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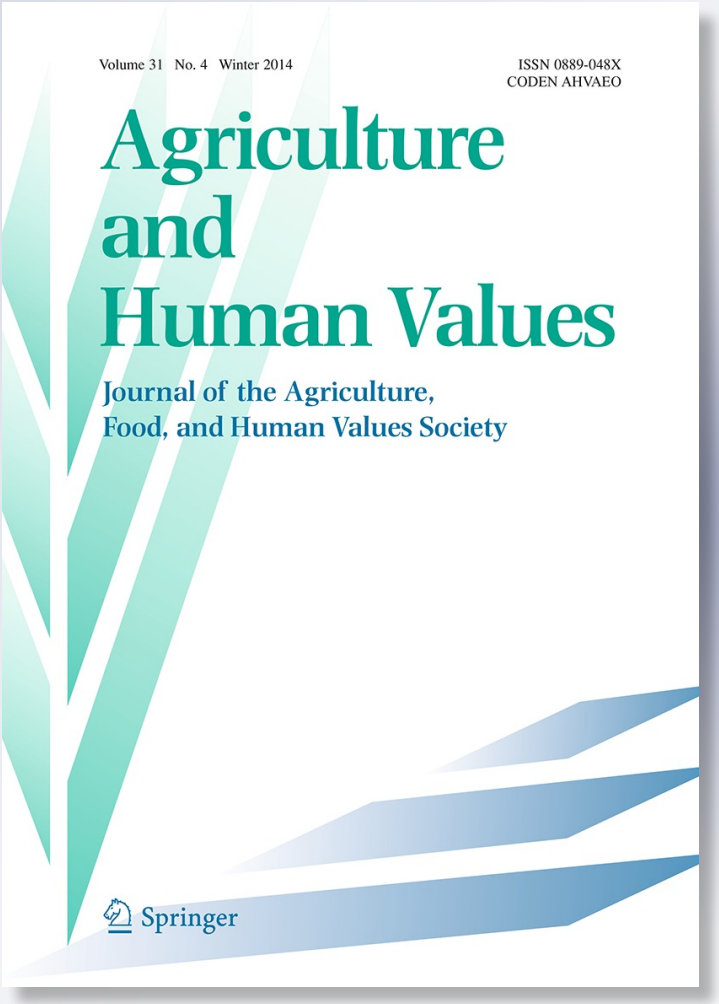

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Abstract In this essay we present three biases that make it difficult to represent farmer voices in a meaningful way. These biases are information bias, individual bias, and short-term bias. We illustrate these biases through two case studies. One is the case of Golden Rice in the Philippines and the other is the case of Bt cotton in India.

Keywords Agriculture · Indigenous knowledge · Biotechnology

Introduction

Representations of the farmer attitudes, opinions, and decisions—in short, the "farmer's voice"—are a common feature in writings on genetically modified (GM) crops. In an issue dedicated to the subject, it is important to problematize the subject. Representations of farmer voices have been especially notable in two of the most closely watched and hotly debated cases of GM crops in the global south. These are the case of Golden Rice in the Philippines (which developers hope to release by 2015–2016) and Bt cotton in India (released in 2002 and now ubiquitous in Indian cotton fields).

Drawing mainly on examples of these cases, we argue that representation of the farmer voice is sensitive to three kinds of biases.[1] *Information bias* refers to the ways in which the farmer voice is shaped by the information used to elicit that voice. Information bias is particularly important where respondents have little knowledge of or experience with the technology under discussion, as is often the case in studies of GM crops. Beyond information bias is what we may call *individual bias*. Voice claims characteristically solicit opinions on an individual basis, whereas farmer opinions on technologies emerge in part through a group dynamic that emerges through actual interaction with the technology. Last is the problem of *short-term bias*. Voice claims privilege short-term questions such as whether the farmer would adopt a technology, obscuring the more difficult-to-specify potential longer-term effects of the technology.

In this essay we use the Philippines and India cases to illustrate these biases and to explain why it is difficult to represent farmer voices in a meaningful way.

Information bias

Representations of farmer voices obviously vary greatly in their empirical basis. Some are based on little evidence beyond anecdote. For example, the industry-supported International Service for the Acquisition of Agri-biotech Applications (ISAAA) posts Philippino farmer quotes on how farmers resent anti-biotech groups for making their lives difficult (ISAAA 2011), and activist websites claim than Indian farmers are demanding an "end to GMO" (Pain 2013). Cohen and Paarlberg (2004:1574) simply

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[1] There are odd exceptions, such as projects that literally center on farmers' voices, such as the synchronous voice message forum trialed in rural Gujarat (Patel et al. 2010).

assume that "the farmer's voice" demands GM crops and downplays risk assessments, while Vandana Shiva assumes the voice of the Indian woman is calling for non-GM heirloom seeds (Shiva 2012).

