gene ethics
working for a GM-free future

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March 2016

Committee Secretary
House of Representatives Standing Committee on Agriculture and Industry
PO Box 6021
Parliament House
Canberra ACT 2600
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Re: the role of technology in increasing agricultural productivity in Australia.

Thanks for the opportunity to comment to the committee on these Terms of Reference. We would also value the opportunity to brief the committee and suggest an additional hearing in Melbourne or Hobart where there are strong innovative food movements unrepresented among commentaries so far.

We will address the committees Terms of Reference, including:

- improvements in the efficiency of agricultural practices due to new technology, and the scope for further improvements;
- emerging technology relevant to the agricultural sector, in areas including but not limited to telecommunications, remote monitoring and drones, plant genomics, and agricultural chemicals; and
- barriers to the adoption of emerging technology.

Gene Ethics:

Vision: Gene Ethics envisages a safer, more equitable and more sustainable GM-free society.

Mission: Gene Ethics is a non-profit educational and policy network of over 3,000 citizens and public interest groups. We want the precautionary principle, scientific evidence and the law rigorously applied to all proposed uses of genetic manipulation (GM) techniques and their living products. Gene Ethics generates and distributes accurate information and analysis on the ethical, environmental, social and economic impacts of GM. Our education programs critically assess GM for the public, policy-makers and interest groups. [1]

Recommendations:

We recommend that the committee propose to:

- amend and extend existing laws and regulations under a COAG agreement, to give the OGTR, FSANZ, APVMA, TGA and other relevant national and state regulators responsibility for the assessment, licensing and monitoring of all new Genetic Manipulation (GM) techniques, technologies and their products, including those badged as 'genome editing'. Good precautionary regulation is not a barrier to the safe and orderly deployment of acceptable innovations;
- a review of the 30 year history and also the future of public and private funding of GM crop and animal R&D, with a focus on the economic value and social returns from that expenditure;
- prioritise funding for non-GM plant breeding programs;

[1] http://www.geneethics.org/about

- inquire into the need for and logistics of an orderly transition from oil-dependent industrial agriculture to agro-ecological and regenerative farming systems suited to Australia's soil and water resources and changing climates, to secure the long term and ecologically sustainable future of Australian agriculture;
- as a food security and sovereignty measure, prioritise building the capacity to permanently feed all Australians independent of global trade in food, with special reference to native flora and fauna that are well-adapted to local conditions;

Executive Summary:

Genetic Manipulation (GM) techniques have failed to materially improve the efficiency of agricultural practices and have not delivered on most of their glowing commercial promises, despite 30 years of expensive research. Yields were not a target trait and GM crops generally do not yield more or higher quality than the best conventional varieties.

A key barrier to adoption of GM crops is that only five broad acre crops – soy, corn, canola, cotton and sugarbeet – with just two agronomic traits – Roundup tolerance and Bt insect toxins – have been commercialised. All except sugarbeet (grown only in the USA) were launched 20 years ago.

Another key barrier was the early patenting of most genes of potential commercial interest so that public institutions were burdened with paying royalties, and growers with extortionate technology user fees, for GM crops.

Shopper demand for GM-free food products has also created durable premiums that make GM crops a less attractive proposition for farmers and grain traders. [2] The majority of GM crop products are sold more cheaply as animal feed or for biofuels.

A technical barrier is that genetic systems are too complex for the crude and inexact cut-and-paste GM techniques developed in the 1970s and 1980s that can only recombine or stack single genes. Scientists agree that most traits involve the interaction of multiple genes, too complex for GM techniques.

Australia's public expenditure and returns from GM R&D appear to be poorly documented. We suspect that it was a very unprofitable investment. This requires urgent analysis and remedy, to secure a sound basis for public policy decisions and the better allocation of scarce R&D resources.

The GM industry asserts rapid global uptake of existing GM crops but expansion peaked in 2014 at about 180 million hectares, in 28 countries, by around 18 million farmers. Australia was 13th among the 28 GM countries with just 500,000 hectares of GM canola and cotton, while 18 countries grew less than 100,000 ha of GM crops.

Globally there are over 1.2 billion hectares of GM-free cultivated farmland, 160 GM-free countries, and over 1 billion GM-free farmers. Here, over 90% of Australia's 134,000 growers remain GM-free and do not want their businesses threatened by a minority of GM enthusiasts.

US farmers still grow 40% of the world's commercial GM broad-acre crops - soybean, corn, cotton, canola and sugarbeet - with the same two Bt and Roundup herbicide tolerance traits - all launched in 1996. Six countries in North and South America grow over 90% of all GM crops, of which over 90% can tolerate being sprayed with the weed killer Roundup. The rest produce Bt insect toxins.

Repeated overuse of Roundup, including on Roundup Resistant GM crops is encouraging growers in many countries to return to GM-free conventional varieties for which demand is strong and premiums consistent.

