering the general aims of the original MAP, it appears that those involved agreed that it was important, not simply to boost agricultural production overall (which could have been achieved by targeting assistance just to large commercial farmers), but also to alleviate hunger and low standards of living among Mexican small-holders. Indeed, the original suggestion to establish an agricultural program in Mexico came from staff in the Rockefeller's International Health Division, who thought that it would usefully complement their existing public health program in Mexico. This idea of integrating public health with agricultural development—an early example of what was later regarded as best practice in development policy—found favor with the Survey

Commission in 1941, with Warren Weaver in 1946, and with Stakman in the early 1950s although it seems not to have been implemented.¹¹

In addition, program designers were aware that alleviating rural poverty would mean addressing the specific needs of peasant farmers and would require more than just the use of commercial inputs. Both scientists and officials were clear, for example, that it would not be possible merely to apply established American cultivation methods to Mexican farming. In its report to the foundation following the first exploratory visit to Mexico in 1941, for example, the Survey Commission noted that they had assessed the state of Mexican agriculture: “Not solely by American standards but in the light of the history and traditions of the Mexican people. It would be wholly impossible, even if desirable, to impose the modern American culture upon Mexico; any improvement that is to be brought about must come within the framework of Mexican culture.” When officials consulted Carl Sauer, a social scientist with extensive experience of Mexico, they got the same message:

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. . . . Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly. The example of Iowa [i.e., where the maize crop was based almost entirely upon a few hybrid varieties] is about the most dangerous of all for Mexico. Unless the Americans understand that, they’d better keep out of this country entirely.¹²

While the advisors’ awareness of the complexity of the challenge facing the MAP is significant, perhaps more striking are the specific measures that the program adopted in order to improve Mexican agriculture. To be sure, it does not seem that Warren Weaver (as director of the Division of Natural Sciences that oversaw the MAP), Mann, or the Advisory Committee consciously considered European models in designing the MAP, although Stakman’s ties with German plant breeders meant that he would almost certainly have heard about the peasant friendly stations there. Nevertheless, several features of the initial breeding program were peasant friendly in the sense that they were designed with the needs of small

farmers in mind, in particular resource-poor farmers who could not afford to purchase new seed annually. In view of the criticism later directed at the MAP for giving wheat breeding such a high profile, it is significant that at the outset the advisors were agreed that maize was the crop to focus upon. Since it was central to most Mexicans' diet and was grown by the great majority of small farmers, maize offered "the greatest opportunity for improvement in Mexican agriculture." Equally important, advisors were not single-mindedly bent upon developing new high-yielding varieties (as had been done in the United States). The most pressing problem, they argued in 1941, was to improve cultivation practices (because of serious erosion and depleted soils). Improving varieties was the next most important issue, but the advisors envisioned these being provided via "introduction, selection *or breeding* [my emphasis]." Accordingly, the MAP initially devoted considerable effort to testing existing Mexican varieties of maize to identify the best one for each locality. Simply by redistributing these to the most suitable locality, one advisor recommended, the quality of maize cultivation could be improved quickly without having to wait years for the development of new varieties. This approach was richly rewarded when it was discovered that yield in some regions could be increased by 20 to 30 percent by introducing a variety native to another region.¹³

In addition, as Karin Matchett's study of the MAP has shown, the program's advisors took into account the economic circumstances of peasant farmers. As the Survey Commission observed in 1941, the problem with US-style hybrid maize was that seed had to be purchased each year, "and the small farmer in Mexico has neither the cash nor the initiative to do this." The breeder on the commission, Mangelsdorf, pointed out that hybrid maize varieties had not been successful in the American South where conditions were similar to those in Mexico. His experience in East Texas had been that it was hard to get small farmers there to purchase hybrid maize seed every year instead of saving seed from the previous harvest. Where farms were small and maize was grown for subsistence rather than for sale on the market, therefore, it was necessary to develop improved varieties that could be replanted year after year. Open-pollinated varieties—where crossing occurs spontaneously in nature rather than under the control of the breeder—he thought, met this need while hybrid maize did not.¹⁴

According to Matchett, although Edwin Wellhausen's maize-breeding program at the MAP included constructing conventional hybrids using the

double-cross method worked out in the United States, most of his efforts through the 1950s used quite different ways of improving maize. Some of the work relied on a simple and traditional method (mass selection) to improve Mexican landraces, but the majority of it was dedicated to making synthetic varieties, a kind of quick-and-dirty hybrid that was relatively high-yielding and whose seed could be replanted each season. Part of the rationale for this was agro-ecological. As a MAP progress report in 1944 noted, conventional hybrid maize varieties in the United States were so heavily tailored for a particular region that “they are complete failures elsewhere while inferior open pollinated lines are more adaptable and can be grown in various regions.” But the MAP’s breeding strategy was also pragmatic; it was much quicker to produce synthetic varieties than double-cross hybrids (which could take over ten years), and, as Mangelsdorf emphasized, Mexico was a good place to turn out something in a hurry because almost anything would be a substantial improvement. The initial results were promising; the first synthetic varieties released by the MAP in 1948 yielded about 30 percent more than the benchmark variety.¹⁵

Despite the MAP’s promising start with a peasant-centered approach to development, it soon became evident that improving the state of peasant agriculture was not going to be easy. By the late 1940s there were signs of disagreement—among advisors as well as within the foundation—on the most effective strategy for transforming Mexican agriculture. And by the 1950s the MAP was no longer pursuing some of its original aims.

At the center of this shift was the question of what role the MAP should adopt in relation to extension. Several months before the Survey Commission’s visit to Mexico, Mann had recommended that a Mexican program should take a two-pronged approach, pursuing not only research but also extension, since the latter offered the promise of a relatively quick impact. Following their visit in the summer of 1941, similarly, it was clear to the Survey Commission that an immediate improvement to Mexican agriculture did not require the production of new practices or varieties. An enormous improvement in yield could be achieved just with the application of existing knowledge. During his visit to Mexico in 1943, Bradfield was struck by the fact that basic forms of good practice such as crop rotation or fertilizing with manure were rare, and the wooden plow was almost universal. The highest priority, he stated in his report to the foundation, should be extension. Following another visit two years later,

he reiterated his concern; something had to be done to improve soil fertility, he argued, before the full fruits of the work on plant disease and new varieties could be exploited. The time was approaching, “if we have not already reached it, when we should begin to think about how the information obtained in the research program can be made most effective in Mexican agriculture.” In another year or two, he thought, there would be enough knowledge upon which to base an extension program. At this point the other members of the Advisory Committee did not agree, arguing that the MAP should stick to research for the time being. But after their visit to Mexico the following year (1946), Mangelsdorf and Stakman concurred with Bradfield: the MAP’s research had been so successful that it was time for the foundation to start pressing the ministry for the development of a properly designed extension program or perhaps even to become involved in extension itself.¹⁶

