

Essay Review

Extension and Experiment: The Politics of Modern Agricultural Science

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Red Revolution, Green Revolution: Scientific Farming in Socialist China

Sigrid Schmalzer, University of Chicago Press, Chicago 2016, pp. 320, Price \$45.00 cloth, ISBN: 9780226330150

Fascist Pigs: Technoscientific Organisms and the History of Fascism

Tiago Saraiva, MIT Press, Cambridge, MA., 2016, pp. 344, Price \$40.00 hardcover, ISBN: 9780262035033

In 1974, a small group of American plant scientists traveled to China as the US Plant Studies Delegation, ostensibly to open channels of communication and exchange with Chinese scientists and to assess the present state of research in the plant sciences in China. During their month-long stay, the delegation visited academic institutes and peasant communes, made observations of agricultural field trials and carried on conversations with scientists and cadres. Although the final report described the group as "favorably impressed by the quality of farming and the appearance of most crops" encountered on their travels, it also expressed delegates' skepticism about the current and future state of agricultural research and education, given the recent upheavals of the Cultural Revolution. "China's agricultural progress... will depend in large part on the ability to reconstruct scientific and educational institutions in such a way that new scientific and technological information and materials are produced in a highly effective way" and, further, on the development of a new generation of researcher and teachers "to replace the relatively few highly trained scientists and scholars now available."¹

Although the US Plant Studies Delegation could hardly have known the details, the two decades preceding their visit had witnessed massive turmoil with respect to Chinese agricultural research and education. The mass mobilization of the Great Leap Forward (1958–61) and the political struggles of the Cultural Revolution (begun in 1966) had not only seen academic institutions dismantled and scientists persecuted, with the obvious effects on research and education, but also the elaboration or intensification of ideas about a specifically socialist science: about who should practice science, where and in what ways, and even what it meant to conduct a scientific experiment. The resulting configuration of

¹ American Plant Studies Delegation (1975), pp. xi, xii.

institutions and activities at times confounded Plant Studies delegates, who arrived with their own ideas about what constituted effective research. For example, as the delegate Philip Kuhn observed, although "experiments" were touted as central to the work of rural agricultural stations, "much of the experimental work at this level actually consists of demonstrations to show peasants the greater yield of improved seed or more advantageous planting densities, and thereby overcome conservative prejudices" (quotation in Schmalzer, pp. 133–34).

Just as Kuhn arrived in China with established notions of what constituted experimentation versus demonstration or extension in agricultural work, so too might a historian approach an account of agricultural modernization in the twentieth century with fixed notions of the roles of experiment and extension in this process. Numerous studies have explored the histories of not just agricultural research and its relationship to agricultural practices, but also the institutionalization of research activities in university departments, government agencies, and agricultural stations. They have carefully charted the implication of agricultural science in political wrangling at local, national, and international levels. Yet just as Kuhn had to adjust his received ideas to make sense of the world he encountered in Maoist China, so too must historians who read Sigrid Schmalzer's *Red Revolution*, *Green Revolution* or Tiago Saraiva's *Fascist Pigs* revise their ideas about the nature of agricultural experiment and extension to grapple effectively with the histories of agricultural modernization these present.

Over a number of decades, historians have developed rich accounts of agricultural research institutions, especially in the United States and Europe, as sites where scientific, state, and commercial interests came together (albeit not without conflict) to support agricultural modernization.² As historians have often emphasized, public funding for these institutions was as much about retaining the support of subjects and citizens as it was about improving production. In the German states, where public funding began to play a significant role in the organization of agricultural research and education in the 1840s, states' support of agricultural schools and colleges, model farms, experiment stations, and extension activities aimed to support industrialization and feed growing populations—and to keep powerful estate owners and politically volatile peasant farmers content.³ In the United States, the creation of publicly funded agricultural colleges and state experiment stations in the late-nineteenth century served similar ends. As the historian Charles Rosenberg summarized in his classic work on this topic, placing emphasis on appeasement over other aims, "subventions for [agricultural] research were concessions to farm power in the form of a pork-barrel issue easily clothed in the neutrality of science and justified in terms of the traditional virtues granted the yeoman cultivators of the nation's farms."⁴

² On the development of agricultural research institutions in the United States, see Rosenberg (1997), Rossiter (1979), and Marcus (1985). On the German case, see Finlay (1992) and Harwood (2005, 2012), and for the Netherlands see Maat (2001). For a contrasting account of Russian agricultural institutions that *de-emphasizes* the role of government, see Elina (2002, 2014).