Commercial GM crop pipelines are virtually empty. Parisi et al say that while: "current GM commercial varieties and the outlook for 2020 are still dominated by a few arable crops (usually for feed or industrial use) and certain agronomic traits, there is a nascent growth in quality traits, with a focus on

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[2] Professor Adrienne Clarke, pers comm., 2003.

biofortified food and industrial applications. Also, more specialty crops are being introduced into the pipeline and bean, rice, potatoes and sugarcane may be cultivated by 2020.” [3]

The International Rice Research Institute (IRRI) reports that GM biofortified Vitamin A rice has not been adopted commercially as its yields are lower than conventional varieties. Poverty alleviation, fresh green vegetables, balanced diets and vitamin supplements are cheaper and more reliable ways to deliver Vitamin A to 800 million poor, malnourished and starving people.

Introduction of GM canola varieties that withstand being sprayed with Roundup weed killer, overuse of chemicals and minimum and no-tillage farming systems are to blame for the rapid development of glyphosate resistant weeds, according to Professor Stephen Powles, director of the Australian Herbicide Resistance centre at the University of WA.

As a result, in a public-private partnership research deal growers will hand $45 million of their mandatory research levy to $50 billion global chemical giant Bayer, to spend five years looking for new chemicals to kill rye-grass and other weeds highly resistant to farm herbicides like glyphosate (Roundup). Powles notes that “Glyphosate-resistant weeds are now all around the world; they are a threat to global food production and we have to address it.”

GMO Myths and Truths, written by well-qualified genetic engineers, challenges the factual basis of industry propaganda with robust scientific evidence and shows how spin has misled governments into poor public policy responses. [4]

Comments:

Genetic Manipulation (GM) techniques have failed to materially improve the efficiency of agricultural practices and have not delivered on most of their glowing commercial promises, despite 30 years of intensive and expensive research. Non-GM European agriculture outperforms the GM in USA. [5] [6]

Yields were not a target trait of GM crop research so GM crops generally do not yield more or higher quality than the best conventional varieties. Croplife CEO Matthew Cossey told this inquiry that: "The future of GM crops is exciting." He made data-free claims that GM crop traits will include: salt, drought and stress tolerance; higher yields; more fats in canola and less in sunflowers; and improved biofuel crops. These claims for complex traits are not borne out by an examination of the GM crop pipeline and the GM giants that are CropLife’s constituents know it.

Last year Monsanto retrenched 2,600 (12%) of its worker as: “part of a cost-saving plan to address declining sales of its biotech seeds and herbicides.” [7] It also bought the Climate Corporation for $1 billion, [8] to refocus on helping farmers meet climate change with more information, not GM crops. In February BASF, another of the big five global chemical and GM companies, slashed its GM R&D staff from 700 to 380 and cancelled most projects except single gene herbicide tolerance and omega-3 fatty acids in canola. [9] Dow and Dupont are merging and DowDupont will be 3 separate entities where: “R&D costs -- especially at DuPont's famed research division -- could be slashed.” [10]

Just 5 mega corporations will control the global industrial food supply. Monsanto failed last year to buy Swiss pesticide and GM seed giant Syngenta. But now ChemChina is set to acquire the company and Syngenta’s board agrees. If completed, the deal will create the world’s 2nd biggest agrochemical and