This initial emphasis upon extension is significant because it reflected the advisors’ concern to reach small farmers. Large farmers, in Mexico as elsewhere, were much better placed to look after themselves. Unlike their smaller brethren, they could afford to take risks with new methods and had the capital to invest in them; many were thus keen to cooperate with the MAP by offering land for field trials and adopting new varieties. But to disseminate the requisite knowledge to small farmers required a functional extension service, which Mexico did not yet have. The existing service, Bradfield pointed out, was totally unsatisfactory. Since its staff had no means of transportation, they never came into direct contact with farmers and were thus reduced to distributing leaflets and answering letters. Given low levels of literacy among peasants, this was not a viable way of reaching the vast majority of farmers. Nor was the MAP ever likely to have either the resources or the manpower to take on such a huge job itself.¹⁷

By 1946 the advisors were not the only ones to have reached this conclusion. During their own visit to Mexico that year, Weaver and Mann met the minister of agriculture who expressed the view that it was time to begin extending the findings and new seeds to farmers. The minister was keen for the MAP to take the initiative in developing a Mexican extension service, and the Advisory Committee concurred, outlining how such a service–funded and administered by government–might be organized. Weaver and Mann endorsed this new emphasis: “a start should be made

now in the difficult but absolutely essential business of introducing into the actual agricultural practices of Mexico the improved materials and methods being developed. We can't finance an extension system for Mexico, nor is Mexico ready for such, but extension must anyway be started." Within a few weeks of returning from Mexico, Weaver had drawn up a list of matters to discuss with MAP Director George Harrar, among them extension. Harrar agreed with the Advisory Committee that the program should have an additional staff member who would concentrate upon extension and liaise with Mexican officials on the development of the service. And it was agreed that Harrar would get the ball rolling by writing to the minister and explaining precisely what, in the MAP's view, the Ministry would need to do in order to get the service underway.¹⁸

In the event, things developed slowly. In 1947 the MAP held farm demonstrations in various regions, and in 1948 the program appointed Mortimer Barrus to work with the Ministry on designing the extension service. But by 1949 Barrus was not receiving the cooperation he wanted from Ministry staff, and when the foundation declined to intervene on his behalf, he resigned. Thereafter formation of the service dragged along more slowly than foundation officials or experts had hoped, and the MAP's collaboration with the Ministry remained difficult. By the early 1950s there was still concern in the foundation that the MAP's considerable technical advances were not being made available to the great majority of Mexican farmers, and some advisors and program staff were clearly frustrated. Reporting on his site visit in 1953, Bradfield noted that, while in principle the use of mineral fertilizers or crop rotation using alfalfa would enormously improve Mexican agriculture, in practice "to handle a system of farming of this more complex type . . . will require more managerial ability and more capital than many Mexican farmers have at the present time." But meeting those needs required an extension service and improved credit arrangements. The dilemma with irrigation was similar. As Wellhausen (who became director of the program in 1952) later remarked, in areas with adequate rainfall it was clear that by simply applying existing knowledge farmers could produce far more than they currently did. But since water was not being efficiently used, the (predominantly small) farmers who needed it were not receiving it, and how to increase yield in areas of low rainfall was much less clear. Although the MAP was adept at developing technical solutions, only government

could provide the necessary infrastructure: “Mexico needs to do something about increasing production in these marginal corn-growing areas because it is in these areas where the population is also beginning to increase. . . . The people from these areas are beginning to march on the cities and form the slums.”¹⁹

Some historians have been critical of the MAP’s failure to develop an effective extension program, arguing that its staff “seemed to feel that large grassroots [extension] campaigns were not part of their agenda,” an attitude that allowed them to “bypass the vexing problems of rural poverty.” One problem with this critique is that it is difficult to imagine how a program as small as the MAP during the 1940s—with relatively limited resources and half a dozen scientific staff—could have mounted anything but a token extension effort. More fundamentally, what the criticism overlooks is the extent to which MAP staff and advisors were aware during the early years of the program that extension was essential and that it would be necessary to assist the Mexican government in strengthening the existing service.²⁰

The fact that the MAP’s work failed to reach peasant farmers was not only due to the shortcomings of the Mexican extension system. For, although Weaver and Mann had called early on for more attention to be given to studying the “economic matrix in which the scientific agricultural studies are placed,” the MAP was slow to move in that direction. One of those who backed Weaver and Mann’s call was William I. Myers, professor of agricultural economics at Cornell and a trustee of the foundation since 1941. Soon after the MAP started, he had spoken with Harrar and Weaver about the need to bring in agricultural economics to supplement the biological sciences and make the MAP a more rounded research program, but with little success. For one thing, the natural sciences and social sciences were situated in different divisions of the foundation and had no experience of collaboration. For another, despite Weaver’s verbal support for studies of economic context, he occasionally expressed the view—to Myers’s annoyance—that farming was “just applied biology.” The MAP staff had been trained in biological sciences with little exposure to either economics or rural sociology, and “they were suspicious of what they didn’t know.” Myers kept pushing. Responding to a MAP progress report in 1951, he remarked that although he liked the report, it was optimistic on what remained to be done. “We have not yet

made even a beginning in the study of economic and social problems that are also important in improving the general level of well-being of the countries concerned.” The foundation, he thought, could research such problems and suggest methods of solving them. By this time even Weaver was coming around to the idea that more work on economic questions was needed, writing to the Advisory Committee that he thought future grants for agriculture should include not only scientific work but “studies of a less specifically scientific nature but also addressed to long-range limiting problems of agriculture (water, land tenure, taxation, etc.).” But Weaver was either unwilling or unable to push this idea since nothing happened for several years. When Stakman recommended in 1954 that the MAP hire a rural sociologist and an anthropologist, one foundation official agreed but thought that such staff only needed to be added in the course of the next decade. A social science perspective on agricultural development was evidently not a priority within the foundation, and it was not until 1956 that an agricultural economist was finally added to the staff.²¹

Why, then, did the MAP give up its original aim of raising productivity on peasant farms? That is the crucial question, but the answer is undoubtedly too complex to develop in depth here. What is worth doing, however, is to outline a number of hypotheses that emerge from the archive and that merit further consideration by historians.

While the views and recommendations of foundation officials were important, the MAP’s actions obviously depended as well upon the field decisions of its own staff, above all, Harrar. And there are indications that Harrar did not always see eye to eye with either officials or advisors. In the autumn of 1946, for example, when Weaver and Mann had returned from Mexico, persuaded that more attention should be given to the economic context in which scientific agriculture was practiced, Harrar objected that adding an agricultural economist to the program would be “dangerous.” His view may have prevailed, since it was another decade—by which time Harrar was no longer director—before an agricultural economist was finally appointed. Similarly, although the MAP’s original focus was on maize, beans, and wheat, by the spring of 1946 Harrar was interested in expanding the scope of the program to include crops with export potential such as fruit, vegetables, sugarcane, oil-bearing plants, pharmaceutical plants, and rubber. Whether he conveyed this proposal

to the minister of agriculture is not clear, but it may be significant that when the minister met with Weaver and Mann later that year, he emphasized that the most important tasks for the MAP were maize, beans, and wheat; other crops could be taken up later. Why might Harrar have deviated from the general line adopted by officials and advisors? There are hints that personality may have played a role. Mangelsdorf, for example, said that “There is some danger that a man of Dr. Harrar’s temperament, eager to get things done, and constantly confronted with immediate problems, will tend to lose sight of the long-time objectives of the program.” There was certainly no shortage of “immediate problems.” As Stakman later recollects, staff were inundated right from the start with people wanting them to work on particular projects that had nothing to do with the main food crops (e.g., improving limes, vanilla, and coffee). If the foundation granted Harrar considerable operational freedom—and there are signs that it did—his conception of what the program should do may have diverted its work away from the direction envisioned by the advisors.²²

