

**BEFORE COMMISSIONERS APPOINTED BY THE WAIKATO DISTRICT
COUNCIL**

UNDER the Resource Management Act 1991

IN THE MATTER of a further submission on the proposed Waikato District
Plan by the **LIFE SCIENCES NETWORK
INCORPORATED** (further submission no. 1295)

**EVIDENCE OF DR ANTHONY JOHN CONNER FOR THE LIFE SCIENCES
NETWORK INCORPORATED**

HEARING 8B: GENETICALLY MODIFIED ORGANISMS

19 December 2019

QUALIFICATIONS AND EXPERIENCE

1. My full name is Anthony John Conner.
2. I hold a BSc Hons degree from the University of Canterbury in botany, ecology and microbiology (1978) and a PhD from University of California (Davis) in genetics and plant breeding (1985).
3. I am currently employed as Science Group Leader for Forage Science at AgResearch, a position I have held for the past eight years. This role involves managing a Group of about 180 staff, casual employees and PhD students working on research projects associated with forage science with a focus on grasses and clovers, plus their associated organisms (symbionts, pests and diseases). I also currently serve on the Council of the Royal Society Te Apārangi as the Deputy Chair of the Academy Executive.
4. My science career in New Zealand has spanned 40 years, predominantly in the DSIR/CRI system. My experience and expertise has embraced both fundamental and applied plant sciences. Since 1985 that has included research on the development of genetically modified crops (especially potatoes), including laboratory and greenhouse experiments, field evaluation, and biosafety assessments.
5. I have been involved with two of applications to the (then) Environmental Risk Management Authority (now the EPA). These involved potatoes with transgenes conferring resistance to potato tuber moth and soft rot bacteria. I also served as an expert witness for ERMA applications to field test transgenic onions and transgenic brassicas. Prior to the HSNO Act, I was involved in about 25 field tests following applications assessed by the 'Interim Assessment Group'.
6. My broad experience is evident from the diverse range of scientific journals in which I have published, including those specialising in breeding, genetics, biotechnology, molecular biology, biochemistry, food science, nutrition, soil science, agronomy, pathology, entomology, botany, ecology, natural history, etc. I have published 190 peer reviewed scientific papers that have been cited over 5100 times. A list of the principal relevant papers and articles is included as Appendix A attached to my evidence.

7. I was elected a Companion of the Royal Society of New Zealand in 2003, appointed as a Fellow of the New Zealand Institute of Agricultural & Horticultural Science in 2010, and was elected as a Fellow of the Royal Society of New Zealand in 2011.
8. I have regularly served in science advisory roles both in New Zealand and internationally. Key roles have included the Scientific Advisory Board of the ERA-Net for the European Union Coordinating Action in Plant Sciences (2013-2017), Advisory Board of the International Society of Biosafety Research (2004-2008); International Society of Biosafety Research Executive Committee (2008-2010); the Pastoral Genomics Science Advisory Panel (2006-2011), and the Tertiary Education Commission PBRF 2018 Quality Evaluation, Biological Sciences Panel (2018-2019). I have regularly acted as a reviewer for government science funding agencies from USA, Germany, the Netherlands, Ireland, Singapore, Australia, and New Zealand.
9. Over my career I have served in editorial roles for seven international scientific journals, including over 20 years for *Euphytica*, an international journal of plant breeding.
10. In preparing this evidence I have reviewed/considered:
 - a. The s42A report;
 - b. The draft evidence of Professor Andrew Allan, and Dr William Rolleston
 - c. Relevant parts of the submissions from submitters seeking controls on GMOs in the proposed Waikato District Plan.
11. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

12. I have been asked by the Life Sciences Network (LSN) to prepare evidence in relation to the request by some submitters to include

controls and prohibitions on genetically modified organisms (GMOs) in the proposed Waikato District Plan. My evidence comments on:

- a. The history of safe use of approved genetic modification;
- b. My experience as an applicant for approval to field test GM crops;
- c. The impact on research organisations of strengthened regulation of GMOs following the report of the Royal Commission of Inquiry on Genetic Modification in 2001, and the likely impact on research organisations if additional controls were imposed in the Waikato District Plan;
- d. The arguments used to make a case to ban or limit the use of GMOs.

