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Te Whare Wānanga o Waitaha
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EVIDENCE Jack Heinemann
TOPIC GMO PC181 / PC18
SUB# 005
DATE 13/6/2016

BEFORE THE WHANGAREI AND FAR NORTH DISTRICT PLAN INDEPENDENT HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Plan Change 131 and Plan Change 18 - Genetically Modified Organisms
AND	
IN THE MATTER	of the submissions and further submissions on the above two plan changes

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SUMMARY STATEMENT OF EVIDENCE BY JACK HEINEMANN ON BEHALF OF WHANGAREI AND FAR NORTH DISTRICT COUNCILS

13 June 2016

Contents

Code of Conduct

1. I confirm that I have read the Code of Conduct for Expert Witness contained in the Environment Court Practice Note and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

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Summary of Evidence

2. In this brief summary I recall my primary evidence and respond to evidence submitted in the interim by some others. I do not intend to read the full brief.

3. I contend that the Proposed Whangarei and Far North District Councils' proposed GMO provisions provide a sound and valid, precautionary framework for regulating the outdoor use of GMOs. Moreover, the proposed GMO provisions are adaptive allowing GMOs to be used in the environment if they offer a net benefit to the community. They create a new opportunity for public participation in local decision-making, consistent with international trends on the outdoor use of GMOs.

4. I contend that they are justified by the uncertainty in the science on GMOs, their potential to cause harm and provide advertised benefits.

The GMO provisions are built upon a sound and valid precautionary framework.

5. In my primary evidence, I set out a description of the international framework for GMO environmental release decision-making[1]. I used the Cartagena Protocol on Biosafety, an international treaty ratified by New Zealand. Additionally I drew upon the international Guidance on Risk Assessment and Risk Management which has been produced to help countries meet their obligations under the Protocol.

6. I found that the proposed Plan Change provisions and the accompanying Section 32 Report[2] comprise a reasonable response to the scientific uncertainty about the effects from outdoor use of GMOs. The GMO provisions and the Section 32 Report are based upon the precautionary approach as outlined in both the Protocol and its supporting documents.

7. The proposed Plan Change provisions are adaptive. "At the point a class or set of GMOs demonstrates potential to provide *net benefits* to the district or region, a plan change can then be made under section 73(1) of the [Resource Management] Act to make these subject to the discretionary provisions. Alternatively, a proponent of a GMO release is able to request a private plan change under section 73(2) of the Act" (emphasis added).

8. The GMO provisions are consistent with the international framework described by the Protocol, which carefully separates decision-making on the release of a

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[1] Please see paragraphs 21-27 of my primary evidence of 12 May 2016.

[2] Proposed Plan Change 131, Proposed Plan Change 18, and related Section 32 Reports.

GMO from the act of conducting a technical (ie scientific) risk assessment. A technical risk assessment forms a critical part of what a decision-maker considers, but the decision-maker can also take into consideration other things. Among these things can be the decision-maker's determination of a net benefit.[3]

9. For example, Article 26 of the Protocol states that: "The Parties, in reaching a decision on import under this Protocol or under its domestic measures implementing the Protocol, may take into account, consistent with their international obligations, socio-economic considerations arising from the impact of [GMOs] on the conservation and sustainable use of biological diversity, especially with regard to the value of biological diversity to indigenous and local communities."

10. Internationally, regulating the release of GMOs is moving to more local levels. For example, new rules have allowed individual countries to 'opt-out' of decisions on environmental release made at the European Union level. Already France, Germany and Scotland have announced their intentions to do so. Engaging local communities in decision-making is endorsed by the International Assessment of Agricultural Knowledge, Science and Technology for Development.[4]

11. Thus I conclude that the proposed GMO provisions are aligned with mainstream frameworks for making decisions on the release of GMOs into the environment. These frameworks are based on a precautionary approach, scientific risk assessment, and public participation in decision-making that may take into account more than just scientific issues.

The GMO provisions are justified by the uncertainty in the science on GMOs, their potential to cause harm and intended benefits.

12. As I mention above, the GMO provisions are precautionary, adaptive, and require that the local community will receive a net benefit from the release of a GMO. In addition to permitting the use of medical and veterinary vaccines, the proposed Plan Change provisions permit work to be conducted on GMOs provided that it is done in containment. The Plan could be changed if were to be demonstrated that a prohibited GMO would provide a net benefit.