³ Harwood (2012), pp. 18–33.

⁴ Rosenberg (1971), p. 2.

Of course, a growing number of agricultural research institutions meant ever-increasing opportunities for professional scientists. Pork-barrel politics notwithstanding, scientists working in relevant disciplines—animal science, botany, chemistry, entomology, genetics, nutrition, soil science, and others—took advantage of their alleged centrality to national economies and leveraged this to achieve greater independence and resources over time.

One recurring source of tension within expanding agricultural research institutions was that of the relevance of scientists' activities to the everyday needs of growers. How did laboratory studies carried out at the university, or even field trials at the agricultural station, translate into more efficient, effective production on farms? Resolving this concern was especially important in contexts where farmers harbored doubts about the usefulness of long-term research projects or those that considered topics not immediately relevant to farm tasks.⁵ In the United States, a system of "cooperative extension" inaugurated in 1914 aimed to bridge this gap, in both perception and practice. The key figure in this system was that of the farm advisor, a professional affiliated with the state's agricultural research institutions but assigned to work directly with local farmers as a source of expert knowledge. As the sociologist Christopher Henke tells us, the rapid instantiation of the US extension system after World War I meant that "at that time, and likely still today, Cooperative Extension represented the most widespread and pervasive arm of state-based expertise in the United States."⁶

Henke's account offers many insights into extension's role in maintaining a certain "ecology of power" in California agriculture. For one, the new extension service and its associated farm bureaus provided an alternative to more disruptive and overtly political farm organizations like the Grange, thereby appealing to those who wished to maintain the status quo distribution of power and authority in the rural United States. Furthermore, in California, and likely elsewhere, extension advisors quickly oriented their activities to serve the interests of large commercial farms—often those most ready and able to adopt the technical solutions promoted via university research—over smaller production units. The extension system, in other words, helped to cement the already on-going process of consolidation and industrialization in U.S. agricultural production.⁷

Accounts of the entangling of scientific, state, and commercial interests in the co-development of robust research and extension institutions and industrial agricultural systems can be, and has been, made more complex—and even more overtly about political power. This is especially, though not exclusively, true where historians have considered

⁵ This is often posited as a reason for the flourishing of genetics at American agricultural institutions, as plant and animal breeding experiments could be used to simultaneously pursue research aims and appeal to the desire for improvement of crops and herds. See, e.g., Kimmelman (1983, 1987), Paul and Kimmelman (1988), Cooke (1997), Rosenberg (1997), and Allen (2000).

⁶ Henke (2008), pp. 14–15.

⁷ Henke (2008), pp. 21–41. The idea of an "ecology of power" is described on pp. 4–10.

cases outside the liberal, capitalist (or emerging capitalist) socio-political contexts that dominate in Euro-American stories. The historian Christophe Bonneuil's account of peanut research in French colonial Senegal, for example, suggests that institutions for breeding and distributing "improved" peanut varieties aimed more to control local peoples than to improve peanuts.⁸ Similarly, critical histories of the Green Revolution, in particular those focused on the agricultural research programs established by the Rockefeller and Ford Foundations, emphasize the political alignment of these programs as well as the redistributions of power that resulted from them. Historians have called attention to the vision of extending familiar systems of capitalist, industrial agricultural production embraced in these programs, which created inroads for American firms. They have also highlighted the aim of creating cooperative capitalist farmers out of potentially disruptive peasant agriculturalists—an agenda that aligned well with US political interests in the midst of the Cold War.⁹ Of course, agricultural research in industrialized countries at times also aimed at controlling farmers and farm communities, not least by relegating key means of production (seeds in particular) to scientific and/or commercial oversight.¹⁰

In short, through the efforts of many scholars who have charted the histories of agricultural modernization, we have learned to see the agricultural sciences and scientists of the twentieth century embedded in local, national, and international politics, and responsible for myriad redistributions of power through their research and extension activities.