The problems in implementing the original vision of the MAP, however, were not confined to matters of governance. For the program depended on the Agriculture Ministry’s extension service to disseminate improved cultivation practices to the peasantry. And a change of government in 1947 brought a different policy on extension, with the result that Harrar’s efforts to persuade the new leaders of its importance ran into “many obstacles and a good deal of resistance.” A service was finally established in 1953, but even by the mid-1960s it had not developed as quickly or satisfactorily as he would have liked. The most serious obstacle from the program’s point of view centered on the mechanisms for the distribution of seed from the MAP’s improved maize varieties. As early as 1946 the Advisory Committee was concerned about the government’s arrangements for multiplying and distributing the new seed. Although Stakman conceded that ideally a state institution should distribute the seed, in practice he and the others worried that the proposed new system was open to abuse and that seed would be made available to large farmers rather than to small ones. The solution, he suggested, might be for the MAP to distribute its own seed (although how its staff could have managed such a gigantic task is not clear). But his suggestion was not taken up, and by the spring of 1947 Stakman was disturbed to see that

responsibility for distribution had been assigned to the newly established National Corn Commission. The MAP, he reckoned, would have to make the best of the situation and try to prevent the same thing from happening with seed from other crops.²³

The resistance that the MAP encountered while trying to improve the extension service is not surprising, given the Mexican economic and political situation after 1940. As de Alcantara, Lewontin, and others have argued, the program of rural development championed by the left-inclined government of Lazaro Cardenas between 1934 and 1940 was abandoned by the center/right governments that came to power over the next twelve years. The latters' power base consisted of an alliance between urban businessmen and large landowners who agreed that public funding should be channeled toward "progressive" commercial farms rather than "backward" peasants (through irrigation works, subsidizing wheat prices, and generous credit terms for big farms), and the large agricultural surpluses thus generated would provide capital for the industrializing economy. Since large farmers received the technical information and assistance they needed, only a rudimentary extension service was required. Thus "post-Cardenas governments gave extremely low priority to the kinds of programs required to support production within commercial *ejidos* [peasant communes]."²⁴

Unfortunately the limitations of the extension service, as MAP staff saw it, derived not only from a lack of government enthusiasm; cooperation with Mexican scientists was also hindered by professional rivalry as well as a clash of cultures. On the one hand, Mexican agricultural scientists appear to have been sensitive about well-funded foreign scientists—especially from north of the border—arriving at the Ministry and questioning traditional ways of doing things. Some of the maize breeders, for example, did not want the MAP's new varieties to displace older ones. On the other hand, the Mexicans' notions of professional status hindered good working relations with peasant farmers. From the visitors' perspective, Mexican agricultural expertise was "book knowledge," not grounded in hands-on experience. Research that took the scientist into the field—something that MAP staff took for granted—enjoyed little status, and even younger Mexicans thought that fieldwork was beneath them. That most Mexican scientists had little sympathy with peasants and were inclined to lecture them only aggravated this problem.²⁵

Finally, the MAP had to deal with political issues. As representatives of an American foundation—and especially one with connections to the oil industry—MAP staff had to tread lightly when offering advice that had policy ramifications. One such issue was land reform. Following the revolution of 1910, peasants had been given tracts of two to four hectares each (five to ten acres), and this farm size remained enshrined in land reform policy through the 1940s. But MAP experts believed that such small farms only could allow subsistence but no surplus production for the market and thus no purchasing power for the peasant. It would be better, they concluded, for land reform in future to parcel out larger tracts. But to voice such views publicly might have jeopardized the program. As Myers later noted, something of this kind had occurred in the Philippines where a western agricultural economist had criticized the landholding system for preserving many large farms, provoking an outcry that nearly shut down the development program. In Myers's view, the economist's analysis was actually correct, but: “You don't go into a country . . . no matter how much you know and how bad their situation is—and tell them what's wrong and what ought to be done about it. . . . [The problem of large landholdings] is one of the basic problems of Latin America—but you can't solve it when you land in the country—[and] tell them how lousy their system is.” Moreover, the history of US intervention, both military and economic, as Harrar recognized, made Mexicans suspicious of American motives, extending even to plans for the reform of Mexican agricultural education. Besides keeping their mouths shut on land reform, MAP staff tended to stay clear of the US embassy because, as Stakman recollects, “I think at that time the Foundation felt that they should retain their independence of action and avoid any appearance of being political.”²⁶

Faced with the scale and complexity of the problem of disseminating MAP results to small farmers, the MAP's lack of control over the extension service, and the need to steer clear of offering advice on basic questions of agricultural policy, there are signs that the staff began to concentrate upon problems where they thought they could make progress. In 1947, for example, Wellhausen argued that areas where a maize surplus could be produced should be addressed first; subsistence areas could be left until later. And in 1951 Bradfield recommended to the Advisory Committee that: “Since the improvement of agriculture is

dependent upon improvements in education, health, transport and the availability of [inputs], priority should be given to the few situations where a well-rounded program of development seems most probably [sic] over situations which are not yet so ready." Similarly, when asked in the 1960s how maize yield could be increased in areas of low rainfall, Wellhausen replied, "I don't really know. These areas we have not been too concerned about. We've . . . concentrated our efforts on the areas which are more productive from the standpoint of corn." This tendency to take the path of least resistance may help to account for the effort eventually devoted to wheat breeding. For one thing, the Mexican government was keen to boost wheat production to meet a growing urban demand and reduce imports, but extension problems were also easier with wheat since growers were literate and had the capital to take advantage of intensive methods. As Myers later suggested, the rapid success of the wheat program was so spectacular—Mexican output trebled in only ten years and by 1958 the country was exporting wheat—that "probably they haven't given adequate attention to other things" such as farm management. It would appear, therefore, that work on easier problems aimed at large commercial farmers gradually displaced that designed to help peasants.²⁷

To conclude, Rockefeller experts and officials believed during the early years of the MAP that the program could and should make an impact upon Mexican poverty and hunger. To this end, they endorsed a program of extension, varietal-testing, and breeding designed to help the small farmer. By the 1950s, however, the program had taken on a rather different cast. Just why the original vision became derailed is not clear but may include factors such as the director's own convictions as to how the program should develop, difficulties in collaborating with Mexican experts, and a lack of control over key institutions such as the extension service. The resulting *modus vivendi* was a division of labor in which the MAP concentrated upon research and training, while leaving responsibility for extension to the Ministry. And, although the success of their research in alleviating hunger was ultimately dependent upon economic and political policies that established the framework in which the new technology would have to operate, this policy arena was one that MAP staff and foundation officials sought to avoid. As a result, the program's greatest impact, despite its original intentions, was upon large farms. For

some this remained a disappointment. When the Advisory Committee returned to Mexico in 1962, one of the things that disturbed them was to see that, despite the useful knowledge and practices the MAP had generated, the lot of the Mexican peasantry remained largely unchanged. As Mangelsdorf remarked, “Some of this has [also] happened in the US. . . . I don’t know what the answer is.”²⁸

Demonstrating that the MAP was a dynamic entity, capable of shifting in response to circumstances, opens up a new area of inquiry for future studies, not only of the MAP but also of other green revolutions. As the first of these programs, the MAP was important as a model for subsequent programs in Latin America and elsewhere, and it remains to be seen whether the later programs succeeded in learning from the MAP’s experience or blindly reproduced it.

