20 YEARS GROWING GM CROPS

Regulation, not science, has curtailed the benefits of our experience.

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In 2009, the European Joint Research Centre (JRC) surveyed the public and private sector plant biotechnology product pipelines. This resulted in a report that predicted new traits that would come to market by 2015, including additional 'first generation traits' that protect plants from pests and diseases, but also 'second generation traits' that result in consumer benefits from increased nutritional value in crops.

2008 Status of GM events and predictions for 2015 from the Institute for Prospective Technology Studies, Joint Research Commission, European Commission http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=2420

The unfortunate reality is that access to biotechnology innovation, and the significant benefits that it could have delivered, fell well short of the JRC predictions, and completely unnecessary costly government regulation is the prime cause of this failure. The JRC had predicted that 91 new events would be commercialised by 2015, and by 2014 there were only 16 new events: a mere 17 per cent of what was predicted. In spite of the significant annual growth in genetically modified (GM) crop adoption (currently approximately 18 million farmers in 28 countries), we have still not seen the predicted introduction of new crops; 80 per cent of the major GM events are still in four major field crops: soy, corn/maize, cotton and canola.

We have also not seen the predicted introduction of new traits, including new combinations of stacked traits—85 per cent of traits on the markets are still herbicide tolerant or insect resistant.

What is more, the growth we had expected to see in public sector–developed products has hardly materialised. Seventy-five per cent of commercialised products are still coming from the leading private sector technology developers.

While the JRC predicted 91 new GM events on the markets by 2015, we only saw 16.

This begs the question: where did we fail? Was it a science issue? Were researchers not able to develop and deliver on the new traits and crops? Interestingly, of the 91 new events predicted, nearly two-thirds of them were already in the advanced development stage in 2008, so it was not the science holding us back.

In a 2012 Phillips McDougall survey of the major private sector technology developers, it was found that, on average, it costs US$136 million over 13.1 years to develop a biotech crop and take it to market. The majority of this cost and time was concentrated in the regulatory science and registration part of the product time line.

The reality is that it is not an issue of technology developers being unable to deliver on innovation, but is rather that the regulatory system is failing to deliver the innovation to farmers.

In this time line to commercialisation, we have seen that the most time-consuming and resource-intensive part of getting a new GM trait to market is actually outside of the technology developer's control. Technology developers have improved the science of plant biotechnology so that they can efficiently create new traits and events; it is the regulatory science and registration aspects of the product time line that are holding up new innovations getting into the hands of farmers. The cost and time involved in regulatory science and registration has increased by 50 per cent over the last decade.

What is truly shocking is that for those countries that import crops for use as food or animal feed, which should require a much less substantial regulatory dossier, the time lines for approval are increasing! For cultivating countries that benefit the most from the technology, approval time lines have remained flat or have slightly improved.

All in all, it is the regulatory system, not the science, that is failing to deliver innovations in plant biotechnology to farmers.

Number of Commercial GM Events

Crop	2008 Status	Prediction for 2015	2014 Reality
Soybean	1	17	5
Maize	9	24	15
Rapeseed	4	10	3
Cotton	12	27	16
Rice	0	15	1
Potatoes	0	8	0
Other	7	23	9
Total	**33**	**124**	**49**

Table 1: Number of Commercial GM events: 2008 and 2014. Note: Commercial means approved and marketed in at least one country.

Events in Commercial Crops by Trait			
Trait	2008 Status	2015 Prediction	2014 Status
Insect Resistance	21	57	26
Herbicide Tolerance	10	32	20
Crop Composition	0	16	2
Virus Resistance	5	10	4
Abiotic Stress Tolerance	0	5	1
Disease Resistance	0	4	0
Nematode/Fungus	0	2	0
Other	0	13	2
Total	36	139	55*

Table 2: Events in Commercial GM crops by trait: 2008 and 2014. Commercial means approved and marketed in at least one country.

Are the days of science-based regulatory systems over?

In many countries around the world, regulatory decisions are increasingly influenced by protectionism, trade manipulation, and ideology such as the anti-science and anti-multinational company movements perpetuated by ideologues and activists.

In some countries (albeit not in Australia), regulators consider more than just the safety of products, taking into account socio-economic impacts, equality of technology impacts, and ethical and spiritual values—and these non-science considerations are preventing innovation from getting into the hands of farmers, and helping to make an impact on food security.

Globally, regulatory systems are failing to deliver such innovation to farmers. For example:

- authorisation time lines for cultivation and import are increasing
- the backlog of pending submissions is increasing
- regulatory decisions will become more complicated as new plant breeding innovations are introduced.

Australia has been lucky enough to have access to GM crop innovations for 20 years. During this time, the technology has provided significant economic and environmental benefits to Australian farmers, and the public at large.

Australia's cotton and canola growers have gained $1.37 billion worth of extra income, and have produced an additional 226,000 tonnes of canola that would not have been produced if conventional technology had been used.

The technology has allowed Australia's farmers to reduce their use of insecticides and herbicides by 22 million kilograms of active ingredient, equal to a 26 per cent improvement in the environmental impact associated with pesticide use on these two crops (cotton and canola).

The reduced use of pesticides has also resulted in a saving of nearly 27 million litres of fuel use, with 71.5 million kilograms less carbon dioxide being released into the atmosphere.

Trait	Increase in farm income 2015	Increse in farm income 1996-2015
GM herbicide-tolerant cotton	10.2 (13.6)	101.6 (136.2)
GM herbicide-tolerant canola	16.6 (22.2)	73.8 (98.9)
GM insect-resistant cotton	47.9 (64.1)	849.6 (1138.5)
Totals	74.7 (99.9)	1025.0 (1373.6)

Table 3: Farm income benefits from growing GM crops in Australia 1996–2015: million US $ (Aus $ million in brackets)

Note: All values are nominal. Farm income calculations are net farm income changes after inclusion of impacts on yield, crop quality and key variable costs of production (for example, payment of seed premia, impact on crop protection and weed control expenditure).

There are three actions that need to be taken to fully realise the potential of the plant biotechnology pipeline, and to ensure that the regulatory delays we have experienced over the last two decades do not hold back the next 20 years of adoption of the technology:

- There is the need to engage with policymakers to reduce the boundaries to entry through regulatory reform (currently all but multinational companies are largely excluded from the regulatory system).
- There is the need to educate stakeholders about the true barriers to new innovation.
- There is the need to look for opportunities for public–private partnerships to deliver advances in agricultural biotechnology to wider groups of farmers.

The future of agricultural biotechnology is bright, but only if the science is allowed to prevail, and public policy and regulation is based on facts, not activist falsehoods.