Yet even if many of us are prepared to accept these political dimensions of agricultural science, it is still bold to claim that these sciences, including their institutions of experiment and extension, have been constitutive of political regimes—that is, that they have been foundational to the envisioning and enactment of these. That is exactly the argument made for socialist China by Schmalzer, and in fascist Europe by Saraiva. Through their powerful narratives, which delve into subjects and materials to date largely untouched by others, each author provides a striking new vantage from which to assess the central importance of agricultural sciences in different economic and political contexts. Schmalzer and Saraiva move beyond the established stories of agricultural modernization under free-market capitalism, amidst colonial development, and within the Green Revolutions of Latin America and South Asia—the narratives that loom largest in the English-language literature.¹¹ In revealing the efforts made to build revolutions, nations, and empires upon the institutions and products of modern agricultural science, these histories demand that readers re-evaluate both assumptions specific to each of their cases, such as the purported

⁸ Bonneuil (1999). See also Scott (1998).

⁹ See, e.g., Oasa (1981), Perkins (1997), and Cullather (2010).

¹⁰ See, e.g., Fitzgerald (1993) and Kloppenborg (2004).

¹¹ For recent scholarship on agricultural science in fascist Europe, see contributions to *Historical Studies in the Natural Sciences* 40(4), special issue on genetics, food production, and fascism. Prior scholarship on science under Nazism had called attention to the support of agricultural science under Hitler, including plant breeding; see, e.g., Heim (2008). For a recent account of the early history of agricultural experiment stations in China, see Lavelle (2015).

rejection of agricultural modernization with in European fascism and Maoism, as well as broader characterizations of the relationship between agricultural science and politics.

Which brings us back to Philip Kuhn, of the 1974 US Plant Studies Delegation, and his musing on the meaning of "experiment" as he heard it discussed at agricultural institutions in China. "Experiment" did indeed carry different implications in socialist China, and not only in the context of agricultural research and education. As Schmalzer describes, the reason for labeling as "experiments" agricultural activities that looked like to an American observer like demonstration or extension (e.g., showing farmers the best methods of planting or introducing them to more productive varieties) was that "'experiment' suggested faithfulness to local needs and provided room for the agency of local people" (p. 134). In Maoist China, agricultural extension had to assume a form that could be seen to draw on and to validate *tu* science—that associated with local knowledge, self-reliance, and mass mobilization as opposed to the *yang* science associated with elites, foreigners, Western scientists, or Chinese experts educated abroad—however much the state still valued and depended on professional scientific and technical expertise. So although the agricultural extension system adopted in China in the 1950s "bore a clear resemblance to that of the United States" (p. 32), revolutionary politics transformed the nature and especially the depiction of the activities carried out therein. These were not to be understood as places where *yang* experts created knowledge that would be transferred to the masses but rather as places where the masses and technicians (and cadres) would come together to experiment with agricultural practices and together discover those that should be adopted more widely.

This articulation of the nature of experiment in agricultural investigations, and the role of the masses in the creation of knowledge, emerged amidst successive transitions of China's experiment and extension network. In 1962, following a post-Great Leap Forward redirection of agricultural research and production, the state increased support for its decade-old system of "agrotechnical extension stations." A decision to expand the number of "demonstration farms" followed in 1963, places where new varieties and methods would be tested and best practices disseminated to local farmers. (p. 39) Such sites were taken to be the central nodes necessary for the transformation of agricultural production; here experiments would be conducted, and scientific knowledge created and shared. As early as May 1964 the otherwise technocratic appearance of these stations began to transform, with the appearance of "mass scientific experiment small groups" bringing together "expert research" and "mass science" (p. 40). And in 1965, the National Conference on Agricultural Experiment launched an "agricultural scientific experiment movement" described in one report as "a revolutionary movement with demonstration fields as the center, specialized science and technology teams as the backbone, and mass scientific experiment as the foundation" (p. 40).

