



Andrew Flachs. *Cultivating Knowledge: Biotechnology, Sustainability, and the Human Cost of Cotton Capitalism in India.* Global Change/Global Health Series. Tucson: University of Arizona Press, 2019. Illustrations. 240 pp. \$90.00, cloth, ISBN 978-0-8165-4025-9.

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Cotton and Biotechnology in India

India figures prominently in global disputes around rural destitution and development, especially mass suicides of cotton farmers. Andrew Flachs has transformed rich fieldwork in South India into consideration of that global contention: agricultural biotechnology. Rival global networks carrying banners of suicide seeds or silver bullets contest its ecological and material consequences. [1]

Cultivating Knowledge takes these disputes to the ground level in South India, specifically Telangana, and especially its Warangal District. Unlike much of the contentious literature, Flachs centers interviews with cotton farmers about their logic in seed choices and survival strategies. How do they construct their set of choices? What knowledge of cultivation do failing farmers deploy in choosing new seeds with new promises? What knowledge do they gain through success or failure?

The answer is, depressingly, very little. Farmers appear mostly as anxious victims of the blooming, buzzing confusion of the marketplace. Farmers in Flachs's samples were convinced through propaganda or local misinformation that choice of seed brand matters most for success. Yet learning about seed differences and consequences is

crippled, seemingly in decisive ways. Thousands of seed choices come and go in villages; there is evidently no rational way for farmers to choose among them systematically. Instead, there is a frenetic chase among farmers to change seeds frequently but with little knowledge of differences and rarely with success. "Despite frequently switching seeds, farmers rarely make a profit, recouping their losses on average in this region every fourth year with a bumper harvest" (p. 37). Flachs codes the farmers as "deskilled," but what has changed is not their cultivating skill but rather the complexity of seed choices and ubiquitous misinformation (pp. 45, 104). Flachs distills their dilemma to a choice between mutually exclusive paths: corporate farming or organic farming.

What indicates corporate farming in villages dominated by small family farms? Flachs uses biotechnology as indicator: specifically Bt cotton, the only legal biotech crop in India. As "the first developing nation where GM [genetically modified] crops would be grown by small farmers, India became the battleground for these two visions" (p. 17). His binary construction reflects a common reductionist dichotomy that is fundamentally

flawed, as his fine book subversively illustrates even as he centers it.

To correct some history: India was not the “first developing nation where GM crops could be grown by small farmers” (p. 17). China began Bt cotton development in the public sector about the same time as India in the 1990s but succeeded where India failed. Chinese farms were even smaller than Indian farms, and state efforts to regulate what could be planted on which tiny plot predictably encountered resistance, mostly covert: weapons of the weak. Contrary to the corporate dominance story, farmers on every continent have found ways to subvert regulation of seeds they want to sow, whether claimed by governments or corporations, just as they defeat controls on growing and selling other illegal plants.[2]

Dramatic tension turns on this fateful choice for cotton farmers: organic or corporate, constituting “mutually exclusive ways of farming” (p. 8). The corporate road is characterized by choosing to plant Bt cotton seeds. However, “villages practicing organic agriculture in which I worked represent farmers working with NGOs as well as corporations” (p. 20). But if organic farmers work with corporations, but the corporate/organic cusp is use of Bt seeds, and some organic farmers openly use Bt seeds or illegal farmer-grown seeds, doesn't this dichotomy fall apart?[3]

No seed knows whether it is organic or transgenic, nor how its genetic alterations occurred. A Bt gene in a seed produces only one trait; seed performance in the soil is a function of many other genes in interaction with one another and the environment. A seed carries genetic material for traits, critical for cultivating knowledge, but how traits get into a particular seed is a mystery to the village farmer. We now know that some transgenesis is indeed natural, mediated by agrobacterium. It does not take a corporation to produce a Bt cotton seed. Farmers can and do cultivate Bt cotton with both legal and illegal seeds, using either conventional or organic techniques.[4]