NOTES

1. This paper was written in part while I was a visiting scholar at the Max Planck Institute for the History of Science in Berlin, and I am grateful to Hans-Joerg Rheinberger and to Institute librarians for their support. An early draft of the paper was presented at the meeting of the Society for the History of Technology at Washington, DC, 2007. I thank participants at that session, as well as my colleague, Inderjeet Parmar, for critical comments.

In Mexico maize yields nearly doubled from the late 1940s to the late 1960s, while wheat production rose eight-fold, but the increase was mainly generated on large irrigated farms. Edwin Wellhausen, “The Agriculture of Mexico,” *Scientific American* 235 (Aug. 1976): 129–50; Barbara Tuchman, “The Green Revolution and the Distribution of Agricultural Income in Mexico,” *World Development* 4 (Jan. 1976): 17–24; E. C. Stakman et al., *Campaigns Against Hunger* (Cambridge: Harvard University Press, 1967), 214–15.

2. Niek Koning, *The Failure of Agrarian Capitalism: Agrarian Politics in the United Kingdom, Germany, the Netherlands, and the USA, 1846–1919* (New York: Routledge, 1994); Jonathan Harwood, “Europe’s Green Revolution: The Rise and Fall of Peasant-Friendly Plant-Breeding, 1890–1945,” MS, in possession of author; Willi Boelcke, “Ueber die Säkulare Strukturentwicklung der Klein- und Mittelbäuerlichen Landwirtschaft in Deutschland Während des 19./20. Jahrhunderts,” in *Entwicklungstendenzen in der Agrargeschichtlichen Lehre und Forschung*, 89–98 (Berlin: Institut für Agrarpolitik, Marktlehre u. Agrarentwicklung, Humboldt-Universität zu Berlin, and Fördergesellschaft Albrecht Daniel Thaer, 1995).

The farms in question were similar in size to those in the developing world. In Bavaria, 60 percent of the farms around 1900 were less than five hectares (twelve acres) in size, Ludwig Kiessling, “Die Organisation einer Landessaatgutzüchtung in Bayern,” *Fühlings Landwirtschaftliche Zeitung* 55 (1906): 329–38. In the West Punjab in the 1950s, 79 percent of farms were less than four hectares, Keith Griffin, *The Political Economy of Agrarian Change: An Essay on the Green Revolution* (London: Macmillan, 1974), 20. In the central highlands of Mexico during the 1970s, where half of Mexico’s farmers lived and rural poverty was pronounced, the average amount of arable land per farm was about six hectares, Wellhausen, “The Agriculture of Mexico,” 136.

3. Jules Billard, "The Revolution in American Agriculture," *National Geographic* (Feb. 1970): 147–85. According to one account, by the late 1960s Ford Foundation officials had concluded that Mexican peasant agriculture would have to disappear if the country's agriculture were to be fully modernized, John Perkins, *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War* (New York: Oxford University Press, 1997), 114. On large farmers' enthusiasm for new methods, see, Don Paarlberg, "The Land Grant Colleges and the Structure Issue," *American Journal of Agricultural Economics* 63 (Feb. 1981): 129–34.

4. Deborah Fitzgerald, "Exporting American Agriculture: The Rockefeller Foundation in Mexico, 1943–53," *Social Studies of Science* 16 (Aug. 1986): 457–83, 459; Cynthia Hewitt de Alcantara, *Modernizing Mexican Agriculture: Socioeconomic Implications of Technological Change, 1940–1970* (Geneva: UN Research Institute for Social Development, 1976), 20, 23; Bruce H. Jennings, *Foundations of International Agricultural Research: Science and Politics in Mexican Agriculture* (Boulder: Westview Press, 1988), chpt. 3. Doubting its commitment to poverty reduction, Olea-Franco writes that the MAP was "in no way a philanthropic enterprise to end hunger in the world," Adolfo Olea-Franco, "One Century of Higher Agricultural Education and Research in Mexico (1850s–1960s), with a Preliminary Survey on the Same Subjects in the United States" (PhD diss., Harvard University, 2001), 721. Although Cotter's book is a study of Mexican agricultural scientists during the twentieth century rather than an analysis of the MAP, he acknowledges that some of the MAP's work during the 1940s sought to improve peasant farmer wellbeing, Joseph Cotter, *Troubled Harvest: Agronomy and Revolution in Mexico, 1880–2002* (Westport, Conn.: Praeger, 2003), 198–99, 322. On balance, he takes the view that the "foundation wanted to push Mexico through the transition from an agrarian to an industrial society . . . and thus tried to create commercial farmers, not vibrant, autonomous communities of peasant corn growers," 322, 188. In Jennings's discussion of the 1940s, he recognizes that there were initially competing visions as to how the MAP might operate, but he underestimates the extent to which alternative approaches were taken seriously by the program's Advisory Committee as well as foundation officials. Moreover, his argument that the MAP decided to try to increase productivity without regard to social consequences ignores the concern among advisors and officials from the mid-1940s about the need for more attention to developing the extension system. Much the same can be said of Stephen Lewontin's "The Green Revolution and the Politics of Agricultural Development in Mexico since 1940" (PhD diss., University of Chicago, 1983). Karin Matchett recognized that the early breeding program was in fact more appropriate for Mexican conditions than was the work being done by Mexico's own breeders, Matchett, "Untold Innovation: Scientific Practice and Corn Improvement in Mexico, 1935–1965" (PhD diss., University of Minnesota, 2002).

Because I am interested in the extent to which the founding vision of the program rested upon earlier European experience, I have drawn primarily upon archival materials that shed light upon the aims and approaches of the foundation during the planning stage. Other historians of the MAP have been concerned with the work that its staff actually did, usually during a later period. Among the existing histories, only Fitzgerald and Matchett have looked closely at the 1940s, and the latter's analysis focuses heavily upon the MAP and Mexican maize-breeding programs from the 1930s to the 1960s rather than upon the general strategy underlying the MAP and its transformation during the early years of the program.

