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**The current status of GM/non-GM canola coexistence in Australian
broadacre farming systems and likely future challenges**

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Abstract:

In a difficult and challenging political environment, the Australian grains industry has implemented a GM/non-GM canola coexistence framework that has succeeded in meeting market requirements for six seasons, with the seventh this year. The processes in place have enabled the industry to supply local demand and to deliver to two thirds to three quarters of production to GM and non-GM export markets, with non-GM canola to Europe as the largest single market.

The challenges and impediments to this practical success have been idealistic rather than scientific, but are on-going. Two of the five Australian States where canola is grown maintain 'moratoriums' prohibiting GM crops under State Government legislation and the Australian Green Party and some State Labor Parties maintain policies to prohibit GM crops. Activist groups associated with the conservation lobbies and the organic food industry maintain their rage against GM crops. The organic food peak body, the Organic Federation of Australia, maintains a 'zero tolerance' policy on GM presence in crops and produce of all types (not just canola) and even to the land. This policy has led to the one single legal case over coexistence brought by an organic grower over GM canola material blown over a fence onto an organic farm (but with no presence within crop or produce). The case was tried and rejected and it was held that the GM producer was fully entitled to follow his industry standard practices, which including his complying with existing coexistence protocols.

The key driver of the uptake of the glyphosate-tolerant GM varieties in use is herbicide resistance, which in Australia and particularly in Western Australian no-till systems represents a global worst case scenario, and includes glyphosate resistance in key weeds. Roundup Ready canola as a component of crop rotation is a valuable tool but it is accepted that it cannot be over-used and that, on balance, growers should rotate Roundup Ready canola with other canola cultivars attuned to different herbicide components as a part of a comprehensive herbicide resistance management framework. The growing of GM and non-GM canola on the same property accentuates the need for strict adherence to coexistence management through the production and marketing chain.

Keywords: Australia, canola, coexistence, litigation

1. Introduction

The Federal Government Office of the Gene Technology Regulator (OGTR) granted clearance of GM canola on health and safety issues in 2003. Three products achieved approval – 'Roundup Ready' (glyphosate tolerant), 'Liberty Link' (glufosinate tolerant) and 'In-Vigor' (GM based hybrid system). The canola industry anticipated the first 'developmental' plantings in the five canola growing states in 2004.

The grains industry had worked long and hard to prepare a positive environment for the technologies. From the outset, the canola supply chain had identified the need for an effective segregation system for GM and non-GM canola in order to meet market expectations/opportunities and to reassure the public and politicians that the advent of GM canola was well-managed. For this purpose, in 2000 the industry had set up Gene

Technology Grain Committee (GTGC), bringing together farming associations, the grain handling, marketing and processing industry, including the Australian Oilseeds Federation, the State Government Agriculture Department research and policy sectors and the technology suppliers Monsanto and Bayer. The purpose of the committee was to share information, to identify where more information was required and commission it, such as canola cross pollination potential/separation distances and practical tests within the grain handling system on its capacity to manage segregation and to what purity limits. The GTGC release a draft coexistence strategy for public comment 'Guidelines for Industry Stewardship Programs and Crop Management Plans' in 2002 and after wide consultation moved forward to develop the 'Canola Industry Stewardship Protocols of Production Systems and Supply Chains' which was ultimately released in June 2003.

The coexistence protocols and commitments from the grain handlers and marketers proved insufficient guarantees in the face of political agitation from anti-GM activist groups. The State governments of the five canola growing states, under delegated powers from the Federal Government to safeguard and promote the economic well-being of their constituencies, declared GM 'moratoriums' under which they could prohibit GM crop production. In the case of New South Wales, this meant that their cotton production, which was 100% GM was permitted but not canola. The rest to varying degrees declared their rejection of GM canola on the basis that GM canola could impact on production and marketing of non-GM produce. The fact that left of centre Labor Parties were in power in four of the five states suggests that their sympathies lay with the anti-GM lobby, but a more positive spin was that they were not convinced that the coexistence protocols were sufficiently proven and signed off.