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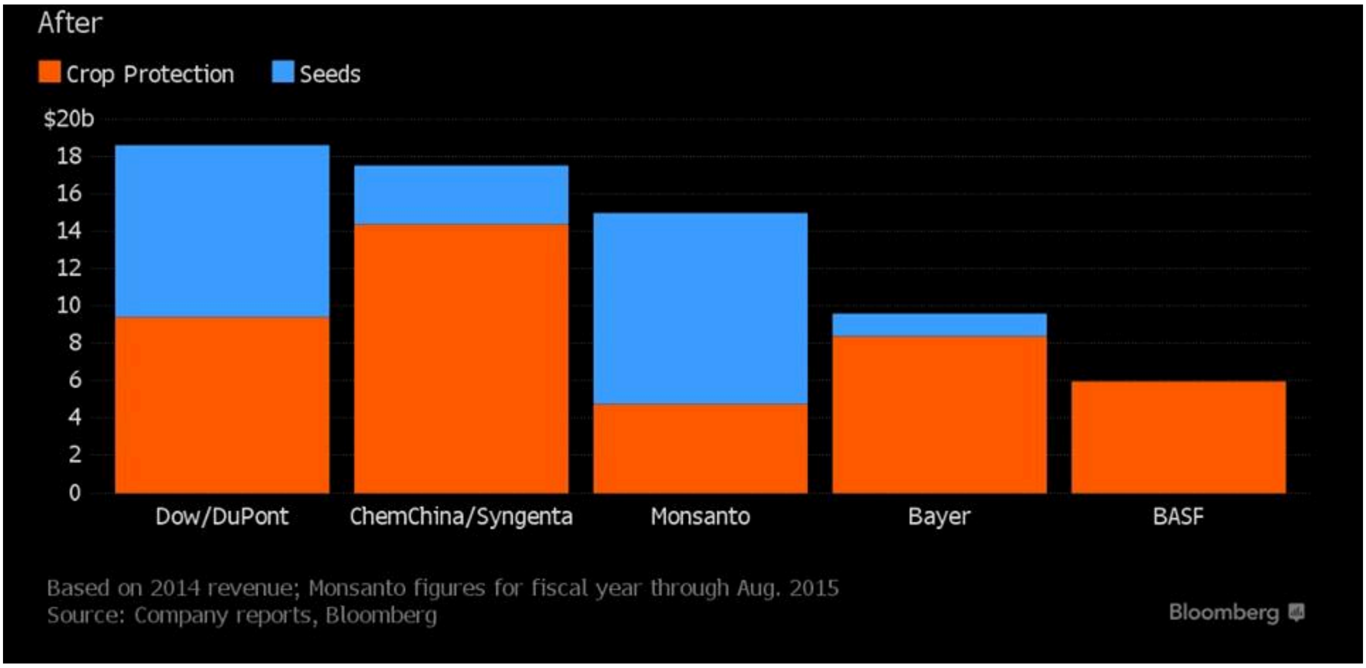
[3] The Global Pipeline of GM Crops out to 2020, Nature Biotechnology (8 Jan 2016): Claudia Parisi, et al: http://www.nature.com/nbt/journal/v34/n1/full/nbt.3449.html
[4] GMO Myths and Truths (2nd edition) Fagan J, et al, 2015. http://gmomythsandtruths.earthopensource.org/
[5] http://dx.doi.org/10.1080/14735903.2013.806408
[6] http://www.globalresearch.ca/us-genetically-engineered-agriculture-is-outclassed-by-europes-non-gm-approach/5341518
[7] http://www.rsc.org/chemistryworld/2015/10/monsanto-2600-job-cuts
[8] http://www.monsanto.com/features/pages/monsanto-acquires-the-climate-corporation.aspx
[9] http://www.thechemicalengineer.com/latest%20news/2016/february/basf-slashes-plant-biotech-research.aspx#.VuiknHCQzhc
[10] http://www.fool.com/investing/general/2016/01/04/the-dupont-dow-chemical-merger-a-lot-of-hype-or-a.aspx

seed conglomerate behind newly merged Dow/Dupont. Monsanto would still be the biggest GM seed company. [11]



A key barrier to adoption of GM crops is that only five broad acre crops – soy, corn, canola, cotton and sugarbeet – with just two agronomic traits – Roundup tolerance and Bt insect toxins – are available. All except sugarbeet (grown only in the USA) were launched 20 years ago. Despite the relative paucity of funding for them, conventional breeding and Marker Assisted Selection have contributed far more to Australian agricultural innovation than two Monsanto-owned GM crops. [12]

Another key barrier was the early patenting of most genes of potential commercial interest so that public institutions were burdened with paying royalties and growers with extortionate technology fees for the GM crops. Former Chair of CSIRO, Professor Adrienne Clarke, lamented that foreign seed, chemical and food-processing giants already own patents on most of the genes typically used in GM crops. [13] The unfairness of patent ownership and control has never been adequately resolved. [14] Our scientists do the work at Australian expense yet the companies reap the profits even when farmers are struggling. GM cotton in Australia is a good example where farmers and taxpayers funded most of the research but Monsanto applies hefty technology fees of $50/bale or up to $401/ha, claiming exclusive ownership of the Bt and Roundup Ready genes. [15]

Strong shopper demand here and in Europe for GM-free food products has also created premiums that make GM crops a less attractive proposition for Australian farmers and grain traders. [16] In WA, traders consistently offer premiums for GM-free canola of up $70/tonne ($50/tonne on 10/3/16), with zero tolerance for any GM contamination. [17]