5. Mann Diaries, 1924–27, Log 10 (Dec. 1924–Jan. 1925) on Germany, Box 42; Mann Diaries, 1926–27 and 1940–42, Log 34 (Dec. 1927) on Finland, Box 43, RG 12.1, Rockefeller

Foundation Archives (hereafter RF); Mann to Wickliffe Rose, June 28, 1924, Folder 329; Mann to Rose, Aug. 27, 1924, Folder 330, Box 23, Ser. 1.1, International Education Board Archives (hereafter IEB), Rockefeller Archive Center (hereafter RAC). Mann notes the views of Asher Hobson of the International Institute of Agriculture that the rapid growth of cooperatives in Europe was due to the “extreme need” to husband small savings, a point that “possibly [had] greater significance than in the US.” C. B. Hutchison, director of agriculture for the IEB for 1926–28, also visited the principal German stations; see, Hutchison Papers, Special Collections, Shields Library, University of California–Davis.

6. One of these advocates for fundamental research was Hutchison, see, Hutchison to Rose, Feb. 1928, Folder 335; numerous documents in Folder 334, Box 23, Ser. 1.1, IEB, RAC. The same conception of agricultural research is evident in the survey of US agricultural education conducted for the IEB by Whitney Shepardson, see, Shepardson, *Agricultural Education in the United States* (New York: Macmillan, 1929). On two paths toward improvement, see, Mann to Rose, Apr. 17, 1925, Folder 331, Box 23, Ser. 1.1, IEB, RAC. In an annual report, the IEB drew a similar distinction between “economic” and “scientific” perspectives in agricultural research. The former developed empirical methods of production and distribution and was local in orientation, while the latter dealt with general principles and was international in scope, see, *Annual Report of the International Education Board, 1925–26* (New York: International Education Board, 1926), 18.

7. On crops, see, Randall E. Stross, *The Stubborn Earth: American Agriculturalists on Chinese Soil, 1898–1937* (Berkeley: University of California Press, 1986), 152, 157, 201–202, and chpt. 6; on selection and farm size, see, H. H. Love and J. H. Reisner, “The Cornell-Nanking Story,” New York State College of Agriculture, *Cornell International Agricultural Development Bulletin No. 4* (1964): 11, 34. These two Cornell breeders observed that “in some ways this is the most difficult part of a crop improvement program,” 33. The director of the program, Selskar Gunn, was an expert on public health who had been unhappy with the fact that most of the Rockefeller’s support for medicine in China (since before World War I) had been directed at the Peking Union Medical College. Although this promoted high standards in medical science, he believed it had too little impact on rural public health. As a result, he called for the China Program to take a “fully integrated” approach to improving educational, economic, and social conditions in rural areas where the vast majority of the population lived. The aim of the program, Gunn argued, was to “coordinate several fragmentary native efforts into a united movement to improve the lot of the Chinese peasant,” see, Gunn cited in James C. Thomson, *While China Faced West: American Reformers in Nationalist China, 1928–1937* (Cambridge: Harvard University Press, 1969), 149.

8. *Annual Report of the General Education Board* (New York: General Education Board) for the years 1932–33 through 1938. Mann may have seen extension as a more important task for the MAP than has been suggested, see, Matchett, “Untold Innovation,” 80.

9. *Annual Report of the General Education Board, 1936–37*; Memo. from Warren Weaver, Mar. 8, 1946, Folder 11, Box 2, Ser. 323, RG 1.1, RF, RAC. On the establishment of the Advisory Committee (later renamed the Advisory Committee on Agricultural Activities), see, Folder 56, Box 9, Ser. 323, RG 1.1, RF, RAC. This committee grew out of the Agricultural Survey Commission established early in 1941, consisting of Stakman, Mangelsdorf, Bradfield, and Richard Schultes—whose task was to visit Mexico, assess the state of its agriculture, and make recommendations on what a Rockefeller program might be able to achieve, see, Folder 70, Box 11, Ser. 323, RG 1.1, RF, RAC.

10. Advisory Committee for Agricultural Activities, "The World Food Problem, Agriculture and the RF," June 21, 1951, Folder 23, Box 3, Ser. 915, RG 3, RF, RAC. Weaver employed the same argument the following month to persuade Chester Barnard, president of the foundation, of the need for a separate division for agriculture, see, Weaver, "Agriculture and the RF," July 1951, Folder 20, Box 3, Ser. 915, RG 3, RF, RAC. On US-Mexican relations, see, correspondence for 1941, Folder 2, Box 1, Ser. 323, RG 1.1, RF, RAC. Lewontin argues that the foundation's plan for an agricultural aid program was supported by US officials because it fit well with the administration's policy toward cooperation with Latin American states after 1938, Lewontin, "The Green Revolution," chpt. 4.

11. In the 1960s Stakman claimed that the seriousness of this problem had been brought home to the advisors by food riots in 1942 and 1943 and "real distress," Interview with Elvin Stakman, RG 13, RF, RAC. On the Int. Health Division, see, Jennings, *Foundations of International Agricultural Research*, 46–48; Cotter, *Troubled Harvest*, 189. This combination of measures aimed at public health as well as agricultural development was also a feature of the foundation's program in China during the 1930s, see, Thomson, *When China Faced West*, chpt. 6. On best practice, see, John Staatz and Carl Eicher, "Agricultural Development Ideas in Historical Perspective," in *Agricultural Development in the Third World*, ed. Carl Eicher and John Staatz (Baltimore: Johns Hopkins University Press, 1990), 20–21. "As the improvement of agriculture and rural life involves not only progress in techniques of crop and animal production but also amelioration of living and health conditions, it seems obvious that the proposed commission [MAP] should be intimately associated with the local office of the International Health Division, thus promoting economy and efficiency," Summary of the Survey Commission's report, Dec. 4, 1941, Folder 70, Box 11; William C. Cobb, "The Historical Background of the Mexican Agricultural Program," 1956, Folder 62, Box 10; minutes of meeting of Mexican Agricultural Commission, June 5, 1941, Folder 71, Box 11, Ser. 323, RG 1.1; Weaver to J. D. Rockefeller III, Oct. 11, 1946, Folder 20; Stakman, Memo. to President Rusk, Folder 21, Box 3, Ser. 915, RG 3, RF, RAC. According to Cotter, in 1945 the foundation considered a cooperative arrangement between the MAP and IHD, but nutrition never became a major issue for the MAP, Cotter, *Troubled Harvest*, 189.

12. Following his visit to Mexico in 1945, Mann drew attention to the "urgent need" to develop methods of maintaining soil fertility that would not require expensive commercial fertilizers, Mann, "Observations in Mexico," Aug. 26, 1943, Folder 4, Box 1, Ser. 323, RG 1.1, RF, RAC. Members of the Agricultural Advisory Committee were familiar with the nature of peasant agriculture. Stakman claimed that the MAP was not unprepared for the problems in Mexico because there had been "a lot of peasant farming in the US when we were young," Elvin Stakman, *The Reminiscences of Elvin Stakman* (Columbia University: Oral History Research Office, 1971), 945; "Report on the Status of Agriculture in Mexico," Folder 70, Box 11, Ser. 323, RG 1.1, RF, RAC, p. 144. As the MAP's director recalled, MAP breeders learned that not all improved varieties of beans were welcomed by peasant farmers; acceptance required that beans had the right color. "So we tried to meet this requirement. Sometimes their preferences are bound up with bitter experience, so unless you know that experience, it is better not to try to interfere too abruptly with customs or habits," Interview with J. George Harrar, RG 13, p. 52; RBF to ARM, AJW, and JAF, excerpt of comments by Carl Sauer on Wallace's proposal, Feb. 10, 1941, Folder 2, Box 1, Ser. 323, RG 1.1, RF, RAC. Sauer, a cultural geographer from the University of California–Berkeley, was not the only Latin American specialist who conveyed this message to the foundation at the outset, see, Cotter, *Troubled Harvest*, 143.