13. Several submitters argued that GMOs released in other countries, mainly if not

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[3] It would be an error to assume that a decision-maker would necessarily issue a decision based entirely on the outcomes of a technical risk assessment. Thus, even a national decision-maker may ban the outdoor use of a GMO that the national regulatory agency deemed to be 'safe'. This is because a decision-maker can take into account many additional issues, including social, economic and the public interest.

[4] "To use GMOs or not is a decision that requires a comprehensive understanding of the products, the problems to be solved and the societies in which they may be used. Thus, whatever choices are made, the integration of biotechnology must be within an enabling environment supported by local research and education that *empowers local communities*" 1. **IAASTD.** 2009. Agriculture at a Crossroads. *In* McIntyre BD, Herren HR, Wakhungu J, Watson RT (ed.), International Assessment of Agricultural Knowledge, Science and Technology for Development. Island Press, Washington, D.C.. Normative judgments will always be contestable and thus we rely on decision-makers to make the final determination.

exclusively GM plants, have documented benefits. I agreed that there is evidence of benefit.[5]

14. However, I also documented that to date the evidence of benefit was highly case and location-specific, and frequently based on mainly short-term measurements. The most recent examination of GM crops by the US National Academies of Science a report also cited in the evidence of Dr Michael Dunbier for Pastoral Genomics confirms that there are no consistent benefits to crop yield, no substantiated sustainable benefits to weed control, and that GM herbicide resistant crops were a significant contributor to the emergence of herbicide resistant weed species (2).

15. Extrapolation of benefit to Auckland/Northland is speculative both because of the quality of benefit assessment and the lack of science on the ability to predict that benefits will transfer to different locations. Moreover, the evidence of benefit in many cases is contested either because of the reasons I have just outlined, or because it was obtained using flawed methodology. Mainstream sources such as the World Health Organisation and *Nature* magazine[6], regarded as the international voice of science, provide unequivocal statements on the uncertainty in the science on both potential for harm and benefit of GMOs. For example, in 2013 *Nature* said that

> "In the pitched debate over genetically modified (GM) foods and crops, it can be hard to see where scientific evidence ends and dogma and speculation begin...Researchers, farmers, activists and GM seed companies all stridently promote their views, but ***the scientific data are often inconclusive or contradictory***" (emphasis added to reference 3).

16. It is no surprise to me that the claims in various statements of evidence provided to the Panel are strident. However, that alone is not evidence of either their accuracy or ability to represent the spectrum of legitimate scientific opinions on benefit.

17. Neither do strident statements that GMOs are safe represent the full spectrum of scientific opinion.[7] There is active debate, with some scientists publishing evidence of potential adverse effects and other scientists publishing evidence of no, or no 'significant', adverse effects on a product-by-product basis.[8] I

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[5] Thus Mr Richard Gardner's evidence for Federated Farmers is incorrect in the claims made in paragraph 27 of his evidence.

[6] Please see paragraphs 70-81 of my 12 May primary evidence.

[7] This section also addresses Dr Michael Dunbier's submission for Pastoral Genomics, paragraphs 88-96.

[8] The latest report from the US National Academies of Science says that they could find no *substantiated* case of particular impact on human health with existing GM crops. "On the basis of its detailed examination of comparisons between currently commercialized GE and non-GE foods in compositional analysis, acute and chronic animal toxicity tests, long-term data on health of livestock fed GE foods, and epidemiological data, the committee concluded that no differences have been found that implicate a higher risk to human health safety from these GE foods than from their non-GE counterparts. The committee states this finding very carefully, acknowledging that any new food—GE or non-GE—may have some subtle favorable or adverse health effects that are not detected even with careful scrutiny and that health effects can develop over time" 2. **National Academies of**

remind the Panel of a meta-analysis of the literature on evidence of safety of GM plants used in food, which observed

> "a certain equilibrium in the number of research groups suggesting, on the basis of their studies, that a number of varieties of GM products (mainly maize and soybeans) are as safe and nutritious as the respective conventional non-GM plant, and those raising still serious concerns" (4).