The apparent contradictions at heart of these initiatives are also at the heart of Schmalzer's historical investigation of what "scientific farming" meant in socialist China. How did "the ideal of a revolutionary bottom-up experiment process" exist alongside "the impulse to impose national models on local communities"? How did "the technocratic privileging of elite, professional science" persist amidst "radical insistence on the primacy of mass science"? (p. 22) Schmalzer explores these questions by examining closely—indeed,

impressively closely, given the nature of sources available—the lived experiences of individuals who engaged in agricultural research and extension amidst the tumult of the Cultural Revolution—*tu* scientists, *yang* scientists, local cadres, state agents, peasant technicians, and sent-down youths.

The story that emerges from her careful readings of Mao-era official documents and reports, later written accounts, and recollections gathered through her own interviews reveals the centrality of agricultural modernization to the "red revolution". "Scientific farming' was embraced in socialist China as a means for the radical transformation of society," she writes (p. 5). This would be a socialist transformation, in which better methods and approaches were to emerge at the grassroots (albeit with the help of elite expertise), overthrowing top-down, elitist structures while also enhancing production and raising standards of living.

Schmalzer's account also encourages a reconsideration of the standard elements of agricultural modernization, which in socialist China incorporated new technologies like mechanized tools and chemical fertilizers while simultaneously vaunting old ones like intensive cultivation and green manures. She urges us to avoid taking the celebration of peasant knowledge and the incorporation of "traditional" techniques into the practices of scientific farming as evidence that China's radical socialist leaders rejected science and modernization. Indeed, Schmalzer assures us that the opposite is true. The agricultural revolution imagined for China "looked strikingly similar" to that envisioned by U.S. officials for Latin America and South Asia in the 1950s and 60s: higher yields produced through modern equipment, modern seeds, and modern chemical technologies (p. 3). Similarly, the valorization of peasant knowledge in propaganda and the efforts made to collect and disseminate their accumulated wisdom were counterbalanced in practice by a widely shared view of peasants as "backward" and in need of new techniques and technologies. What made China's approach to agricultural modernization different from the green revolutions encouraged elsewhere was not its stance toward modern science and technology. It was instead the roles identified for agricultural scientists versus peasant farmers in the creation and implementation of new agricultural practices—and, of course, the promised political outcome. Agricultural modernization would not suppress revolution, but foment it.

Saraiva, too, offers a corrective narrative about the embrace of modernization by political regimes, in this case the fascist governments of mid-twentieth century Germany, Italy, and Portugal. In his exploration of the institutions and individuals behind the creation and dissemination of such things as disease-resistant wheat varieties and hearty sheep breeds, he dismantles the notion that the back-to-the-land movements of these regimes, with their emphases on peasants and soil, pigs and potatoes, were somehow pitted against modern science and technology. The creation of uniform wheat, profitable sheep, and other "technoscientific organisms" by expert breeders at state-sponsored institutions depended on scientific expertise, and their wider dissemination on the industrializing ambitions of both scientists and national leaders.

Consider the case of Nazi potatoes. Prior to 1933, scientists at the *Biologische Reichsanstalt für Land- und Forstwirtschaft* (BRA) had established procedures for evaluating potato varieties, a staple of German agriculture, for disease resistance and other desirable

qualities and generating lists of approved types. Its activities of potato surveillance and market intervention, pursued in the name of increasing national potato production, expanded dramatically under Nazism as state interest in food self-sufficiency escalated. In 1934, under a Seed Decree issued by the Nazi Government, a crop registry system was established that limited marketable varieties to *only* those on the approved list. Whereas farmers in the 1910s would have had access to some 1,500 potato varieties, the list by 1937 was limited to just 74 (p. 80). Although, strictly speaking, the *Reichsnährstand* (RNS, a government body established to regulate and supervise all aspects of food production) took responsibility for enforcing the Seed Decree, the staff of BRA performed key tasks such as producing the list of varieties—a list based, ultimately, on knowledge of potato diseases and techniques for rapid evaluation that had been developed at BRA over decades. The BRA was responsible for further potato-related duties, including tracking and eliminating potato pests, developing standardized procedures for pathogen testing, breeding blight-resistant potato varieties, and more. As Saraiva reminds us, "The capacity of the RNS to intervene in German agriculture grew with each new experimental system developed by the BRA"; as such its scientific staff were playing an "important part in the expansion of the Nazi regime" (pp. 98–99).