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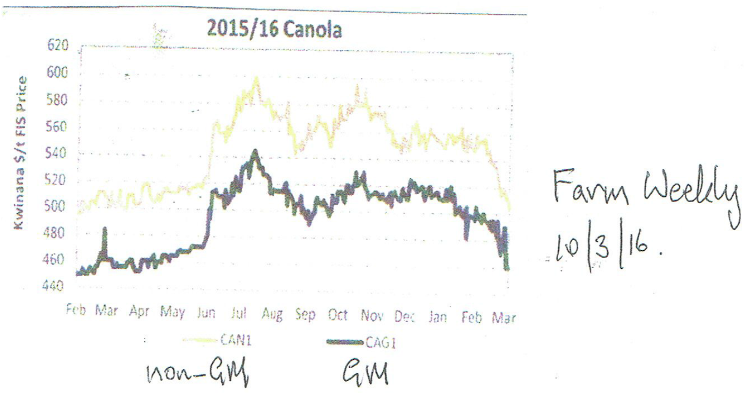
[11] http://www.bloomberg.com/news/articles/2016-02-03/chemchina-offers-to-purchase-syngenta-for-record-43-billion
[12] http://www.greenpeace.org/australia/Global/australia/GM_Fact_Sheets/Download_GE_not_needed_factsheet.pdf
[13] http://www.pc.gov.au/inquiries/completed/rural-research/submissions/sub120.pdf
[14] http://www.lifescientist.com.au/content/biotechnology/article/agbiotech-s-growing-pains-460339488
[15] http://cottonchoices.com.au/
[16] Professor Adrienne Clarke, pers comm., 2003.
[17] Farm Weekly Newspaper, print weekly quotations and graphs.



Commodity	Geraldton	Kwinana	Albany	Esperance	EPR FIS 15-16
CAG1	$444	$444	$444	$444	$504
CAN1 (Certified)	$484	$494	$494	$494	$544

A technical barrier is that genetic systems are too complex for the crude and inexact cut-and-paste GM techniques developed in the 1970s and 1980s have not delivered on most of their promises, despite 30 years of concerted research. Genetic systems are too complex for the crude and inexact cut-and-paste GM techniques based on the flawed Watson/Crick one gene, one protein model can only recombine or stack single genes. Scientists now agree that most traits involve the interaction of multiple genes, too complex for GM to transform.

Genetic complexity will confine existing commercial GM crops to a few single gene traits as existing cut-and-paste GM techniques developed in the 1970s and 1980s. They are unable to deliver on their many promises, as they are unable to transfer multi-genic traits to new hosts.

Most of the GM industry and governments promised applications and benefits have never materialized as they include complex genetic traits: higher yields, drought and salt tolerant crops, nitrogen fixation in grains, longer shelf-life food, more nutritious and Omega-3 enriched foods, food biofortified with Vitamin A and iron, less synthetic chemicals, etc. Existing GM techniques can't deliver on these promises, as it has proven impossible to cut-and-paste the genes and genetic interactions for complex traits between unrelated genetic systems, as many scientists agree. For instance:

- Dr Richard Richards of CSIRO Plant Industry says: "... breeding combines many traits and most are controlled by many genes, including performance in dry environments, grain yield, tolerance to high temperatures, and once the wheat is turned into flour, improved baking quality. GM technologies are generally only suitable for the single gene traits, not complex multigenic ones." [18]
- Dr Heather Burrow, former chief executive officer of the Beef Co-operative Research Centre, agrees: "... hundreds, even thousands, of interacting genes control important production traits like growth rate, feed efficiency and meat quality - not the handful that researchers had originally believed." [19]
- Australian Bureau of Resource Sciences says: "Most complex phenological traits such as water-use efficiency and heat tolerance have multi-genic inheritance patterns and, therefore, plants genetically modified for these traits have not progressed far down the product development pipeline." [20]
- Even Dr Clive James of the industry-backed International Service for the Acquisition of Agrobiotechnology Applications (ISAAA) concedes: "Drought tolerance is an infinitely more complex

[18] Top five myths about genetic modification http://theconversation.edu.au/top-five-myths-about-genetic-modification-2664
[19] Weekly Times, Beef CRC chopped, 11/9/11
[20] Australia's crops and pastures in a changing climate - can biotechnology help? Julie Glover, et al, Bureau of Rural Sciences, 2008, Page 43 http://www.daff.gov.au/SiteCollectionDocuments/ag-food/biotech/climate-change-and-biotechnology.pdf

trait than herbicide tolerance and insect resistance, and progress is likely to be on a step by step basis." [21]

- In 2003 this paper reported that: “After ten years of research using transgenic plants to alter salt tolerance, the value of this approach has yet to be established in the field.“ In 2016 results remain elusive. [22]
- Klaus Menrad et al. assert: “genetic engineering of crop plants will remain restricted to certain applications and will to play a significant role in the plant breeder’s toolbox unless the genetic engineering of polygenic traits will become possible.” [23]
- Altieri says: “Traits such as drought tolerance are polygenic – determined by the interaction of multiple genes. Consequently, the development of crops with such traits is a complex process that could take at least ten years and is not in the agenda of companies interested in recovering the high cost of biotech research and development.” [24]

Australia’s public expenditure and return on GM R&D appears poorly documented. This requires urgent remedy to secure a sound basis for public policy decisions and the better allocation of scarce R&D resources. We must rely on an undated Agriculture, Fisheries and Forestry Australia submission #77, to the House of Representatives Standing Committee on Primary Industries and Regional Services Inquiry into Primary Producer Access to Gene Technology. These stats appear to be 15 years old so need urgent updating to 2016. The committee and the public need to be able to discern if Australia’s investment in GM crop R&D has been effective and what it has returned to those who funded it – growers and taxpayers. The submission said:

> “Australia’s current expenditure on agricultural gene technology is estimated to be around $100 million per year, or about 10% of total agricultural R&D expenditure. … Most agricultural gene technology is being developed by public sector researchers, with CSIRO spending about $40 million per year on gene technology research in 1998. … In mid 1997, nine research and development corporations (RDCs) were funding 88 gene technology projects to a total of $28 million (about $12 million pa). … the Corporations are jointly funded by the Commonwealth and by industry levies.” [25]

Pouring public money into GM technology which primarily had corporate goals, rather than the interests of farmers, was a waste. Agriculture Minister Warren Truss estimated that between 2003 and 2005 some $1.29 billion had been spent on gene-manipulation research and development in that period alone. [26]

The GM industry asserts rapid global uptake of existing GM crops [27] but their expansion peaked in 2014 at about 180 million hectares in 28 countries, by approximately 18 million farmers. Those growers are less than 1% of the world's farmers as: "Approximately 2.6 billion people, 40% of the world’s population, depend on agriculture for their livelihood." And if 28 countries grow some commercial GM crops (those in the America's grew 87% of all GM crops), then 160 countries and 60 dependent territories are still GM-free. GM crops have stalled and are on the decline as this report convincingly shows. [28] Sixteen of the 28 countries (including Australia) grew less than 500,000 ha (5,000 sq km) of GM crops each.

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[21] Media Release: Commentary by Dr. Clive James, Chair of ISAAA, in the June 2012 USDA Crop Acreage Report http://www.isaaa.org/kc/cropbiotechupdate/pressrelease/2012/default.asp

[22] http://redsalinidad.com.ar/assets/files/mejoramiento/J.%20Exp.%20Bot.-2004-Flowers-307-19.pdf

[23] Future Impacts of Biotechnology on Agriculture, Food Production and Food, Klaus Menrad et al. https://books.google.com.au/books?id=VSzvCAAAQBAJ&pg=PA302&lpg=PA302&dq=genetic+engineering+polygenic+crop+traits&source=bl&ots=p-kGzIgJQL&sig=1nQD_sgQLbHA0zkBIpZmjUItV88&hl=en&sa=X&ved=0CCIQ6AEwAGoVChMI5vid_tPBxwIVZtumCh382Ap7#v=onepage&q=genetic%20engineering%20polygenic%20crop%20traits&f=false

[24] Genetic Engineering in Agriculture, Miguel A Altieri, P19. https://books.google.com.au/books?id=OMUQKXA1NVUC&pg=PA19&lpg=PA19&dq=genetic+engineering+polygenic+crop+traits&source=bl&ots=6KTWGoKNLq&sig=ddLNaklUcmvYPorPHORHlloowI4&hl=en&sa=X&ved=0CEwQ6AEwCWoVChMI5vid_tPBxwIVZtumCh382Ap7#v=onepage&q=genetic%20engineering%20polygenic%20crop%20traits&f=false

[25] Unable to identify its URL on the federal government site.

[26] http://www.grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-57/News-in-brief

[27] http://isaaa.org/resources/publications/briefs/49/executivesummary/default.asp

[28] http://www.foeeurope.org/who-benefits-gm-crops-industry-myths-240414

ISAAA Table 1. Global Area of Biotech Crops in 2014: by Country (Million Hectares)

Rank	Country	Area (million ha)	Biotech Crops
1	USA	73.1	Maize, soybean, cotton, canola, sugarbeet, alfalfa, papaya, squash
2	Brazil	42.2	Soybean, maize, cotton
3	Argentina	24.3	Soybean, maize, cotton
4	India	11.6	Cotton
5	Canada	11.6	Canola, maize, soybean, sugar beet
6	China	3.9	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay	3.9	Soybean, maize, cotton
8	Pakistan	2.9	Cotton
9	South Africa	2.7	Maize, soybean, cotton
10	Uruguay	1.6	Soybean, maize
11	Bolivia	1.0	Soybean
12	Philippines	0.8	Maize
13	Australia*	0.5	Cotton, canola
14	Burkina Faso	0.5	Cotton
15	Myanmar	0.3	Cotton
16	Mexico	0.2	Cotton, soybean
17	Spain	0.1	Maize
18	Colombia	0.1	Cotton, maize
19	Sudan	0.1	Cotton
20	Honduras	<0.05	Maize
21	Chile	<0.05	Maize, soybean, canola

22	Portugal	<0.05	Maize
23	Cuba	<0.05	Maize
24	Czech Republic	<0.05	Maize
25	Romania	<0.05	Maize
26	Slovakia	<0.05	Maize
27	Costa Rica	<0.05	Cotton, soybean
28	Bangladesh	<0.05	Brinjal/Eggplant
	Total	**181.5**	

US farmers still grow 40% of the world's commercial GM broad-acre crops - soybean, corn, cotton, canola and sugarbeet - with the same two Bt and Roundup herbicide tolerance traits - all launched in 1996. Countries in North and South America grew over 87% of all GM crops in 2014, of which over 90% can tolerate being sprayed with the weed killer Roundup, while the rest produce Bt insect toxins.