EXECUTIVE SUMMARY

13. I agree with Professor Andrew Allan that the general international consensus is that approved GM is acceptably safe (for the reasons and with the caveats he has in his evidence).
14. From my experience, the HSNO/EPA process is rigorous and thorough.
15. Since the Royal Commission's report in 2001 (which recommended that New Zealand keeps options open), research on GM has slowed/stalled because the regime/process is complex, costly, time-consuming and onerous. A ban on releases or additional controls in the district plan, particularly if they might result in different /conflicting outcome from the HSNO/EPA process, would be a major disincentive to further research and development.
16. I agree with Dr William Rolleston that separation distances can be appropriately managed in NZ like the rest of the world. Co-existence can be achieved in a range of ways and does not need to be regulated by resource consents under the RMA.

17. Many of the arguments used to make a case to ban or limit the use of GMOs are based on incorrect assumptions, unsubstantiated information, poor experimentation, or poor interpretations of scientific information. In any event, all the concerns raised by submitters can either be addressed by the EPA under the HSNO Act, or they overstate the residual risk of an approved GMO. Consequently, it is my opinion that there is no need additional controls on approved GMOs under the RMA.

THE HISTORY OF SAFE USE OF APPROVED GENETIC MODIFICATION

18. I have read the draft evidence of Professor Andrew Allan, and I agree with his analysis and conclusions in respect of the safety of approved GM crops and what the general scientific consensus is around residual issues of uncertainty of effects.
19. The first GM crop (tobacco with virus resistance) to be planted on a large scale (about 8000 ha) in the central Henan province of China in 1992. This was followed by the FLAVR SAVR tomato in the USA in 1994. By 1996, 1.7 million ha of GM crops were planted in six countries: USA, China, Canada, Argentina, Australia and Mexico. By 2017 up to 17 million farmers in 24 countries planted 189.8 million ha of genetically modified crops. The main crops were cotton, soybeans, maize, canola, alfalfa, sugar beet, papaya, squash, potato eggplant, and apples. This technology has been available globally for 25 years (over a generation), with no documented untoward negative impacts on the environment or food safety that can be attributed to the GM status.
20. In New Zealand GM products are commonly used in the clothing industry (cotton), the feed industry (poultry and pig feed) and the food industry. Over the past two decades Food Standards Australia New Zealand have granted many approvals for the use of GM foods. The following examples remain current as approved GM ingredients in food in New Zealand: soybean (16 approvals), canola (7 approvals), corn (27 approvals), potato (5 approvals), cotton (16 approvals), alfalfa (2 approvals), rice (2 approvals), and safflower (1 approval). There have been no documented incidents of negative impact on food safety from these GM foods in New Zealand.

21. In addition to the reports referred to by Professor Allan, I have listed in Appendix A a number of scientific publications that I have authored or co-authored: The main conclusion from all these scientific papers and publications is that approved GM crops are no more risky than new crop cultivars bred by conventional plant breeding technologies. The risks of properly approved GM crops to natural ecosystems, agricultural ecosystems, food industries and consumers will be no different than the effects of growing, processing and eating new cultivars from traditional crop breeding. Furthermore, the precision and power of molecular biology offers greater confidence of achieving and monitoring the desired outcome in GM crops relative to traditional crop breeding.
22. I do not agree with the submissions which state that there are risks of GM crops which have been approved by the EPA that need further and additional controls in the Waikato District Plan.

MY EXPERIENCE AS AN APPLICANT FOR A GMO APPROVAL

23. Field tests on GMOs have been successfully undertaken in New Zealand over the last 30 years with no untoward impacts (first planted at Lincoln, Canterbury in 1988). Over these 30 years I have been responsible for most of the field tests (over 30) in New Zealand on GM plants. The majority of these field tests occurred prior to the HSNO Act and applications were assessed by the 'Interim Assessment Group'. Since 1998, I have also been involved in applications to the Environmental Risk Management Authority (now known as the Environmental Protection Authority). This has involved potatoes with transgenes conferring resistance to potato tuber moth (the major insect pest of potatoes) and soft rot bacteria (the major bacterial disease of potato). I have also acted as an expert witness for applications to ERMA for field tests on transgenic onions, forage brassicas, vegetable brassicas, and cattle.