18. I provided in my previous statements of evidence accounts of many different perspectives on both safety and benefit from many hundreds of scientists. I sited nuanced and careful statements from many of the same organisations that are quoted by eg Federated Farmers and Pastoral Genomics. I concur that some scientists have the view that existing commercialised GM crop plants are safe. There are scientists, some of them the same, that believe that existing commercialised GM crop plants provide benefits. There are scientists that do not believe that such evidence exists, or is equally strong, for all commercialised GM crops.

19. In Pastoral Genomics submission by Dr Michael Dunbier (paragraph 89.2) he stated that the PEW survey "showed that 88% of 3748 US scientists surveyed agreed that GM food is safe". Therefore, clearly, 12%—or 450—US-based surveyed scientists, must not generally agree.

20. Dr Dunbier says of me that my "approach to GM risk and regulation is not strictly based on available science" (paragraph 90). I agree (but probably for different reasons). My approach is in line with best practice risk assessment and risk management research, informed by the best available science. This approach is also consistent with the recently released US National Academies of Science report on genetic engineering that Dr Dunbier quotes in his evidence. That report (2) says that

    a. "sweeping statements about GE crops are problematic because issues related to them are multidimensional" and

    b. "sweeping statements are problematic because the formation of policies for GE crops involves not just technical risk assessment but legal issues, economic incentives, social institutions and structures, and diverse cultural and personal values."

21. Technical science is not the only important input to consider. In addition, science itself is subject to framing which is a source of some of the disagreement between scientists who, without exception, have personal values.

22. Some submitters attempt to define consensus rather than the process through which consensus is reached.[9] In my view, this approach impedes attempts to achieve consensus. It is instructive to again call upon the US National

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Sciences E, and Medicine. 2016. Genetically Engineered Crops: Experiences and Prospects. The National Academies Press, Washington, DC..

[9] For example, Pastoral Genomics submission by Dr Michael Dunbier defines consensus as "as 'agreement; majority view'" (paragraph 88). Decisions may be reached by majorities, but a consensus-process is more involved.

Academies of Science report just published. That report never claims to be a consensus view, but it does describe the intentions of the National Academies to follow a consensus-study process.

> "Our committee embraced the Academies consensus-study process, which requires that 'efforts are made to solicit input from individuals who have been directly involved in, or who have special knowledge of, the problem under consideration' and that a study 'report should show that the committee has considered all credible views on the topics it addresses, whether or not those views agree with the committee's final positions. Sources must not be used selectively to justify a preferred outcome.'"

23. Intriguingly, searching the US National Academies of Science report on genetic engineering for the word "consensus" often returns the phrases "no consensus" or "no scientific consensus".[10] In the preface, the chair of the committee that wrote the report said

> "Before and during the committee's first meeting, *we received comments from people and groups expressing the view that the scientific evidence establishing the safety of current GE crops was so solid and well-reviewed that the only potentially useful task for the committee would be to examine emerging genetic-engineering technologies. We considered those comments but believed that available analyses were not complete and up to date* and that an examination of the data on diverse biological and societal aspects of both current and future GE crops would therefore be useful" (emphasis added to 2).

It appears to me reasonable, then, for the Councils to also have this view.

24. There are few if any examples of attempts to achieve a scientific consensus view on genetic engineering other than the process conducted by the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), which involved hundreds of researchers and international peer reviewers (5). I discussed this report in my primary evidence.[11]

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[10] The chair of the report panel said in the preface: "decisions about how to govern new crops needs to be made by societies. There is an indisputable case for regulations to be informed by accurate scientific information, but history makes clear that solely 'science-based regulation' is rare and not necessarily desirable. As a small example, how would science alone decide on how important it is to prevent a decline in monarch butterfly populations?"

[11] The IAASTD report was a five year $US 11 million international research exercise involving over 400 researchers and governed by a Bureau whose membership included government appointments, industry and civil society. In Dr Michael Dunbier's evidence, he gives me elevated status as a 'principal author' (his submission paragraph 89.1). However, I was a 'principal author' among several on a single chapter of the Global Report, which was but one component of the IAASTD product. Nevertheless, I was selected by the Secretariat to be one of four on the writing team for the biotechnology section of the Synthesis Report to the IAASTD, and elected by the Bureau and the Secretariat to be the single biotechnology author representative to the Intergovernmental Panel that discussed and adopted the report. In that role, I represented the broad evidence underlying the report and not my own research,

25. I reproduced five representative quotes in paragraph 41 of my primary evidence showing a diversity of scientific opinion.