By following specific organisms—indeed, specific breeds—over time and through space, Saraiva makes a strong case that one ought to understand these not simply as "tools of fascism" but as "major elements in imagining a fascist alternative modernity" (p. 10). As he makes evident via many examples, it was only through the creation and circulation of scientifically bred potatoes, pigs, sheep, wheat, and other agricultural organisms that the political projects of fascist regimes could be materialized on the ground. The creation of a well-fed German peasantry rooted to the soil in the Nazi state demanded disease-free potato lines and hardy pigs that could be fed off the land. Similarly, there could be no Portuguese settlers to extend the Portuguese nation across South West Angola, without hardy desert sheep whose fur could be sold at high price in European markets for those settlers to ranch. And so on.

Just as important as the organisms themselves in materializing fascism were the institutions created to foster their development, mass production, and dissemination to farmers. Consider again the case of potatoes in Germany, and the central role of the BRA in standardizing potato production along the lines envisioned by the Nazi government. A similar story may be repeated for the role of the *Istituto Nazionale di Genetica per la Cerealicoltura*, which along with agricultural commissions, seed associations, and experiment stations were central to Mussolini's campaign to attain self-sufficiency in wheat production, the so-called Battle of the Wheat. In the case of a comparable wheat campaign in Portugal, Saraiva argues that new varieties and the institutions created to amplify and control their production "contributed to the first institutional forms of the Portuguese fascist corporatist state" (p. 48).

Through their research, agricultural scientists produced standardized and industrializable organisms; fascist regimes produced institutional forms that facilitated the dissemination and utilization of those "technoscientific organisms"; technoscientific potatoes, wheat, and pigs in turn produced the material form of the fascist state. Lest one take from this summary that Saraiva draws a line between scientists and politics, let me be

clear that *Fascist Pigs* presents a complex enmeshing in which scientists both serve and are served by the aims of the state. This is not, as he reminds us, a story of the "alternative science that fascism produced" but of "the alternative fascist world that science produced" (p. 6).

Saraiva's emphasis on agricultural experiment stations as key sites for the dissemination of new varieties and breeds as well as the modeling of idealized agricultural settlement and production—which rendered them central to the realization of fascist ambitions for achieving self-sufficiency in food and rooting citizens to the land—dovetails with Schmalzer's thorough-going discussion of the role of agricultural extension and demonstration in socialist China. And in the case of Saraiva, too, the analysis diversifies considerably our understanding of what agricultural experiment and extensions systems have been envisioned to do and have done.

Whereas Schmalzer's reconstruction of the lived experiences of those who participated in the mass scientific experiment movement in China serves as a corrective to accounts of science in the years of the Cultural Revolution that emphasize failure, hardship, and suffering, Saraiva's account continually calls attention to the overlooked implication of agricultural research in the tactics of oppression, domination, and extermination pursued by fascist regimes. Agricultural stations, and the technoscientific organisms they developed, were key components of the systems of production and governance—violent, authoritarian systems of production and governance—intended to root German, Italian, and Portuguese peasants to the national soil.¹² They also played a prominent role in colonial contexts. Saraiva's detailed accounts of agricultural stations in Italian Ethiopia and Portuguese Mozambique and South West Africa, as well as research projects carried out at Auschwitz, call attention above all to "the continuity of fascist colonialism with other European post-slavery imperial experiences" (p. 144). In other words, he emphasizes that commodity production to support the expansion of the national economy was not only enabled by agricultural research but also dependent on the brutal subjugation of native peoples (and, in the case of Auschwitz, death-camp workers) and extraction of their labor.

