



Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Epistemological depth in a GM crops controversy



Daniel J. Hicks

Rotman Institute of Philosophy, University of Western Ontario, London, Ontario, N6A 5B8, Canada

ARTICLE INFO

Article history:

Received 27 October 2014

Received in revised form

1 January 2015

Available online 11 March 2015

Keywords:

Genetically modified organisms

Feed the world

Evidence

Scientific controversies

Nancy Cartwright

Controlled experiments

ABSTRACT

This paper examines the scientific controversy over the yields of genetically modified [GM] crops as a case study in *epistemologically deep* disagreements. Appeals to “the evidence” are inadequate to resolve such disagreements; not because the interlocutors have radically different metaphysical views (as in cases of incommensurability), but instead because they assume rival epistemological frameworks and so have incompatible views about what kinds of research methods and claims *count as evidence*. Specifically, I show that, in the yield debate, proponents and opponents of GM crops cite two different sets of claims as evidence, which correspond to two rival epistemological frameworks, classical experimental epistemology and Nancy Cartwright’s evidence for use. I go on to argue that, even if both sides of the debate accepted Cartwright’s view, they might still disagree over what counts as evidence, because evidence for use ties standards of evidence to what is sometimes called the “context of application.”

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When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

1. Introduction

It seems to be a widespread assumption that *evidence resolves factual controversies*. As Thomas Kelly puts it, “Objective inquiry is evidence-driven inquiry, which makes for intersubjective agreement among inquirers”; he goes on to call this the *neutral arbiter* role for evidence, in disputes “among rival theories and their adherents” (2014). Similarly, in his influential paper on the epistemology of disagreement, Richard Feldman presents the basic puzzle of disagreement as a rhetorical question: “how can there be reasonable disagreements when the parties to the disagreement have been confronted with a single body of evidence?” (2011, 143) Feldman expects that, if two parties have the same evidence, equal powers of reasoning, and are both reasonable, then they should not disagree with each other. The evidence, he thinks, would be sufficient to resolve the controversy.

Of course, the assumption that evidence resolves factual controversies has been seriously and repeatedly challenged over the last five decades by philosophers, historians, and sociologists of

science. Discussions of underdetermination, incommensurability, theory-ladenness of observation, and so on, have shown that, insofar as evidence must be characterized in terms derived from controversial theories, there is logical room for opponents of these theories to discount the evidence. (Of course, there remains some disagreement among scholars about the extent to which evidence really must be characterized in terms derived from controversial theories. For a review of this literature, see Bogen, 2014, §§4ff.)

These discussions have generally dealt with what we might call *metaphysically deep* controversies; that is, the interlocutors in these cases have radically different ideas about what kinds of things exist (or, at least, what kinds of things are involved in the phenomena of interest) and what kinds of properties and relations they might stand in. (Compare Feldman’s discussion of cases in which “people ... have different fundamental principles or world views,” 2011, 148–9.) For example, for Einstein but not for Newton, the mass of an object depends on its speed relative to an observer; and Priestly but not Lavoisier was willing to countenance negative mass (see, among hundreds of works, Hoyningen-Huene, 2008; Kuhn, 1961, 1962 (1996), esp. chs. 9–11; Newton-Smith, 1981, 10–13, 114–21, 155–62).

However, many scientific controversies are not metaphysically deep: all of the interlocutors agree on what kinds of things,

E-mail address: hicks.daniel.j@gmail.com.

properties, and relations are involved. These include many socially significant controversies, such as tobacco, climate change, and vaccinations. Generally speaking, the interlocutors in these cases do not have radically different ontological assumptions; the tobacco industry and AMA did not have fundamentally different conceptions of the nature of cancer, for example. And yet the controversy may persist, if it is *epistemologically deep*. If the interlocutors have radically different ideas—not about what kinds of things exist, but rather—about what kinds of research should be carried out in order to support or undermine a claim, then they will not be able to agree on *what counts as evidence*. Indeed, we would expect the two sides to offer two different sets of claims as evidence; consequently, “the” evidence will not be able to resolve the controversy.

Environmental controversies provide a large class of metaphysically shallow yet epistemologically deep and socially significant controversies. For example, in recent work on the controversy over the causes of colony collapse disorder [CCD], Daniel Lee Kleinman and Sainath Suryanarayanan have shown that commercial beekeepers and toxicologists work with different epistemological standards. Beekeepers argue that a widely-used class of agricultural insecticides—neonicotinoids—play a major role in CCD, appealing to their own observations in the field. Toxicologists—and the US Environmental Protection Agency—require controlled experiments, often conducted in laboratory settings, and based on these conclude that neonicotinoids play little to no role in CCD. Beekeepers and toxicologists do not work with radically different conceptions of, say, the chemical structure or possible mode of action of neonicotinoids. Instead, the controversy persists because the observations collected by beekeepers are not regarded as evidence by toxicologists or regulators (Suryanarayanan & Kleinman, 2013).