26. All sixty-one countries attending the IAASTD intergovernmental panel "welcomed the reports as an important accomplishment and decision-making tool that will help guide the future of agriculture in both policy and practice. 58 [of 61] Governments have approved both the Global Summary for Decision Makers and the Executive Summary of the Synthesis Report."[12]

27. In his evidence, Dr Dunbier described the IAASTD report as "single discipline or single sector based science views" (paragraph 89.1). This is a misinformed characterisation of the IAASTD process which included experts in science, economics, sociology, outreach, law, regulation and development chosen from academia, industry, government and civil society. It has been called agriculture's equivalent of the International Panel on Climate Change. Indeed, the Director Prof Bob Watson, was also a chair of the IPCC and he designed the process.

28. I think that it is far more important for the Panel to consider what scientists believe about future GMOs which might be considered for use in Northland , rather than focus backwards on the debate on existing GM crops. Future GMOs may not be crops and may certainly have modifications unlike those of crops that have so far been commercialised.[13] I could not find a single regulatory agency or peak scientific body anywhere in the world that based on evidence of existing commercialised GM crops have claimed that all future GMOs would be safe or provide net benefits.[14]

29. For example, the US National Academies of Science report said clearly that there "is an urgent need for publicly funded research on novel molecular approaches for testing future products of genetic engineering so that accurate testing methods will be available when the new products are ready for commercialization" (emphasis added to 2).

30. This illustrates that there is no single scientific view on all aspects of GMOs and validates the Council's proposed Plan Changes allowing for local, community-based, risk management.

31. Meanwhile several statements of evidence submitted in opposition to the proposed Plan Change provisions drew upon a report by Professors Barry Scott and Clive Ronson, for the New Zealand Royal Society.[15] This report was commissioned by Federated Farmers and was specific to the draft Section 32 Report produced by the Inter-council Working Party on GMO Risk Evaluation

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with the confidence of my 400 colleagues. My book *Hope not Hype*, which Dr Dunbier also cites, was written from my preparatory notes for the Intergovernmental Panel.

[12] http://www.unep.org/dewa/agassessment/indexdf4f.html.

[13] As the recent US National Academies of Sciences report clearly states, the historical experience of GMOs released into the environment is extremely limited. See paragraph 35 of this evidence.

[14] This point applies also to Mr Richard Gardner's evidence for Federated Farmers paragraph 59b-c.

[15] For example, paragraph 59a of the submission by Mr Richard Gardner for Federated Farmers and paragraph 70 of the submission by Dr Michael Dunbier for Pastoral Genomics. This report was included as appendix four to my primary statement of evidence 12 May 2016.

and Management Options..

32. I analysed the report by the Royal Society in my primary evidence.[16] The Royal Society report was critical of the section 32 analysis. However, I found that in many places the Royal Society report lacked scientific detail as to why the section 32 analysis or its underlying evidence was incorrect. Where details were provided, there were often some significant errors of fact or interpretation. Most importantly, in key sections the Royal Society report took quotes out of context, or from what I could tell actually manufactured quotes. These errors in places undermined what the Royal Society authors were saying. I believe that this made the Royal Society report unreliable.

33. My analysis of this report, which was also provided in evidence at the Auckland Independent Panel Hearings last year, has not been contested by the authors even though at least one of them served as a witness opposing the proposed GMO provisions.

Summary

34. For these reasons and others I believe that the Councils have valid reasons for adopting the Proposed Whangarei District Plan Change (PC131) and the Proposed Far North District Plan Change (PC18) along with the proposed amendments outlined in the Planners Section 42A Report.