But other claims to the farmer's voice rely on data collected explicitly to discern farmer views, knowledge, propensities, values, or decision-making. These studies are diverse, including surveys of agroecological knowledge and perceptions of crop populations (Soleri and Cleveland 2001), of farmer response to hypothetical scenarios (e.g., Schnurr and Mugabi-Muguzi this issue; Soleri, et al. 2008), valuation exercises (e.g., Ramaswami et al. 2012), and farmer focus groups (e.g., Beckwith et al. 2003).

But if a farmer has never seen or used a technology, then the farmer's opinions of that technology is highly sensitive to what information the farmer is given. Thus, with possible approval of India's first GM crop looming, a consortium of organizations dominated by anti-GM groups convened a "citizens jury" in Andhra Pradesh. Aiming to give voice to "those people most affected" by visions of agricultural development, organizers selected a jury with heavy representation of poor farmers (who are rarely early adopters of technology) and then screened videos they had made depicting three visions of the agricultural future. Jurors had some disagreements, but largely agreed with a statement expressing opposition to "GM Crops—including Vitamin A rice and Bt cotton" (Pimbert and Wakeford 2002). A similarly inspired farmer jury was organized in Mali in 2006, as that country was considering Bt cotton, had a similar result (Bryant 2007), generating the headline in London "Mali farmers reject GM crops as attack on their way of life" (Selva 2006).

Meanwhile, a researcher working with ISAAA constructed a voice for Philippino "farmer leaders" on Golden Rice by asking them "if they would grow a new 'yellow rice' that is fortified with vitamin A and that will be given free by the IRRI" to most farmers. It warrants mention here that according to the IRRI itself and its partner in Golden Rice development, PhilRice, it has still not been established that Golden Rice raises vitamin A levels.[2] At any rate, the reader will be unsurprised that most respondents answered this question in the affirmative (Chong 2003). Equally unsurprising is that when Golden Rice was characterized as a threat to exports, farmers asked the Agriculture Secretary to block it (Yap 2013).

Interested in the views of Philippino rice farmers on Golden Rice, a researcher working with the ISAAA interviewed farmer leaders in Nueva Ecija province. Asked about their "most trusted sources of information on agriculture," most farmer leaders named the Department of Agriculture in Quezon City, followed by the Philippine Rice Research Institute. These are exactly the answers we should expect from someone designated a "leader" and interviewed as such by clipboard-wielding scientists, although these interviews tell us little about how ideas are actually being formed.[3]

Individual bias

Representations of "farmers' voice" are normally based on assessments made by farmers as isolated respondents: the farmer is given selected information by the scientist (or activist) on economic, agronomic, or ecological aspects of the technology, and then is asked for his/her individual response. The problem here is that there is a vital social component to the establishment of farmer opinions and practices. Farmers interact with and take cues from each other; the majority of information, interpretations, and attitudes come from within the society of farmers itself. Farmers in an area obviously do not all agree with other, but farming is far too complex to be figured out from scratch by individuals, and farmers rely on mixtures of empirical information from individual "environmental learning" and discussion with and emulation of other farmers. These social dynamics always play some role in the attitudes and convictions behind the farmer's voice.

Research among cotton farmers in Warangal District, Andhra Pradesh, India, has examined interactions between individual environmental learning and various types of social learning.[4] As documented by Stone (2007), for these cotton farmers agricultural "payoff information" on agricultural practices and technologies is highly unreliable. The problems with payoff information include rapid change in insect populations, pesticide technologies, and

[2] As of 2013, IRRI responded to claims that Golden Rice would save lives and eyesight, pointing out that "it has not yet been determined whether daily consumption of Golden Rice does improve the vitamin A status of people who are vitamin A deficient and could therefore reduce related conditions such as night blindness," and that it would not be distributed unless this were determined to be the case (IRRI 2013). Tang et al. (2012) reported that Golden Rice raised Vitamin A levels in a sample of well-nourished Chinese children, but no trials have been conducted on the actual target population of poorly-nourished children.

[3] We are confident that an actual ethnographic study of Nueva Ecija farmers would reveal that very few practices or opinions were attributable to either the Department of Agriculture in Quezon City or PhilRice, and that farmers acted on a near-daily basis on information gleaned from local sources.

[4] Since 2013, this research has been funded by the grant "GM Crops and Indigenous management," awarded to Stone by the John Templeton Foundation. Stone's research on Indian agriculture from 2000 to 2012 was funded by National Science Foundation (Grants 0078396 and 0314404), the Wenner-Gren Foundation for Anthropological Research, and by Washington University. Methodologies are described in detail in the cited articles.