To illustrate: one farmer in the early days of Bt cotton in Gujarat gave this example. There were at the time three legal choices of Bt cotton seeds, and many more uncounted but readily obtainable illegal seeds from the local cottage industry (named Kavach, Rukshuk, etc.). One of the first three legal Bt seeds was MECH 184. It was locally unpopular, but one farmer noted a critical distinction missing from the cultivating knowledge: MECH 184 seeds needed a lot of nurturing very early, as from a mother's milk, to thrive. With an early monsoon or assured irrigation, MECH 184 seeds would yield an excellent crop, largely undamaged by bollworms. But in a later monsoon, MECH 184 would suffer more than other cultivars, like MECH 162, unless irrigated. Both were Bt cultivars, but farmers with assured irrigation had a wider range of seed choices than dry-land farmers. It was water, and genetically driven moisture sensitivity in some seeds, not a Bt gene, that was critical.

In Flachs's account, all differences among seeds are flattened to Bt or are organic. There have been thousands of Bt cultivars in India, most legal, many not. That very proliferation, that churning, undermines settled cultivating knowledge among his interviewees. We do not find in this book stories like the one above: farmers acquiring knowledge of variation within the broad category of genetically modified cultivars. The legal distinctions and controversies over seeds differentiated into GM and non-GM/organic were not created by farmers but were creations in the first instant of transnational elites with interests in rationalizing biotechnology globally for trade and secondarily by urban elites within domestic political systems seeking to either promote or discourage certain technologies.[5]

Cultivating Knowledge takes a distinctly and self-consciously seed-centric position, lending dramatic structure: “a seed is a choice that cannot be taken back” (p. 3). More broadly, Flachs's approach is “best understood as constrained choices and as

performances, an anthropological and political ecology view of agriculture” (p. 8). Among these performances is farmer suicide. Warangal District, where the author worked intensively, is the origin of the suicide-seed trope energizing opposition to biotechnology in India, spurred by the publication by Vandana Shiva and colleagues in 1998 of *Seeds of Suicide: The Ecological and Human Costs of the Globalization of Agriculture*—before there was any Bt cotton anywhere in India. The suicide-seed trope has gone viral through international mobilization and brilliant parody (the international film sensation *Peepli Live* was India’s official entry for the 2010 Academy Awards). Despite the mobilizational and political impact of suicide seeds, Flachs rightly concludes that there is no evidence of a causal connection between Bt transgenes in cotton cultivars and farmer suicides. Still the claim mobilizes opponents of biotechnology.

Most cotton farmers grow cultivars with some Bt gene, so the concept is an oddly reductivist category for something so complex as a seed, or as an indicator of corporate farming. Bt simply indicates a single gene (in early years), now typically two genes, from the soil bacterium *Bacillus thuringiensis*, that produce insecticidal proteins toxic to bollworms: one or two genes among the eighteen thousand or so genes in cotton. The reification and segregation of Bt plants as GMOs (genetically modified organisms), encoded in law, was the work or choice not of farmers but of national state and international agreements. The GMO classification proved valuable to multinational seed companies by excluding small firms like Navbharat in Gujarat that lacked the resources to comply with rigid biosafety regulations multilateral firms find manageable.[6]

That same Bt gene (in a different genetic event) was incorporated into India’s innovative Bt *brinjal* (eggplant, aubergine) in both hybrid and open-pollinated varieties that performed the same insecticidal function. Bt eggplant proved successful in Bangladesh but could not be coded as cor-

porate farming: the government obtained the technology from India, then subsidized and backed its development with research, vigorous outreach, and promotion in fields.[7] A Bt alone does not a corporate make. Bt *brinjal* is not legal in its mother India, thanks to Jairam Ramesh and urban mobilization.[8] But predictably, given the portability of seeds and the agronomic success of the plant, Bt *brinjal* has by stealth come home to India as an illegal immigrant.