24. The introduction of the HSNO Act and the Environmental Risk Management Authority greatly increased the rigour and thoroughness of the assessment and approval of applications. It was my experience that an extremely cautious approach was taken to these applications under the HSNO Act. During those processes I was involved with there was much discussion from submitters and members of the hearing panels about the need for caution, and the importance of social, economic and cultural considerations in the decision making. I understand this also to have resulted in the precautionary principle having been fully embraced. Approvals have only been granted with the imposition of highly restrictive controls have they have been administered by the Ministry of Primary Industries.

THE IMPACT OF THE EXISTING HSNO REGIME AND IMPACT OF ADDITIONAL CONTROLS ON FIELD TRIALS AND A BAN ON RELEASE OF GM CROPS

25. The Royal Commission on Genetic Modification held in New Zealand almost 20 years ago recommended 'proceed with caution'. This thorough assessment of genetic engineering recognised the value of the technology and the need to balance benefits versus risks. 'Proceed with caution' means release of GMOs within appropriate constraints when necessary. The use of GMOs in New Zealand is now regulated by the Environmental Protection Authority on a case-by-case basis and is considered one of the most conservative regulatory regimes in the world. Issues of safety (including environmental safety), adverse effects on areas such as markets, effects on Maori and local iwi, other adverse effects, risks (and risk mitigation) and management are all considered by the EPA. Given the strict regulation on GM in New Zealand, it is my opinion that there is no further need to District Councils to impose further limitations.

26. The regulation of GMOs was further strengthened following the report of the Royal Commission of Inquiry on Genetic Modification in 2001. With the introduction of the Hazardous Substances and New Organisms (Genetically Modified Organisms) Amendment Act in 2002, it became mandatory that no heritable material could be released from field tests. This has been interpreted to include pollen, which means no GM plant can be allowed to flower in the field as insects and wind

cannot be absolutely controlled. This has effectively resulted in a moratorium as virtually no applications for field tests have been made to the ERMA/EPA since 2002. Consequently, AgResearch has been forced to undertake field test of ryegrass and clovers in North America. This has slowed research on GM crops because the regime/process is complex, costly, time-consuming and overly onerous to meet the necessary controls imposed on field tests. The AgResearch plan is to advance directly to full release with controls in New Zealand. Additional controls in the district plan, particularly if they might result in different /conflicting outcome from the HSNO/EPA process, would be a major disincentive to further research and development.

27. AgResearch is currently involved in the field testing in the USA of GM ryegrass with high metabolizable energy (high lipid content) and GM white clover with increased condensed tannins. These products present opportunities to lower methane emissions from the rumen of grazing animals. For the high lipid ryegrass we anticipate a 17% reduction in nitrate losses and at least a 15% reduction in methane production, while increasing the growth rate and productivity of the grass. These options have the potential for huge positive outcomes for farming systems in New Zealand, including those in the Waikato District Council. Imposing a ban in the district plan on the use of GMOs which have been approved by the EPA will be denying local farmers access to potential solutions to current key environmental limitations on farming. Imposing additional limitations in the district plan on approved GMOs may well have the same effect.
28. AgResearch operates a world class animal facility involving transgenic animals on the Ruakura campus. When this facility was approved in 1998 part of the area fell within the Waikato District Council. There are major research contracts supporting this work from the Ministry of Business, Innovation & Employment. Any restrictions on GM organisms imposed by local Councils will threaten the continuation of this research, resulting in a potential reduction of innovation and capability.

29. Genetic technologies are developing rapidly with the current tools of gene editing (still regarded as genetic modification in New Zealand) being more precise, highly accessible to local scientists outside multinational corporations, more predictable and considerably cheaper than the former genetic modification technologies. These new gene editing technologies are now capable of making changes which are indistinguishable from traditional (non-regulated) breeding techniques and can be considered as safer than those techniques. These developments will provide new opportunities to develop plants and animals with characteristics that will enhance production while minimising environmental footprint of agriculture, horticulture and forestry. Such outcomes are critical for the future of the New Zealand economy. This will only be possible with scientific research, including field tests on GMOs in New Zealand. A ban or any limitations on the use of GMOs in the district plan will be denying opportunities for future generations.
30. I have read the draft evidence of Dr William Rolleston, and I agree with his analysis and conclusions in respect to separation distance and co-existence. The placement of restrictions on approved GM organisms in District Plans or requiring farmers to obtain resource consents overlooks the ability for different forms of agriculture to co-exist. Co-existence of GM crops with conventional cropping and organic farming is effective in other countries that grow GM crops. Conventional cropping and organic farming co-exist in New Zealand. The same principles apply to the existing co-operation between New Zealand farmers involved in the seed industry, where working together to prevent cross pollination between different seed crops growing on neighbouring farmers is a critical component for the highly valued for the local and export seed industry. Co-existence of GM crops with conventional cropping and organic farming is entirely feasible in New Zealand, and that can be achieved without the use of resource consents under the Resource Management Act.