13. During the 1920s Stakman became acquainted with Theodor Roemer. Professor of plant breeding at the University of Halle, Roemer had visited the University of Minnesota in 1925, after which the two men set up a student exchange between their universities, and Stakman was visiting professor at Halle in 1930, Interview with Stakman; Stakman, *The Reminiscences of Elvin Stakman*. Stakman's knowledge of the German plant-breeding stations may also have been based on his experience with the IEB's agricultural work from about 1926 when he became an advisor to Hutchison, see, Hutchison to Rose, Mar. 20, 1926, Folder 334, Box 23; Shepardson to Hutchison, Aug. 5, 1927, Folder 339, Box 24, Ser. 1.1, IEB, RAC. For the focus on maize, see, "Agricultural Conditions and Problems in Mexico," 1941, Folder 2, Box 1, Ser. 323, RG 1.1, RF, RAC. Wheat, unlike maize or beans, was not central to most Mexicans' diet; the demand came from the wealthier urban sector of the population. Moreover the number of farmers who grew wheat was only 2 or 3 percent of the number who grew maize, and wheat farms were larger and better irrigated. Within a few years, the program devoted increasing attention to wheat, much to the annoyance of Sauer, who dismissed it as a food consumed by "the privileged fraction of the population," see, Sauer to Joe [presumably Joseph Willits], Feb. 12, 1945, Folder 9, Box 2, Ser. 323, RG 1.1, RF, RAC. Between about 1950 and 1970 the MAP allocated similar levels of research funding to wheat and maize, see, Delbert T. Myren, "The Rockefeller Foundation Program in Corn and Wheat in Mexico," in *Subsistence Agriculture and Economic Development*, ed. Clifton R. Wharton (London: Cass, 1970), 438–52. This "wheat bias" has been cited by historians—correctly—to illustrate the large farm orientation that the MAP eventually acquired, see, Lewontin, "The Green Revolution," 127. The advisors' support for improved techniques did not entail dismissing all native cultivation practices. In their work on beans, MAP breeders took into account the traditional practice of intercropping beans with maize since they thought it was likely to continue for generations to come, see, Cotter, *Troubled Harvest*, 188. The quotation is from Summary of the Survey Commission's report, Dec. 4, 1941, Folder 70, Box 11, Ser. 323, RG 1.1, RF, RAC. "Agricultural Conditions and Problems in Mexico"; Mangelsdorf to Alfonso Gonzalez Gallardo, Dec. 10, 1943, Folder 6, Box 1; Harrar to Weaver, Jan. 11, 1946, Folder 11, Box 2, Ser. 323, RG 1.1, RF, RAC.

14. Matchett, "Untold Innovation"; Karin Matchett, "At Odds over Inbreeding: An Abandoned Attempt at Mexico/United States Collaboration to 'Improve' Mexican Corn, 1940–1950," *Journal of the History of Biology* 39 (July 2006): 345–72. The quotation is from "Agricultural Conditions and Problems in Mexico." Mangelsdorf to Gallardo, Dec. 10, 1943; Interview with Paul Mangelsdorf, RG 13, RF, RAC, p. 69. Mangelsdorf envisioned a two-track breeding program in which the MAP should develop US-style hybrids since he believed that large Mexican farms could make good use of them. To argue that a high-input model suited to commercial farming "was ultimately the only . . . plausible model to which these scientists could refer" (Fitzgerald, "Exporting American Agriculture," 463), thus fails to recognize the extent to which MAP staff were sensitive to the needs of Mexican peasant farmers. Similarly, Cotter's claim that "the MAP did not create seeds to solve the problems of peasant farmers" (Cotter, *Troubled Harvest*, 188) is not true, at least for the 1940s. Although Lewontin recognizes that the original emphasis of the maize-breeding program was on open-pollinated varieties, he misses the significance of this fact, Lewontin, "The Green Revolution," 157–58.

15. In the double-cross hybrid method, the breeder selects four inbred lines that have been derived from five or six generations of inbreeding. Lines A and B are then crossed with each other, as are lines C and D, and finally the AB hybrid is crossed with the CD

hybrid in order to produce the desired variety. Landraces are mixed varieties (consisting of many distinct subtypes) that have been traditionally planted in a particular locality over many generations and are thus well adapted to it. On synthetic varieties, see, Matchett, "At Odds over Inbreeding," 351, 366; Matchett, "Untold Innovation," chpt. 2 and 163. The potential value of synthetic varieties had been proposed a few years earlier for regions "where hybrid corn may not be economically feasible," see, Merle Jenkins, "The Segregation of Genes Affecting Yield of Grain in Maize," *Journal of the American Society of Agronomy* 32 (Jan. 1940): 55–63. de Alcantara attributes advocacy for synthetics primarily to Mexican maize breeders of the late 1940s, evidently unaware that the MAP had embarked on such a breeding program several years earlier, de Alcantara, *Modernizing Mexican Agriculture*, 37–38. The quotation is from Progress Report, Nov. 1, 1944, Folder 40, Box 6, Ser. 323, RG 1.1, RF, RAC, p. 5. On the need for speed, see, Interview with Mangelsdorf, p. 69. That MAP breeders placed a higher priority on speed in developing new varieties than did their Mexican counterparts is clear from Matchett, "Untold Innovation," chpt. 6. On the yield of synthetic varieties, see, Stakman, *Reminiscences of Elvin C. Stakman*, 1071.

16. "Experience," Mann wrote, "justifies confidence that considerable improvement in economic and living conditions can be expected from such [extension] methods. . . . They constitute the most direct approach to the relatively early introduction of changes," Memo. from Mann, Feb. 20, 1941, Folder 70, Box 11, Ser. 323, RG 1.1, RF, RAC. For the Survey Commission's view in 1941, see, "Agricultural Conditions and Problems in Mexico." The other key issues cited by Bradfield were education and cooperative production and marketing, see, Draft Annual Report for 1943, Folder 38, Box 6, Ser. 323, RG 1.1, RF, RAC. The quotation is from Bradfield, "Report of Trip to Mexico, August 7–15, 1945," Folder 10, Box 2, Ser. 323, RG 1.1, RF, RAC. On the change of heart in 1946, see, Mangelsdorf, "Report on a Trip to Mexico for the RF, Feb.–Mar. 1946," Folder 61, Box 10, Ser. 323, RG 1.2, RF, RAC. In 1947 Mangelsdorf struck the same note. The technical progress achieved in four years had been amazing, but "whether these achievements can now be translated into . . . immediate improvement of Mexican agriculture," only time would tell, see, Mangelsdorf, "Report on a Trip to Mexico," Feb. 1947, Folder 61, Box 10, Ser. 323, RG 1.2, RF, RAC, p. 9. Among items suggested for discussion at the October 1946 meeting of the Advisory Committee, Stakman proposed what the foundation might do to compensate for the weakness of the extension system in Mexico. Should the foundation take responsibility for distributing seed of new varieties, he asked? Ideally, the Mexican government should do this, but there were practical difficulties. And if the foundation did decide to do this, the method of distribution might need to be different for ejidos and for landowners, Stakman to Mann, Sept. 5, 1946, Folder 57, Box 9, Ser. 323, RG 1.1, RF, RAC.