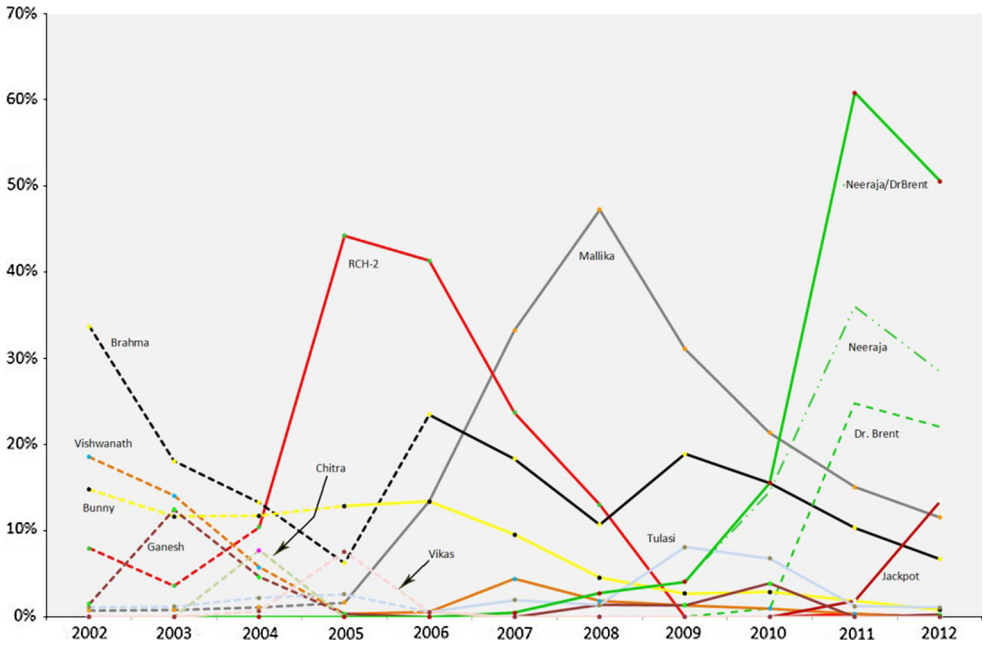

Fig. 1 Patterns in cotton seed choices in four villages in Warangal District, Andhra Pradesh, India. *Note*: Cotton farmers normally buy between one and three branded seeds each year, and each brand bought by each farmer counts as one seed choice each year. The graph depicts 3,162 seed choices. The y-axis shows the percentage of all seed choices accounted for by specific brands. Only the popular fad seeds are shown. There were several hundred seed brands marketed during this period. Details of the study are provided in Stone et al. (2014)

seed technologies; reliance on the market for deceptively-labeled branded hybrid seeds; and unpredictable agroecological impacts of some technologies. These challenges contribute to three general impediments to the process of "agricultural skilling": unrecognizability, inconsistency, and overly rapid rate of technological change. The result is "agricultural deskilling", as payoff-based environmental learning is almost wholly supplanted by social learning, or emulation (also see Henrich 2001). The emulation is manifested in striking seed fads that are not explainable by agronomic considerations.

Recent research funded by the John Templeton Foundation reveals further social aspects of decision-making. For instance, there are caste effects: in Warangal villages, we often see lower-caste farmers emulate the seed choices of upper-caste farmers. But we have also documented previously unknown long-term dynamics: a striking pattern of fads in which a different seed surges to wild popularity every 3 years (Fig. 1). The pattern is driven by endogenous dynamics rather than agronomic properties (Stone et al. 2014); the fad seeds do not outperform other seeds and they correspond poorly to rollouts of new seed technologies. Moreover they do not suddenly underperform after spiking in popularity. Instead, a period of conflicting opinions (such as in 2004, 2007 and 2010 in Fig. 1) is followed by a growing "buzz" (Telugu: *talk manchiga vachindi*) that one seed will be successful. The seed's popularity then snowballs through density-dependent emulation (Henrich 2001)—a process quite similar to recursive bandwaggoning (Abrahamson 1991) or to information cascades (Bikhchandani et al. 1992).

The unexpected periodicity in fads has yet to be theorized, but it does resonate with the belief expressed by several farmers that seed companies become complacent after 3 years and begin to sell bad products. Wise farmers, they claim, switch seeds every 3 years to avoid defective seeds.

Given the complexity of these social dynamics affecting actual technology choices, the exercise of asking farmers for *ex ante* opinions on technologies clearly risks being contrived. But such social dynamics are unlikely to be included in voice studies, and indeed are actively discounted by soliciting individual farmer opinions.