Herbicide tolerant weeds have become a very expensive management problem and increasing numbers of US farmers have turned away from Roundup tolerant varieties to non-GM since 2009. [29] High seed technology fees are an added incentive to go non-GM. [30]

Introduction of GM canola varieties that withstand being sprayed with Roundup weed killer, overuse of chemicals and minimum and no-tillage farming systems are to blame for the rapid development of glyphosate resistant weeds, according to Professor Stephen Powles, director of the Australian Herbicide Resistance centre at the University of WA. He now admits that GM crop plants, repeatedly sprayed with glyphosate (Roundup) weed killer, have created global weed resistance problems. He notes that “Glyphosate-resistant weeds are now all around the world; they are a threat to global food production and we have to address it.” This pandemic costs farmers megabucks to manage, and many in North and South America face ruin. [31]

In Australia, an immediate, effective strategy to delay glyphosate resistance in weeds would be restrictions on the use of glyphosate and a ban on GM canola. This would reduce glyphosate spraying in favour of the other integrated strategies Dr Powles recommends as effective. Everyone would be far better off with only GM-free canola varieties, since export markets want GM-free and pay $50/tonne premium for a regular supply untainted by GM and Australian shoppers also prefer GM-free. [31] The Swinburne National Technology and Society Monitor consistently finds that Australian shoppers are very uncomfortable with GM foods and that GM animal products come last on the scale of acceptance, behind nuclear power plants. [32]

Dr Powles should have spoken up sooner, to advocate management strategies that do not rely on the overuse of glyphosate-based chemical formulations but was instead a very high profile and influential GM grower also advocating the adoption of Roundup Ready GM canola. Monsanto was also just irresponsible to make the broad-spectrum herbicide glyphosate into a targeted and specific one, by

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[29] http://www.non-gmoreport.com/articles/mar09/farmers_planting_non-gmo_soybeans.php
[30] http://naturalsociety.com/farmers-are-starting-to-ditch-gmo-soy-beans/
[31] http://www.gmfreeaustralia.org.au/assets/script/ckfinder/userfiles/files/Resources/GM-FREE-SHOPPING-LIST.pdf
[32] http://www.swinburne.edu.au/lss/spru/spru-monitor.html

deliberately making crops that tolerate being sprayed with it. They also knew GM canola, corn and cotton could out-cross their herbicide resistance genes to their weedy relatives. [31]

A desperate public-private partnership research deal sees the GRDC growers handing $45 million of their mandatory research levy to $50 billion global chemical giant Bayer, to spend five years looking for new chemicals to kill rye-grass and other weeds highly resistant to farm herbicides like glyphosate (Roundup). This may never come to fruition as many chemical companies saw resistance coming and started searching for a replacement herbicide more than a decade ago. None is in sight. [33]

Commercial GM crop pipelines are virtually empty. Parisi et al say that while: "current GM commercial varieties and the outlook for 2020 are still dominated by a few arable crops (usually for feed or industrial use) and certain agronomic traits, there is a nascent growth in quality traits, with a focus on biofortified food and industrial applications. Also, more specialty crops are being introduced into the pipeline and bean, rice, potatoes and sugarcane may be cultivated by 2020." [34]

"The huge genetically modified (GM) crop steamroller is showing distinct signs of running out of steam. While still a big and growing contributor to global grain production output, particularly in categories such as the corn, cotton and oilseed markets in North and South America, growth in GM crop acreages is flattening. … 'All the low hanging fruit in genetically modified technology that's been invented has already been plucked,' conceded Michael Mack, chief executive officer of global crop protection and seeds business Syngenta. … The GM seed sales business was now reaching "saturation point" … While 10 years ago, many pundits had forecast a shrinking market for crop protection chemicals because of the rise and rise of GM plant varieties with built-in herbicide, fungal and insect resistant traits, he said Syngenta's crop protection business was now bounding ahead with more sophisticated products and new releases driving more sales." [35]

GM biofortified Vitamin A rice has not been adopted commercially as its yields are lower than conventional varieties. Poverty alleviation, fresh green vegetables, balanced diets and vitamin supplements are cheaper and more reliable ways to deliver Vitamin A to 800 million poor, malnourished and starving people.