ASSERTIONS OF HARM FROM APPROVED GENETIC MODIFICATION ARE NOT CREDIBLE

31. In my expert opinion, the arguments used to make a case to ban or limit the use of GMOs are generally based on incorrect assumptions, unsubstantiated information, poor experimentation, or poor interpretation of scientific information. These accusations are often made by non-experts with little understanding of the science involved. Although the asserted risks of genetic modification seem plausible at a general level, there is a lack of understanding that the issues being presented are not necessarily a consequence of genetic modification and that such risks equally apply to conventional breeding technologies. Furthermore, the examples used generally involve contained laboratory experiments undertaken to illustrate potential and perceived risks. These examples are never intended as positive development of new organisms, never intended for release into the environment, and would never be approved by regulatory bodies for release into the environment.
32. In my experience, assertions and discussions of risks associated with GMOs generally have been of little assistance to decision makers when considering specific proposals for GMOs. The consideration of risks and benefits of GMOs at a general level was a major feature of the Royal Commission of Inquiry on Genetic Modification in 2001. I presented evidence to that Inquiry. As I have mentioned, the Royal Commission's report resulted in changes to the HSNO Act which strengthened of various controls, although I understand the Commission found that the HSNO Act was basically sound and appropriately precautionary.

33. In my view, it is critical that the development and potential uses of GMOs are considered on a case specific basis and there is a robust system and processes in place to assess both the risks and the benefits of those specific proposals. Furthermore, an appropriately cautious approach is taken to that assessment by a competent science-based organisation or agency. In my experience, that is what New Zealand currently has with the HSNO Act (though in my view it is unnecessarily restrictive in some respects). I can see no benefit in having in a district plan a ban or additional controls on GMOs which have been approved by the EPA under the HSNO Act.

CONCLUSIONS

28. Genetic modification has been safely used throughout the world for over a generation (25 years). For the GM crops that have received regulatory approval for release, there have been no documented untoward negative impacts on the environment or food safety that can be attributed to the GM status.

29. GM crops are not any more risky than new crop cultivars bred by conventional plant breeding technologies. The risks of GM crops to natural ecosystems, agricultural ecosystems, food industries and consumers will be no different than the effects of growing, processing and eating new cultivars from traditional crop breeding.

30. In my opinion, there is no need for the District Council to impose further limitations on approved GMOs given that:

- a. the strict regulatory system already in place at a national level via the Environmental Protection Authority (with the controls imposed on any approvals closely monitored by the Ministry for Primary Industries) provides an appropriate precautionary approach in the best interests of all New Zealand;
- b. co-existence of GM crops with conventional cropping and organic farming is entirely feasible in New Zealand;
- c. any bans or additional limitations on the use of GMOs in the district plan will stifle local research and innovation critical for New Zealand's future and would likely deny local farmers with potential solutions to current key environmental limitations on farming.

Appendix A – LIST OF RELEVANT PUBLICATIONS

Aibara, K., Conner, A.J., Hussein, L.A., Jaffe, W.R., Jonas, D.A., Miller, S.A., Notani N.K., Somogyi, A. and Volgarev, M.N. 1991. Strategies for assessing the safety of foods produced by biotechnology. Report of a Joint FAO/WHO Consultation. World Health Organisation, Geneva. 59 pp.

Conner, A.J. 1995. Case study: food safety evaluation of transgenic potato. In: Applications of the principles of substantial equivalence to the safety evaluation of foods or food components from plants derived by modern biotechnology, WHO/FNU/FOS/95.1, Pp 23-35. World Health Organisation, Geneva.