Illegal, off-market Bt cotton seeds have been prominent in India, following technology innovations.[9] Flachs’s great contribution is centering the consequences of ineffective regulation and market malfeasance for destabilizing knowledge on the farm. Chapter 4 (subtitled “The Problem with Learning on GM Cotton Farms”) explains “false choices.” Knowledge for cultivation is obfuscated, disrupted by the frenetic hucksterism of seed salesmen. To capitalize on the frantic search for Bt seeds in Warangal District, fraudsters tricked farmers with counterfeit seeds labeled “Bt” but expressing little or no Cry1Ac protein. Other crooks sold fakes labeled “Mahaco” to impersonate Monsanto’s partner Mahyco, evidently assuming peasants cannot read. These counterfeit seeds were quite variable in expression of the insecticidal protein, and thus in plant protection, but no farmer knew this. Simultaneously, genuine biotech seeds—such as “Kurnool Bt” for district of origin—were sold illegally in unlabeled cloth bags. Some seeds were secreted out of the production line of corporate producers and sold on the black market without brand names. These genuine stealth seeds, like those of Navbharat, actually carried the anti-bollworm trait, but farmers could not make this distinction.[10] The consequence was more genetic anarchy than corporate dominance.

Flachs himself notes that underground innovation and stealth adoption of seeds were contrary to corporate interests, specifically Mahyco/Monsanto’s: “Despite the official ban, seed brokers sell Bollgard III and HT seeds, even selling them

online!.... but it is important to remember that the first Bt seeds were similarly stolen and disseminated throughout India before their legalization” (p. 182). Many farmers honestly believed their Bt seeds had failed, not knowing whether or not their "Bt" seeds expressed Bt proteins. But counterfeit seeds, fake Bt seeds (*nakalli* in Telugu), need no corporate dominance to fly below the radar of the indifferent state.

Faddish mania for the latest and best Bt cultivar that bedevils Flachs's farmers is familiar mass behavior. Untethered from information about traits critical for cultivation success, seed fads disable cotton farmers. How susceptible are cultivars to moisture or temperature stress, pathogens, soil Ph? What are agronomic strengths and weaknesses of the plant's genome? The reification of an undifferentiated GMO serves a strategy for political mobilization but is antithetical to cultivation of knowledge, or knowledge of cultivation.

Given the opacity and disinformation in the maze of biotech cottons, defection to organic would then seem sensible. Yet the non-Bt choice may not be viable without ideologically driven groups, often with transnational connections, providing subsidies in "show farms" or "show villages." The section of chapter 5 titled "The Social Benefits of Being an Organic Show Farmer" explains how model farms supported by organic-promoting organizations or marketing networks are dependent on assistance for inputs and promotion unavailable to non-organic farmers. Flachs notes: "Organic agriculture takes the gambling out of farmwork" (p. 134). Could this be a solution for India's destitute farmers? The numbers in these show farms and show villages are very small; generalization of the support system seems infeasible, certainly unlikely at a scale under liberalization.

Here then is a great puzzle. Why do farmers keep growing an inedible cash crop that so frequently leads to debt, despair, and sometimes suicide? I was told, when asking that question in Warangal in 2006, that a good harvest in a year of

good prices can change a family's life like nothing else. Alternatives, such as millets or peanuts, offer nothing but a low-level and still insecure equilibrium.

What is to be done? This is an unfair ambush on ethnography. But Flachs's findings do prompt that question. Flachs himself argues that the alternative of organic farming in privileged enclaves of show villages, whether under private or corporate auspices, is extremely limited and not available to many farmers. The problem for the farmers in Telangana is not that they have to choose between Bt or not-Bt; it is that they have insufficient good land or finance in an increasingly market-driven system with thin, unstable margins subject to uncontrollable shocks: floods, droughts, evolution of pests, changing climate.