17. Interview with Bradfield, RG 13, RF, RAC.

18. On Mann and Weaver's visit, see, "Topical Diary of Visit to Mexican Agricultural Program; WW and ARM, Sept. 12 to Oct. 6, 1946; JDR 3rd and WIM Sept. 28 to Oct. 6, 1946," Folder 12; "Visit to Mexican Agricultural Program, ARM and WW, Sept. 12–Oct. 6, 1946; Summary Conclusions," Folder 13, Box 2, Ser. 323, RG 1.1, RF, RAC. In a memo, apparently from Weaver, the items to be discussed with Harrar included "Is there a Mexican who could be trained in the US to head up the extension work?," "How much have Mexicans themselves developed in knowledge, organization and personnel which could be used in the extension service?" and "To what extent have Mexican scientists collaborated with RF personnel? Are they sharing in the RF [projects]?" "For Discussion with Harrar," Oct. 28, 1946, Folder 13, Box 2, Ser. 323, RG 1.1, RF, RAC. On Harrar's agreement, see,

“Topical Diary of Visit to Mexican Agricultural Program”; minutes of meeting of Advisory Committee for Mexican Agriculture, Oct. 17, 1946, Folder 67, Box 10; “Report on the Mexican Agricultural Program prepared by JGH,” Nov. 14, 1946, Folder 13, Box 2, Ser. 323, RG 1.1, RF, RAC.

19. Fitzgerald, “Exporting American Agriculture,” 471–72; Cotter, *Troubled Harvest*, 197–98. On collaboration with the ministry, see, Minutes of Nov. 1948 meeting of the Advisory Committee on Agriculture, Folder 59, Box 9, Ser. 323, RG 1.1; “Report on Trip to Mexico, Aug.–Sept. 1953 and Oct. 1953, by Richard Bradfield,” Folder 61, Box 10, Ser. 323, RG 1.2, RF, RAC. Among the advisors, Bradfield was most aware of the ways in which technical solutions had to be adapted to farmers’ circumstances as well as of the role that extension and other non-research measures could play in agricultural development. This broader vision was again evident from the 1960s when, as head of the Multiple-Cropping Systems Division at the International Rice Research Institute, he was repeatedly critical of the institute’s single-minded focus upon producing high-yielding rice varieties dependent upon irrigation. This ignored the needs of two-thirds of Asian rice farmers, he argued, whose land was neither irrigated nor suited to rice monoculture, see, Robert S. Anderson et al., *Rice Science and Development Politics: Research Strategies and IRRI’s Technologies Confront Asian Diversity (1950–1980)* (Oxford: Clarendon Press, 1991), 42–46, 86–88. On Wellhausen’s career, see, “Wellhausen,” *American Men & Women of Science*, T–Z, 15th ed., Book XIII (New York: Bowker, 1982). On water use, see, de Alcantara, *Modernizing Mexican Agriculture*, 52, 309. The second quotation is from Interview with Wellhausen, RG 13, RF, RAC, p. 56.

20. The quotation is from Fitzgerald, “Exporting American Agriculture,” 471, 467; de Alcantara, *Modernizing Mexican Agriculture*, 42–43. Matchett’s view that the Advisory Committee’s decision in 1941 to take a “top-down” approach was a “defining moment at which any immediate plan for an extension program lost most of its ground to a program built primarily around research” (Matchett, “Untold Innovation,” 81, 84) misses the lack of initial consensus among advisors, as well as the growing concern with it among both advisors and officers by the mid-1940s. Even by the mid-1950s, when the MAP had eighteen foundation scientists and over one hundred Mexican scientists, the program was not large enough to provide an extension service, see, de Alcantara, *Modernizing Mexican Agriculture*, 21, 86. What the MAP might have attempted was a manageable pilot program aimed at peasant farmers in one region. If well done, this might have stimulated farmer interest in the MAP’s work and demonstrated to the Ministry how the new extension service should be designed. Whether this possibility was conceived or attempted, I do not know.

21. The first quotation is from “Visit to Mexican Agricultural Program, ARM and WW, Sept. 12–Oct. 6, 1946; Summary Conclusions.” Sauer voiced concern in 1945 about what he saw as pressure to introduce “American methods unsuited to the country. The same thing is true all over Latin America, where Argentina is the only country that was designed to fit into the North Atlantic pattern of agriculture. Are these proper questions for social science? I think they are,” Sauer to Joe, Feb. 12, 1945. In 1946 Myers recommended adding an agricultural economist, not only to the MAP staff but also to the Advisory Committee, see, “Topical Diary of Visit to Mexican Agricultural Program.” According to Jennings, in 1949 Myers urged Harrar to offer an institutional home to a sociologist who was investigating the extension process in Mexico, Jennings, *Foundations of International Agricultural Research*, 122–23. The second quotation is from Interview with Myers, RG 13, RF, RAC, p. 56, 82. Although impressed with the MAP’s technical achievements, Myers’s disappointment with what he saw as the program’s “one-sided” character prompted him to set up a

small foundation focused on the economic and social dimensions of development: the Agricultural Development Council. The third quotation is from Myers to Barnard, Aug. 27, 1951; Weaver to the Advisory Committee on Agricultural Activities, Oct. 30, 1951, Folder 20, Box 3, Ser. 915, RG 3, RF, RAC. Two years earlier the trustee, John S. Dickey, had called upon the foundation to add a social scientist to the MAP, see, Cotter, *Troubled Harvest*, 205. For Stakman's recommendation, see, Stakman, memo. to President Rusk and CBF to DR, Jan. 12, 1954, Folder 21, Box 3, Ser. 915, RG 3, RF, RAC. That economics came so late to the MAP is cited by historians as evidence of the program's narrow conception of development; what nearly all of them have missed (the exception being Jennings) is the strength of the opposing view among advisors and officers.