Conner, A.J. 1995. Biosafety assessment of transgenic potatoes: environmental monitoring and food safety evaluation. In: D. D. Jones (Ed.), Proceedings of the 3rd International Symposium on the Biosafety Results of Field Tests of Genetically Modified Plants and Microorganisms, Pp 245-262. University of California, Oakland.

Conner, A.J. 1995. Biosafety evaluation of transgenic asparagus. In: D.D. Jones (Ed.), Proceedings of the 3rd International Symposium on the Biosafety Results of Field Tests of Genetically Modified Plants and Microorganisms, Pp 363-369. University of California, Oakland.

Conner, A.J. 1997. Genetically engineered crops: environmental and food safety issues. The Royal Society of New Zealand Miscellaneous series, No. 39: 34 pp.

Conner, A.J. 1997. Gene introgression via genetic engineering and traditional breeding: are the benefits and risks any different for crop plants? The Royal Society of New Zealand, Miscellaneous Series, No. 46: 19-25.

Conner, A.J. 2006. Biosafety evaluation of transgenic potatoes: gene flow from transgenic potatoes. In: S.H. Huang, S. Chen and C.Y. Lin (Eds) Ecological and environmental biosafety of transgenic plants. Agricultural Research Institute, Council of Agriculture, Taichung. Taiwan Agricultural Research Institute Special Publication No. 126: 127-139.

Conner, A.J. and Jacobs, J.M.E. 1999. Genetic engineering of crops as a potential source of genetic hazard in the human diet. Mutation Research, 443: 223-234.

Conner, A.J. and Jacobs, J.M.E. 2000. Food risks from transgenic crops in perspective. *Nutrition*, 16: 709-711.

Conner, A.J., Glare, T.R., and Nap, J.P. 2003. The release of genetically modified crops into the environment: II. Overview of ecological risk assessment. *The Plant Journal*, 33: 19-46.

Conner, A.J., Jacobs, J.M.E. and Genet, R.A. 1997. Transgenic potatoes versus "traditional" potatoes: what's the difference? In: G.D. McLean, P.M. Waterhouse, G. Evans and M.J. Gibbs (Eds), *Commercialisation of transgenic crops: risk, benefit and trade considerations*, Pp 23-36. Cooperative Research Centre for Plant Science and Bureau of Resource Sciences, Canberra.

Davidson, M.M., Butler, R.C., Wratten, S.D. and Conner, A.J. 2006. Impacts of insect-resistant transgenic potatoes on the survival and fecundity of a parasitoid and an insect predator. *Biological Control*, 37: 224-230.

Nap, J.P., Metz, P.L.J., Escaler, M. and Conner, A.J. 2003. The release of genetically modified crops into the environment: I. Overview of current status and regulations. *The Plant Journal*, 33: 1-18.

O'Callaghan, M., Gerard, E.M., Waipara, N.W., Young, S.D., Glare, T.R., Barrell, P.J. and Conner, A.J. 2004. Microbial communities of *Solanum tuberosum* and magainin-producing transgenic lines. *Plant and Soil*, 266: 47-56.

O'Callaghan, M., Gerard, E.M., Bell, N.L., Waipara, N., Aalders, L.T., Baird, D.B. and Conner, A.J. 2008. Microbial and nematode communities associated with potatoes genetically modified to express the antimicrobial peptide magainin and unmodified potato cultivars. *Soil Biology and Biochemistry*, 40: 1446-1459.

ISAAA 2017. Global status of commercialized biotech/GM crops in 2017: Biotech crops adoption surges as economic benefits accumulate in 22 years. ISAAA Brief 53. ISAAA, Ithaca, NY, 143 pp; and <http://www.foodstandards.govt.nz/consumer/gmfood/applications/Pages/default.aspx> .

European Commission Report, A Decade of EU-Funded GMO Research (2001-2010), Directorate-General for Research and Innovation, Biotechnologies, Agriculture, Food. EUR 24473 EN https://ec.europa.eu/research/biosociety/pdf/a_decade_of_eu-funded_gmo_research.pdf)

National Academy of Sciences, USA (National Academies of Sciences, Engineering, and Medicine. 2016. *Genetically Engineered Crops: Experiences and Prospects*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/23395>).