Short-term bias

Adoption of agricultural technologies often leads to latent effects, unforeseeable by the farmer, manifested only after time has passed. In the closely-watched case of Bt cotton in India, the spate of studies showing yield advantages and enthusiastic adoption have been used as a proxy for the farmer's affirmative voice (Herring 2008). But with few exceptions (Kathage and Qaim 2012; Stone 2011), these studies focused on short-term yield advantages in the first year or two after adoption (for a summary see Stone 2012) or even before adoption (Qaim and Zilberman 2003). This fetishizing of short-term effects is especially problematic given the recent agricultural history in India, where there was a high demand for Bt cotton in the 2000s largely because of the catastrophic agroecological fallout from the rapid adoption of the previous round of farm technologies a

few years before. Pesticide-intensive proprietary hybrid cotton seeds were adopted widely in the 1990s (Lalitha et al. 2009; Stone 2011), but quick profits (due mostly to favorable markets and initial effectiveness of pesticides) rapidly gave way to pesticide treadmills and spiraling input costs. It was this package that formed the technological component of the ghastly problem of farmer suicide (Gruère and Sengupta 2011; Stone 2002, 2011; Vasavi 2012), not the Bt seeds as various activists have claimed.

The hybrid seeds would also have problematic long-term effects. They led to farmers being inundated with hundreds of often deceptively labeled brands which helped to undermine the skilling process (Stone 2007; Stone et al. 2014). No farmer could have considered the prospect of such agricultural deskilling when first forming an opinion of commercial hybrids, nor could he have fast-forwarded to a decade later and seen himself blindly joining a seed herd each year.

Such latent effects of the hybrid seed market and heavy pesticide use fell outside of the decision-making window of farmers and of the analysis window of agricultural scholars. If you ask a farmer whether he would buy a certain technology, or if you assume that a purchase is a straightforward indicator of farmer desire, then you will convince yourself that the farmer's voice is calling out for that technology. This is a myopic view of the farmer voice because of its short-term bias. A more meaningful question to ask would have been if the farmers were calling out for a seed/pesticide regime that would lead them into an unsustainable, suicidal, agro-entomological hell.

When farmers began to eye Bt seeds in the early 2000's, an overriding concern was rapid relief from the treadmill they had been on since the previous round of technology adoption. Although some concern was expressed in both the activist (GRAIN 2001) and academic literature that "many of the problems of the pesticide treadmill could be replicated on a genetic treadmill" (Stone 2004), we do not know how such potential latent effects impacted farmer views or voices.

Whither the farmer voice

Claims about the "farmers' voice" tend to obscure the complexities of agricultural decision making. Such claims are sensitive to the specific information given to farmers for their reaction (information bias); they are generally oblivious to the social nature of agriculture (individual bias); and they often valorize opinions about technologies and practices without regard to long-term impacts (short-term bias). Given this critique, we will not make any claims to channel the voices of farmers in the Philippines or India. On the contrary, the two case studies showcase the difficulties in rendering farmer opinion in a meaningful way. Still years from being released, Golden Rice continues to serve as a high-profile trope in pro-GM advocacy (where it is used to construct opponents as murderers) to a lesser extent in anti-GM advocacy (where it is constructed as an overrated band-aid). Opinions on it, whether held by farmers, other stakeholders, or bystanders, are singularly sensitive to information bias because there is so little hard information available. Beyond the unknowns about nutritional effects (noted above), it is unknown what variety or varieties will be used to introduce Golden Rice or how the rice will be marketed or distributed.

In contrast, Bt cotton is the one GM crop that is widely planted by smallholders, and India leads the way with over 7 million planters (James 2013). Yet each of the biases discussed above continues to confound representations of the "farmer's voice". Even information bias remains an issue because of the multiple conflicting understandings of "Bt cotton" even after a 14 year history of commercialization. In extensive discussions with farmers we find some who can offer an accurate definition of "Bt cotton," but many others who believe Bt to be a toxin applied to seeds, a type of seed with a suite of agronomic properties, or a technology distinct from the trademark Bollgard. Moreover, it is commonly believed that Bt cotton has been replaced by a technology termed "double Bt" (when in fact the original Bt technology has been joined by five separate new technologies, only some of which incorporate two Cry genes). There are even farmers who mistakenly believe they no longer plant Bt cotton. Any rendering of the voice of these farmers on Bt cotton is sensitive to how Bt cotton is defined to them, even after years of commercialization.

Our analyses not only show the importance of both social bias and long-term dynamics, but also reveal new ways in which these are linked. We see that decisions on seeds are not only strongly shaped by emulation, but also increasingly so, with each new periodic fad seed accounting for more of the total seed choices.

The role of the new transgenic technologies is neither obvious not easy to isolate in a cotton sector undergoing rapid changes in various technologies, ecologies, and practices (Stone 2012). Stone's panel study of a sample of villages before and after virtually complete adoption of Bt seeds did find positive impacts of yields and pesticide use (Stone 2011), but also raised a larger question directly relevant to the farmer decision-making: if Warangal cotton farmers suffer from deskilling due to inconsistency, unrecognizability, and accelerated technological change, then an increasingly rapid flood of transgenic technologies and brands may alleviate symptoms at the expense of exacerbating the underlying cause.

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