The real problem of "cultivating knowledge" in Telangana then is that there seems to be no viable alternatives within the realm of knowledge. Farmers are trapped with unmanageable choices. Why? Political ecology is the author's methodological commitment but remains mysterious as explanation. Flachs rightly criticizes economists for their emphasis on physical yield as a measure of success, but it is hard to discern the explanatory value added from his political-ecology approach. Looking around India—and Asia generally—one would like to know more about dynamics of the local state, the state government, political parties, social mobilization, and power relations on the ground. These matter fundamentally for surviving in agro-ecologies increasingly stressed by factors beyond the control of any farmer. With a robust official social support system, revival of seed certification, robust affordable crop insurance, effective technical outreach, improved water control, and flexible credit terms outside the moneylenders' stranglehold, farmers' choice set would fundamentally change. Why or how is this not possible?

In sum, Flachs has done a fine job in portraying the anxiety and complications of farmers mak-

ing momentous choices in an exceptionally difficult environment of unpredictable pests, uncontrollable climate change, and fickle markets that can make or destroy a farmer. He concludes that Bt cotton is neither suicide seed nor silver bullet. Whatever its faults as market commodity, genuine Bt cotton seeds reduce chemical pesticide use and do not drive suicides. There are no silver bullets, in genes or organic alternatives. Where this stimulating investigation goes astray, I think, is buying into an ideological dichotomy—prominent though it is—premised on a reductionist view that politicizes seeds based on how they acquire new traits rather than what new traits may contribute to farmers' capacity to survive, both known and unpredictable misfortunes of nature and market.

Notes

[1]. Ronald Herring and Robert Paarlberg, "The Political Economy of Biotechnology," *Annual Review of Resource Economics* 8 (2016): 397-416.

[2]. Cong Cao, *GMO China: How Global Debates Transformed China's Agricultural Biotechnology Policies* (New York: Columbia University Press, 2018). Also see Bharat Ramaswami, Carl Pray, Lalitha Narayanan, "The Spread of Illegal Transgenic Cotton Varieties in India: Biosafety Regulation, Monopoly, and Enforcement," *World Development* 40, no. 1 (2012): 177-88; and Ronald J. Herring, "Biotechnology: The Seed Panopticon Encounters Arts of Resistance," *Journal of Asian Studies* 80, no. 2 (2021): 415-22.

[3]. Devparna Roy, "Of Choices and Dilemmas: Bt Cotton and Self-Identified Organic Cotton Farmers in Gujarat," *Asian Biotechnology and Development Review* 12, no. 1 (2010): 51-79.

[4]. Devparna Roy, Ronald Herring, and Charles Geisler, "Naturalizing Transgenics: Loose Seeds, Official Seeds, and Risk in the Decision Matrix of Gujarati Cotton Farmers," *Journal of Development Studies* 43, no. 1 (2007): 158-76.

[5]. Per Pinstrup-Andersen and Ebbe Schioler, *Seeds of Contention: World Hunger and the Global*

Controversy over GM Crops (Baltimore: Johns Hopkins University Press, 2000); and Ronald J. Herring, "Whose Numbers Count? Probing Discrepant Evidence on Transgenic Cotton in the Warangal District of India," *International Journal of Multiple Research Approaches* 2, no. 2 (2008): 145-59.

[6]. Herring. "Biotechnology."

[7]. Anthony M. Shelton, Sayed H. Sarwer, Md. J. Hossain, Graham Brookes, and Vijay Paranjape, "Impact of Bt Brinjal Cultivation in the Market Value Chain in Five Districts of Bangladesh," *Front. Bioeng. Biotechnol* 8 (2020): 498, doi: 10.3389/fbioe.2020.00498.

[8]. Ronald J. Herring, "State Science, Risk and Agricultural Biotechnology: Bt Cotton to Bt Brinjal in India," *Journal of Peasant Studies* 42, no. 1 (2015): 159-86, DOI 10.1080/03066150.2014.951835.

[9]. K. S. Jayaraman, "Illegal Bt Cotton in India Haunts Regulators," *Nature Biotechnology* 19, no. 12 (2001): 1090; and K. S. Jayaraman, "India Produces Homegrown GM Cotton," *Nature Biotechnology* 22, no. 3 (2004): 255-56.

[10]. Herring, "Whose Numbers Count?"

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