Leading research group, HarvestPlus, is trying to 'biofortify' staple crops - bananas, cassava and sweet potato, as well as rice - but these foods are not a solution to the impacts of diets consisting of over 90% of low-nutrient staples. As HarvestPlus admits: "Fruits, vegetables and animal products are rich in micronutrients, but these foods are often not available to the poor. Their daily diet consists mostly of a few inexpensive staple foods, such as rice or cassava, which have few micronutrients. The consequences … can result in blindness, stunting, disease, and even death." [36]

So, malnutrition and starvation are problems of poverty, inequity and social injustice which cannot be solved by a technology that adds just one nutrient to an unbalanced diet. Like other polished rice, Golden Rice is also deficient in many other micronutrients such as iron and zinc, essential for good health. A top-quality, balanced, diet of fresh fruits and vegetables is the way to solve nutrient deficiencies, starvation, malnutrition, ill-health and also social justice challenges. Making a diverse diet of good food affordable and empowering people with their own seeds and land to grow their own may be a durable solution to nutrient deficiency. Golden Rice is not.

Globally, agriculture is still predominantly GM-free. There are over 1.2 billion hectares of GM-free cultivated farmland, 160 GM-free countries, and over 1 billion GM-free farmers.

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33 Growers seed weed research partnership, The Australian, 14/3/16

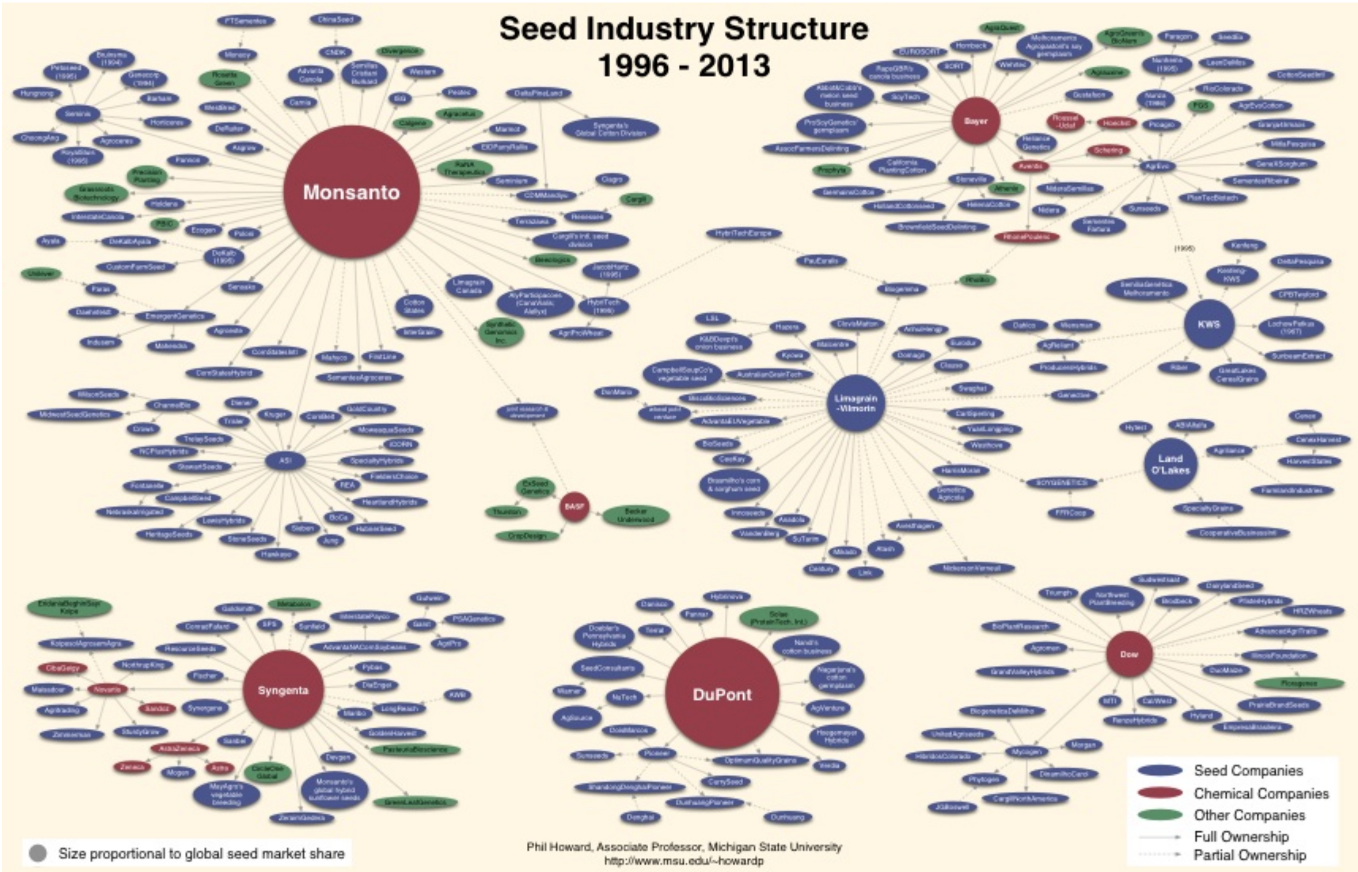
34 The Global Pipeline of GM Crops out to 2020, Nature Biotechnology (8 Jan 2016): Claudia Parisi, et al: http://www.nature.com/nbt/journal/v34/n1/full/nbt.3449.html