—Read statement ends here.—

Response to Pastoral Genomics (Dr Michael Dunbier) 31 May 2016

35. In paragraphs 56-58 of his evidence, Dr Dunbier contests my characterisation of knowledge from the outdoor use of GM crops as "limited", mainly citing figures from an industry public relations group called the ISAAA. Setting aside that the ISAAA figures are contested and likely inflated, I will simply recall a similar statement by the US National Academies of Science, whom Dr Dunbier also quotes: "Given the small number of commercialized traits and the few crops into which they have been incorporated, the data available to the committee were restricted mostly to those on herbicide resistance and insect resistance in maize, soybean, and cotton. The data were also restricted geographically in that only a few countries have been growing these crops for a long period of time" (2). Thus I would say again that our knowledge from outdoor releases is indeed limited in important ways.

36. In paragraph 60 of his evidence, Dr Dunbier says that with "such widespread introduction of these novel traits (N.B. introduced by non-GM mechanisms) it might have been expected that evidence of the harm caused to non-target organisms or from weediness to have been presented by the Council. That it has not indicates that the claim of irreversibility is grossly overstated." Unfortunately, he provides no evidence of how 'widespread' these non-GM plants are or the scale of their cultivation.

37. In contrast, I provided examples of gene flow and weeds specific to GM crop plants in my primary evidence (paragraph 35a and 84). Dr Dunbier contests

[16] Please see paragraphs 86-121 of my 12 May 2016 statement of evidence.

only the example of canola (see his paragraph 68), saying that conventional canola is also difficult to contain. His response is problematic for several reasons.

a. He does not mention the other examples of gene flow that I provided in paragraph 84, and the significant 2016 US General Accounting Office report on the topic that I cited there.

b. The canola in question can have multiple herbicide resistances (ie is "stacked") and thus it is the GM trait that makes these versions virtually impossible to remove from other cropping systems.

c. It is experiences such as these, following on from intended uses of GM crops as approved by national regulators, that make local authorities and communities concerned.

38. Dr Dunbier concludes in his paragraph 73 that: "There is no reason to suppose that any future crop system options should be foreclosed because of the field testing or commercial introduction of GM crops if the customary commercial standards of cultivar purity are accepted." The examples I provided in paragraph 84 of my primary evidence show how unsound that expectation is.

39. I agree with much of what Dr Dunbier says in paragraphs 61-66 of his primary evidence. In particular, I agree that unwise use of herbicides in any cropping system can result in herbicide resistant weeds and that the 2016 US National Academies of Science report confirmed that GM cropping systems have increased the proportion of resistant weeds specific to the glyphosate-resistant GM trait used there.

40. However, what I contend is that the predictable outcome of using a herbicide-resistant GM crop plant is unwise use of herbicides. Recall that the US National Academies of Science both confirmed that herbicide resistance was the major of only two significant commercial traits ever released[17], and it said: "In areas where planting of [herbicide resistant] crops led to heavy reliance on glyphosate, some weeds evolved resistance and present a major agronomic problem" (2).

41. Connected with the *intended* use of GM Roundup[18] Ready crops, weeds resistant to glyphosate-based herbicides have arisen in environments that a) were free of such weeds before the GM cropping system was introduced despite long use of the same herbicides and b) were also predicted to remain free of such weeds. This argument was made explicitly by the manufacturer of Roundup nearly 20 years ago (6).[19]

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[17] "only two traits—insect resistance and herbicide resistance—had been genetically engineered into a few crop species and were in widespread use in 2015" 2. **National Academies of Sciences E, and Medicine.** 2016. Genetically Engineered Crops: Experiences and Prospects. The National Academies Press, Washington, DC..

[18] The active ingredient of Roundup is glyphosate.

[19] "Finally, the potential for obtaining glyphosate resistance through metabolic inactivation is considered low since there is no evidence for glyphosate metabolism having conferred resistance naturally in any plant species after more than two decades of commercial applications" 7.

42. Experience shows that pesticides will be used in such a way when coupled to GM cropping systems (6, 8). Nearly all commercial GM crops are intended to be grown as monocultures in simple pest and/or weed management systems. Nearly all new GM staple crops look to be the same for the foreseeable future. Thus, in my view, there is substance to the "claim of a unique risk", albeit quantitative, from existing GM cropping systems in relation to controlling weeds.