The grains industry took the view that they needed to assemble more evidence that coexistence was achievable, that all levels of the industry had completed the necessary processes and that all had unequivocally signed off on their commitment to deliver choice of GM or non-GM to the market and to Australian processors and consumers. Leadership was provided by the Federal Government Department of Agriculture Fisheries and Forestry (DAFF), by the Grains Research and Development Corporation (GRDC), an organisation set up and funded by the Federal Government as the main investor in grains research through funding from production levies on the grains industry matched by the Government and by the Australian Oilseeds Federation, the central coordinating body of the oilseeds industry.

The principles were developed through a series of investigations and workshops and finally were agreed across the industry and signed off by all the key participants in the document 'Delivering market choice with GM canola'.¹ The next step was to formalise agreement on the process, which came with the production in 2007 of the comprehensive documentation as the 'Principles for process management of grain within the Australian supply chain'.² The principles set up a quality assurance process along the entire supply chain including verification (e.g. sampling and testing) when needed to verify the integrity of the processes from planting seed through to grain presented for sale accords with customer specifications. The verification process is varied to comply with market requirements, including sampling, testing and documentation. In

accordance with QA requirements, compliance with the systems will be capable of being verified by appropriate document review and reference to standards held by relevant sectors of the industry. The principles and processes have been taken up and managed by the Australian Oilseeds Federation which maintains and oversees the delivery of market requirements for domestic and export trade.

Finally, the moratoriums were lifted, starting in 2008 in the States of Victoria and New South Wales, and two years later in Western Australia. Tasmania and South Australia have maintained their moratoriums through to the present, in the latter case despite repeated pleading from the industry that they would rather have access to GM and that they see no advantage in market access or gross margins.

2. The Current Status of GM/Non-GM Canola Coexistence

2.1 The Farming System and Role for Canola

Canola is an important rotational crop in Australian winter cropping systems in the temperate southern states of Australia, with wheat by far the most important crop in the so-called ‘wheatbelt’ (see Table 1).

Traditionally, the farming system in these areas was a blend of cropping and sheep production – hence the alternate title ‘wheat-sheep zones’ – which is still largely the case. However, with the cropping area almost doubling and sheep numbers nearly halving over the last two decades, the trend is clearly towards higher crop production. Annual cropping area over the last decade (1991-92 to 2000-01) averaged 23 million hectares, up from a level of 19 million hectares in the previous decade. Over the same period Australia’s sheep herd decreased from 125 million to 88 million. As livestock production declined across the wheatbelt, the traditional pasture rotational phase was taken up by a number of grain legumes – field peas, lupins, faba beans, chickpeas and lentils. These provided a ‘break crop’ for the cereals, helping disease carryover management, providing different weed management options and adding rhizobial nitrogen. Canola has found a place in the farming system as an alternative to grain legumes as a rotational option rather than as a specialised crop and is grown right across the wheatbelt in the southern states.

In the last five years, canola has steadily increased in area as the preferred rotational option almost doubling in area over this period (see Table 2). While taking into account the long-term trend for an increase in cropping over livestock production, the main increase in canola in rotations has mainly been at the expense of grain legumes. As an example, in Western Australia, grain legume sowings declined from 2.1 Mha in 1999 to 0.6 Mha in 2010.

There are two key areas driving the switch from grain legumes to canola:

- Profitability comparable with cereals

Gross margins from canola are at least comparable with wheat and in most years and locations can be expected to be 25 to 30% higher.^{3,4} The export market demand for Australian canola has grown steadily, mostly for non-GM grain to Europe, underpinning prices (see Table 3). An increased local investment in canola breeding has brought forward better varietal options, including specialty oil

canola (high oleic, low linolenic acid). In the current crop, the majority of varieties are hybrid, resulting in increased productivity. By comparison, the gross margins for grain legumes have been challenged by their fungal disease susceptibility, particularly to the Black Spot/*Ascochyta* complex resulting in yield loss and increased costs of control.⁵

- Rotational advantages in wheat/barley production

Crop rotation has a number of intrinsic drivers – fertility in the case of legumes, pest & disease management and weed control. In the minimum tillage cropping systems that predominate through the Australian wheatbelt, weed management is by far the most important driver. While far from perfect, canola has turned out to have a much better range of selective weed management options in this regard than grain legumes.