35 Farm Weekly, August 2015: http://www.farmweekly.com.au/news/agriculture/cropping/general-news/is-gm-running-out-of-steam/2738930.aspx?storypage=0

36 http://www.harvestplus.org/content/about-harvestplus

GMO Myths and Truths, written by well-qualified genetic engineers, challenges the factual basis of industry propaganda with robust scientific evidence. [37]

Concentrated ownership and control of the global seed supply is not in the public interest and governments should ensure that seed germplasm resides under public control.



From: https://msu.edu/~howardp/

Conclusions:

Innovation is the key to food security and sovereignty but the new suite of agricultural solutions to problems like climate change, unreliable water supply and soil loss will not include GM seeds and more pesticides. It's time to move on from GM, to investing more R&D resources into the ecological agriculture systems that will be the way of the future when oil and phosphates run out and the climate radically changes.

The IAASTD report can be one of our guides. [38] So let's move on to more sustainable, secure and safe eco-agricultural systems as the UN's IAASTD Report proposes for the future: [39] We must also take back control of the global seed supply - GM and conventional - now owned by a small corporate cartel. [40] GM crops are in decline with shopper demand for GM-free foods attracting premiums, and unmanageable weeds created by the repeated spraying of RR crops encouraging North American growers back to conventional varieties.

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[37] GMO Myths and Truths (2nd edition) Fagan J, Antoniou M, Robinson C, 2015. http://gmomythsandtruths.earthopensource.org/
[38] http://www.unep.org/dewa/Assessments/Ecosystems/IAASTD/tabid/105853/Defa
[39] http://www.unep.org/dewa/assessments/ecosystems/iaastd/tabid/105853/default.aspx
[40] https://www.facebook.com/woodprairiefarm/posts/10151627864792045

The UN reports enough food is grown to feed over 10 billion people, but it is mal-distributed, unaffordable for most hungry people, and at least 30% is wasted. The problems of hunger and malnutrition result from poverty, not crop yield. Most US shoppers want GM-free and food processors are working on supplying it.

We must aim to be better, not bigger! Australia's population is about 25 million and our agriculture typically produces enough to feed 70 million people. So we have a modest amount of primary produce to export. 'Better' ensures quality and continuity but bigger implies continuation of the mass production of bulk commodities, exported without value-adding. As Asia, the Pacific and Indian regions have over 3 billion mouths to feed, our quality exports should be in strong demand among those who can afford them.

We will never be a big player. So we must focus on being smarter so our reputation, and therefore the value of our food and fiber, continues to increase. Australian owned and run family businesses should be encouraged to do top quality production and processing, to value-add here in Australia. Then we can find valuable markets, both domestically and overseas.

The first priority should be to feed all Australians well, as everyone has the right to good food. A well-fed, healthy, well-paid population here will create a sound basis for successful businesses to prosper and grow. This foundation will serve us well for exporting our surpluses. Thinking of local markets as add-ons to exports is counter-productive.

Ideally, production of the whole Australian food supply would shift to post-organic systems, with biodynamic the nearest to the ideal. This model would take a wholistic approach to every aspect of production - people, animals, seed, soil, animal manures, composting, recycling urban organic material.

As the oil and phosphates on which industrial agriculture depends will sharply decline over the next century, making a well-planned and timely transition to agro-ecological systems of organic production is essential. It will also be advantageous to the quality and marketability of our food production and processing.

Most of the biggest GM crops, soy and corn, produced in North and South America go into animal feed and biofuels. Feedlots are not the direction that Australia should go. Open range, grass fed animals are a plus for us. So are GM-free crops. Premiums have been paid since 2006, even before any GM was grown because Europe and other buyers did not want the North American GM products.

A discussion of the food supply that is optimum for Australia's interests would include novel food production and processing technologies such as genome editing, nanomaterials and food irradiation, etc. These would negatively impact plans to make and promote quality foods, including processes and ingredients now prohibited in organics - GM, food irradiation (exposing 'fresh' fruits and vegetables to energy equal to 10 million x-rays), nanomaterials (metallic products smaller than a human cell in processing and packaging), synthetic biology (synthetic organisms that never existed before), synthetic chemical residues (such as Roundup) and including bovine growth hormones, veterinary medicines, processing aids and additives.

SA and Tasmania have set the ball rolling with excellent food production and marketing programs. We need a new model for Australia. SA companies KI Pure Grain, Temple Bruer Wines, Paris Creek dairy, and many more are leading the way. We need ways to encourage others to follow.

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