Saraiva's analysis of these particular stations—and their core products of coffee, cotton, and rubber—converges with previous accounts of imperial agricultural stations as instruments for the control of native peoples and environments. His subsequent investigation of agricultural stations meant to support settler colonies (rather than commodities markets) comes to still starker conclusions. As he explains, fascist ambitions for empire included both the creation of self-sufficient economies independent of the world market as well as the physical extension of German, Italian, and Portuguese peasant populations into Eastern Europe and Africa. And in the latter case, experiment stations and technoscientific organisms served less as instruments for the control of native peoples and more as tools for enabling the obliteration of such peoples. Karakul sheep, a breed prized for its heartiness in poor conditions and for the prices garnered for its wool, attracted attention from scientists and politicians of all three regimes. They created research programs and stations to support its further development as an agricultural animal and its

¹² This, too, is thematized in contributions to the *HSNS* issue mentioned in fn. 11.

dissemination across newly acquired lands—lands that had just been or would soon be cleared of local peoples. "Karakul," Saraiva summarizes, "is a good point of entry into the larger history of fascist frontier genocide" (p. 233).

If reading *Green Revolution, Red Revolution* productively upends one's ideas about the nature of an agricultural experiment, *Fascist Pigs* gives a new, and more harrowing, perspective on the work of agricultural extension. Here extension is not simply the dissemination of best practices and improved agricultural organisms, though it certainly includes that. It is also the physical extension of the authoritarian state, into the everyday lives of German, Italian, and Portuguese citizens in the mid-twentieth century and, with particular violence, over peoples and lands encountered through imperial domination.

Taken together, these provocative books should encourage historians of agricultural modernization to consider whether established narratives of research and extension could be enriched. Perhaps, for example, the easy availability of institutional and scientific records in the cases of German or American agricultural experiment stations (as opposed to the challenges faced by Schmalzer in her research, and thus her need to reconstruct from the bottom-up) has resulted in our overlooking the understanding of experiment at the grassroots level.¹³ My work on mid-century American gardeners suggests that they routinely characterized themselves as "experimenters" and took pride in contributing knowledge to a community of like-minded practitioners.¹⁴ Might we find similar perspectives among farmers? Perhaps we have also neglected too much the responses of professionals, in practice, to the evidence produced by the "experiments" of farmers; historians of colonial agriculture have revealed cases where the ideas of European scientists about best practices were transformed by their observations of local approaches.¹⁵ Undoubtedly the understanding of what constitutes a meaningful experiment has never been as clear as Philip Kuhn imagined.

There is also the challenge advanced by Schmalzer, similarly made by Jonathan Harwood in his work on Europe's Green Revolution, that in considering how agricultural modernization unfolded in different social and political contexts—for example, friendly to peasants in some places but decidedly unfriendly in others—we might come to a new vision of how agricultural research and production can and ought to be organized.¹⁶ We know well from existing studies that the adoption of new agricultural technologies, produced within agricultural research institutions and introduced with good intentions—can entail significant social and political consequences alongside greater production: Hybrid corn empowered seed sellers over farmers. Mechanized tomato harvesters privileged large-scale growers and made some labor redundant. The high-yielding varieties of the Green Revolution in many cases further advantaged better-off farmers while leaving poorer agriculturalists behind. In short, using the best agricultural science and latest technology to enhance productivity has

¹³ See Henke (2000) for an analysis of the role of place in the interpretation of agricultural experiments.

¹⁴ Curry (2014).

¹⁵ Bonneuil (1999), Tilley (2011). I thank Jonathan Harwood for this observation.

¹⁶ Harwood (2012).

not always resulted in the greater security of farmers or in increased human wellbeing. Schmalzer suggests that in confronting the history of agricultural modernization in Maoist China, with its particular articulation of the relationship between science and society and between agricultural change and social change, "we will be better positioned to confront problems of hunger and sustainability in appropriately social and political ways, and avoid the pitfalls of imagining purely technological solutions to the problems we face together" (p. 26).

Of course, giving due attention to political and social arrangements in setting goals for agricultural research and making decisions about production should not lead us to see scientific and technological tools as secondary in addressing the shortcomings of contemporary agricultural systems around the world. As Saraiva makes abundantly clear, the alternative modernist reality imagined in fascism was only made possible through scientific research. Though this may make us wary of the power of science and technology, it should also alert us to the possibilities of establishing a research infrastructure—and a constellation of technoscientific organisms—that support a different, more equitable and sustainable, agricultural modernity than the one we now inhabit.

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