Suryanarayanan and Kleinman frame their analysis of the CCD controversy partly in terms of recent work on expertise by sociologists Harry Collins and Robert Evans (Collins & Evans, 2007). As Suryanarayanan and Kleinman see it, the controversy is a struggle between credentialed and non-credentialed experts—toxicologists and beekeepers, respectively—for recognition and authority as sources of evidence and other knowledge claims.

In this paper, I take a more epistemological approach to a distinct epistemologically deep controversy, over the yields of genetically modified [GM] crops.¹ While some aspects of the broader controversy over GM crops are metaphysically deep—such as rival conceptions of nature (Lacey, 1999, chap. 3; McLeod-Kilmurray, 2009)—this does not seem to be the case with the specific controversy over yields. Even to the extent that there is ambiguity or disagreement about how yield should be measured—see note 3—this does not seem to be ambiguity or disagreement about what kinds of things exist or what kinds of relations they stand in.

Just as a lack of metaphysical depth does not preclude epistemological depth, it also does not preclude *axial depth*, that is, radical disagreement concerning values. While I am primarily interested in epistemological depth here, in Section 5 I situate the yield debate in the broader controversy over whole systems of food production. Again, aspects of this controversy are metaphysically deep. But I emphasize differences about how decisionmaking authority should be organized and agricultural practices should be evaluated, which

do not as such seem to involve deep differences about what kinds of things exist. This is axially (or perhaps “axiologically”) deep disagreement, rather than metaphysical disagreement, and I argue that it underpins some of the epistemological depth in the yield controversy.²

Overall, the current paper has four tasks. First, empirically, I show that the two sides in this controversy appeal to different sets of evidence. Second, philosophically, I show that these two sets of evidence correspond to two rival epistemological frameworks. Third, I argue that, on one of these frameworks, there is a tight relationship between evidence and the context of application, and that the two sides in the GM yields controversy disagree about the context of application. Thus, even if the two sides in the controversy could agree on the same epistemological framework, they would not necessarily agree on what counted as evidence. Both the second and third points indicate significant epistemological and axial depth in the crop yields controversy. This suggests that methodological, epistemological, and axial reflection will be needed to resolve the controversy. So, fourth, this paper aims to provide theoretical or philosophical background for a companion paper for practicing scientists actually involved in crop yields research. The current paper assumes a primary audience of philosophers of science, but except for a few technical discussions should mostly be accessible to researcher in fields such as science studies and agronomy.

I proceed as follows. In Section 2 and Supplement S.1, I provide a brief background on GM crops and analyze three frequently cited review reports on GM crop yields. Two of the reports are “pro-GM”: they purport to provide evidence that GM crops have higher yields, and are cited by proponents of GM crops. The third is “anti-GM”: it purports to provide evidence that GM crops do not have higher yields, and is cited by opponents. In Supplement S.2, I discuss some issues related to funding, conflicts of interest, and the disciplinary training of the authors of these reports. In the body of the paper, I focus on the sources of evidence cited in each report. I show that the pro-GM reports tend to cite surveys of farmers, especially in “developing” countries, while the anti-GM report tends to cite controlled field trials conducted by scientists in the United States. In short, the two sides of the GM controversy work with two different sets of evidence.

In Section 3, I argue that these two different sets of evidence correspond to two rival epistemological frameworks or conceptions of evidence, and thus that the controversy is epistemologically deep. The use of controlled field trials corresponds to what I call classical experimental epistemology, in which causal relationships are investigated by holding fixed all variables except the purported cause and effect. By contrast, farmer surveys fit much better with Nancy Cartwright’s evidence for use, which is more concerned with the ways in which the causal relationship depends on the presence or absence of other “support factors.” Section 4 considers two philosophical responses to this epistemologically deep controversy.

In Section 5, I work within the framework of Cartwright’s evidence for use to examine the relationship between research methods, evidence, and the context of application—the “extra-scientific” situations in which research findings will be put to use. In Cartwright’s framework, a key question is whether research provides us with evidence that is relevant (in a technical sense) to some other situations of interest. Drawing on the work of rural sociologists, I argue that GM proponents and opponents are interested in different situations—they have in mind different contexts of application. Research methods and evidence that are relevant to

¹ To be clear, this paper does not discuss other controversies surrounding these crops, such as their effects on human health or non-target insects such as butterflies. Thus, I am speaking here about a GM controversy, not *the* GM controversy. In Section 5, I do put the yield controversy in the context of a broader debate that might be called “the” food systems controversy. I thank an anonymous reviewer for pushing me to clarify this point.

² I thank two anonymous reviewers for encouraging me to clarify the relations among metaphysical depth, epistemological depth, and values.

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