43. Dr Dunbier and I are agreed on many of the observations he makes in his paragraphs 69-71. What he says there, however, does not refute my primary evidence nor, more importantly, address the key points that I made in paragraphs 104-107 of my primary evidence. In summary, benefits, where they have been observed,

    a. have not been sustainable;

    b. are claims based on generally lower quality evidence;

    c. may not transfer between countries and cropping systems; and

    d. are confined to plants whereas the proposed GMO provisions are about all organisms that might be genetically engineered.

44. In paragraph 41 of Dr Dunbier's submission he questions the validity of the Section 32 Report saying that its "analysis of the literature on GM risk assessment and risk management is both incomplete and out of date. Sanchez (2015) notes over 31848 reports published on GM crop safety before 2006 and since 2005 there have been hundreds more peer reviewed studies published on GM safety (see Sanchez ibid) and impacts of GM on the environment, the economy and society."

    a. A characterisation of the literature as Dr Dunbier provides is commonly made but easily misunderstood. The number of papers published 'on' an issue does not equate to the number of papers published that conclude GMOs are safe or have no adverse impact on the environment. In my reading I find that many of these papers find evidence of harm (4, 9, 10). In some of these papers, the authors do not comment on the significance for technical risk assessment, in others they do not express concern, and in some they do express concern.

    b. Moreover, Dr Dunbier's reference to numbers of papers on the topic does not provide a sense that the studies have been adequately

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Bradshaw LD, Padgette SR, Kimball SL, Wells BH. 1997. Perspectives on glyphosate resistance. Weed Technol. **11:**189-198.. "One question that has arisen is whether the probability of the occurrence of herbicide-resistant weeds will increase due to glyphosate use on crops with added glyphosate-resistance genes. This question can be addressed in two ways. First, glyphosate has been used repeatedly in some agronomic systems (e.g., perennial tree crops) for many years with no resistant weeds occurring. Since the use patterns of glyphosate on crops with glyphosate-resistant genes are limited by amount and frequency of glyphosate applications, it is reasonable to expect that the probability of glyphosate-resistant weeds evolving will not increase significantly over that considered with current use" 7. ibid..

distributed across different kinds of GM plants, or provide sufficient power of replication in each specific case to justify confidence.[20]

45. Dr Dunbier says in his paragraph 40 that I have suggested "that Pastoral Genomics is requesting that current and future GMOs should be unregulated." I, however, made no such assertion and conclude that Dr Dunbier has misread my evidence.

46. Dr Dunbier (as does Mr Gardner) claims that the Section 32 Report is out of date. I have addressed this issue extensively in my primary evidence.

47. I have thoroughly addressed Dr Dunbier's paragraph 72 and the evidence he relies upon in paragraphs 109-119 of my primary evidence, which he does not refute.

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48. 1. **IAASTD.** 2009. Agriculture at a Crossroads. *In* McIntyre BD, Herren HR, Wakhungu J, Watson RT (ed.), International Assessment of Agricultural Knowledge, Science and Technology for Development. Island Press, Washington, D.C.

49. 2. **National Academies of Sciences E, and Medicine.** 2016. Genetically Engineered Crops: Experiences and Prospects. The National Academies Press, Washington, DC.

50. 3. **Gilbert N.** 2013. Case studies: a hard look at GM crops. Nature **497:**24-26.

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56. 9. **Hilbeck A, Binimelis R, DeFrage N, Steinbrecher R, Szekacs A, Wickson F, Antoniou M, Berano PL, Clark E, Hansen M, Novotny E, Heinemann J, Meyer H, Wynne B.** 2015. No scientific consensus on GMO safety. Env. Sci. Eur. **27:**4.

57. 10. **Krimsky S.** 2015. An illusory consensus behind GMO health assessment. Sci. Tech. Human Val. **in press:**1-32.

[20] As an authoritative team stated: "A relatively remarkable finding of the present review is that the published scientific literature between October 2006 (Domingo, 2007) and August 2010 (current review) on edible GM plants, concerns only to three products: corn/maize, soybeans, and rice, rice being comparatively the less abundant. We have not been able to find citations involving investigations on GM potatoes (except a review by Arvanitoyannis et al., 2008), peas, tomatoes, pepper, etc., after October 2006" 4. **Domingo JL, Bordonaba JG.** 2011. A literature review on the safety assessment of genetically modified plants. Env. Int. **37:**734-742..