22. "Topical Diary of Visit to Mexican Agricultural Program." Three years later Harrar again declined to take up Myers's suggestion that the MAP take seriously the social dimensions of agricultural development, see, Jennings, *Foundations of International Agricultural Research*, 123. On Harrar's expanded program and the ministry's reaction, see, Memo, Mar. 1946, Folder 11, Box 2, Ser. 323, RG 1.1, RF, RAC. Despite its original peasant friendly intentions, the MAP was slow to get started with research on beans, beginning its work in 1949, and it was 1954 before expenditure on beans reached one-half of that spent on wheat, see, de Alcantara, *Modernizing Mexican Agriculture*, 25. The second quotation is from Mangelsdorf, "Report on a Trip to Mexico," 1943, Folder 61, Box 10, Ser. 323, RG 1.2, RF, RAC, p. 4. On limes, etc., see, Stakman, *Reminiscences of Elvin C. Stakman*, 976. In 1949 the president of the foundation appears to have overruled Weaver in favor of giving Harrar such operational freedom, see, Jennings, *Foundations of International Agricultural Research*, 120.

23. The first quotation is from Interview with Harrar, RG 13, RF, RAC, p. 183. Wellhausen was similarly disappointed. The gains in yield through improved fertilization practices were largely confined to "better farmers." Only a few ejidos managed to do this, and there was a risk of rural riots among poor farmers unless the government provided more assistance for them via extension, Interview with Wellhausen, p. 169.

Lewontin finds it "remarkable" and "ironic" that Stakman et al. should have been so critical of the National Corn Commission since in his view "the Foundation . . . had come to Mexico with the intention of cooperating with just these groups [large farmers]," Lewontin, "Green Revolution," 175, 165. But this is remarkable only if one has missed the fact that the original conception of the MAP was far more peasant friendly than has yet been recognized. On Stakman's reluctant conclusion, see, Stakman to Mann, Sept. 5, 1946, Folder 57, Box 9; minutes of meeting of Advisory Committee for Mexican Agriculture, Oct. 17, 1946, Folder 67, Box 10; Stakman to Weaver, May 16, 1947, Folder 15, Box 2, Ser. 323, RG 1.1, RF, RAC. During a site visit in 1947, Mangelsdorf learned that the Corn Commission had been set up by a friend of the new president and two of this friend's associates. Opinion was divided among Mexican agricultural scientists on whether or not these three would appropriate the commission's funding but do nothing. Mangelsdorf, "Report on a Trip to Mexico." But the Corn Commission's vulnerability to corruption was not the only problem with the state distribution system. According to Matchett, the commission possessed inadequate facilities for multiplying the seed provided to it by the breeders, and its staff did not take sufficient care to maintain seed quality, Matchett, "Untold Innovation," 218. Moreover, the commission favored hybrid maize varieties and made little effort to multiply and distribute the open-pollinated varieties developed by the MAP, see, Lewontin, "Green Revolution," 166–74. Finally, in addition to the president's Corn Commission, the Ministry chose to set

up its own rival organization—the National Commission for the Increase and Distribution of Improved Seeds—which sought to control the distribution of MAP seed. The result, as Harrar put it, was that “progress was not as rapid as it might have been,” Interview with Harrar, p. 96; Interview with Wellhausen, p. 102–104. On the chaotic history of the two corn commissions, see, Fitzgerald, “Exporting American Agriculture,” 466–67; de Alcantara, *Modernizing Mexican Agriculture*, 74–75.

24. The quotations are from de Alcantara, *Modernizing Mexican Agriculture*, 311, 307; Lewontin, “Green Revolution,” 114–20. Possibly, extension was not the only arena in which MAP proposals fell upon deaf ears. In 1948, for example, the Advisory Committee agreed that the development of local crop improvement associations should be “cautiously encouraged,” see, Minutes of Nov. 1948 meeting of the Advisory Committee on Agriculture, Folder 59, Box 9, Ser. 323, RG 1.1, RF, RAC. What happened to this recommendation is not clear, but according to de Alcantara, from the 1940s the formation of such cooperatives among large landowners was common, while among peasants in receipt of government credit it was illegal, de Alcantara, *Modernizing Mexican Agriculture*, 311–12, 51. Such associations had also been promoted early in the twentieth century by staff at the Bavarian plant-breeding station who saw them as a way to facilitate the introduction of new cultivation practices on small farms.

25. On resistance to new varieties, see, Matchett, “At Odds over Inbreeding”; Cotter, *Troubled Harvest*, 190. Mangelsdorf had the impression that neither of the two most important Mexican maize-breeding groups were prepared to coordinate their work with that of the MAP, Mangelsdorf, “Report on a Trip to Mexico.” On Mexican aversion to field work, see, Interview with Harrar, p. 36; Olea-Franco, “One Century of Higher Agricultural Education and Research in Mexico,” chpt. 6; Cotter, *Troubled Harvest*, 192–93. In his early maize-breeding work, Wellhausen found it easier to cooperate with farmers than with experiment stations whose staff struck him as jealous and overly concerned with their personal reputations, Interview with Wellhausen. Cotter judges Mexican agricultural scientists to have been more concerned with enhancing their professional status than aiding the peasantry, Cotter, *Troubled Harvest*, 156–57, 203–204, 324–26. One consequence was that in the 1930s Mexican experiment stations were giving more attention to export crops than to maize, see, Matchett, “At Odds over Inbreeding,” 353.

26. That the foundation was cautious about development programs that might be seen by the host country as controversial is evident from the mid-1930s when an official familiar with Mexican conditions recommended to the foundation’s president that although education was a delicate issue, agriculture was relatively uncontroversial, see, Lewontin, “Green Revolution,” 91–92. Weaver seemed to have absorbed this message as he remarked that assisting countries with elementary education was “obviously hot politically,” Weaver to Rockefeller, Oct. 11, 1946, Folder 20, Box 3, Ser. 915, RG 3, RF, RAC. On land reform, see, Mann, “Observations in Mexico”; Cotter, *Troubled Harvest*, 189. The first quotation is from Interview with Myers, p. 86. On suspicion of American motives, see, Interview with Harrar, p. 46; Interview with Stakman, p. 211. The second quotation is from Stakman, *Reminiscences of Elvin C. Stakman*, 974.

27. On Wellhausen’s view in 1947, see, Cotter, *Troubled Harvest*, 196. The first quotation is from Bradfield to Agricultural Advisory Committee, June 15, 1951, Folder 20, Box 3, Ser. 915, RG 3, RF, RAC. The second quotation is from Interview with Wellhausen, p. 56. A decade later he noted that there was still little effort devoted to the development of drought-tolerant varieties and that this task would be harder than the kinds of breeding

that had been undertaken during the 1940s and 1950s, see, Wellhausen, "The Agriculture of Mexico," 148–50; Lewontin, "Green Revolution," chpt. 6. On extension and wheat growers, see, Dana Dalrymple and William I. Jones, "Evaluating the 'Green Revolution,'" MS. presented at American Association for Advancement of Science and Consejo Nacional de Ciencia y Technologia, Mexico City, 1973, in possession of author, pp. 16, 26; Myren, "The Rockefeller Foundation Program." The third quotation is from Interview with Myers, p. 67.

28. Stakman et al., *Campaigns Against Hunger*, 214. According to one source, in 1960 over 80 percent of Mexican farmers' families were living at a subsistence level or worse, see, de Alcantara, *Modernizing Mexican Agriculture*, 310. The quotation is from Interview with Mangelsdorf, p. 110.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.