For over fifty years, Australian broadacre farmers have steadily increased adoption of minimum tillage systems driven by the need to protect fragile soils prone to erosion coupled with a harsh climate with frequent droughts. This move has been underpinned by the emergence of a raft of effective herbicides that offered more than the ‘old guard’ of the phenoxys for broadleaf weeds crop rotation and tillage for grassy weeds. Reduced tillage commenced with the introduction of the pre-sowing ‘knockdown’ bipyridyl herbicide ‘Spray.Seed’ (paraquat/diquat). While this gave a good start to the season, grassy weeds and particularly the major grass weed annual ryegrass (*Lolium rigidum*) only got worse. ‘Treflan’ (trifluralin) was introduced in the early 70’s but the need and the need to incorporate made it a poor fit with the emerging system. Reduced tillage was saved by the arrival in the late 70’s of ‘Hoegrass’ (diclofop-methyl), the first of the aryloxyphenoxy-propionates (‘fops’) and which enabled in-crop selective control of ryegrass. Spray.Seed was soon to be substantially replaced by ‘Roundup’ (glyphosate) as a knockdown because of its wider spectrum and greater flexibility in timing. In rapid succession came a range of new selective herbicides, including the first of the sulfonyl ureas, ‘Glean’ (chlorsulfuron) which provided outstanding control of both grasses and a range of broadleaf weeds in wheat and barley and became standard practice.

The grain legumes as rotational crops were also well served by new herbicides, especially for grassy weeds, with the arrival of the cyclohexanediones such as ‘Select’ (clethodim) and other ‘dims’ and newer ‘fops’ such as ‘Fusilade’, which seemed to offer endless options and were far superior to simazine, the triazine that had been widely used in the past. Unfortunately, too little was learned too late and now herbicide resistant ryegrass is everywhere.^{6,7} Other herbicide resistant weeds, both grass and broadleaf, are also emerging, notably wild radish *Raphanus raphanistrum*.⁸

There are many differences of the degree to which resistance is expressed. Some of the older products such as the triazines and trifluralin retain a greater level of control of ryegrass than the fops and dims. There are also differences between locations, based on the history of herbicide application.⁹ In the State of Western Australia, the situation is by far the worst in line with the fact that the State has the longest history and highest level of adoption of no-till systems – in keeping with having the most at-risk sandy soils. The

differences are of degree, not absolutes and all Australian broadacre farmers know they have a major challenge ahead. There is a strong weed science research community working on the problems, notably the team in the Australian Herbicide Resistance Initiative (AHRI) led by Steve Powles, but also on the ground in the numerous formal and informal farmer groups across Australia striving to preserve the products they still have. The approach needed is to manipulate the crop/pasture rotations and herbicide groups used to control weeds but also to incorporate non-chemical controls where possible (e.g. weed seed collection/destruction).

2.2 The Adoption of Roundup Ready Canola

The emergence of canola as a preferred rotational crop to grain legumes in terms of weed management has gained momentum on the introduction of herbicide-tolerant varieties. ‘Conventional’ (non-GM) triazine-tolerant (TT) varieties were introduced in 1993 and atrazine and simazine offered selective control of cruciferous and other broadleaf weeds and a measure of control of annual ryegrass and other grass weeds. The herbicide-tolerance mechanism in these varieties had other metabolic effects which produced a 15 to 25% yield reduction, but TT varieties came to dominate canola plantings. In the lead-up to farmers having access to Roundup Ready canola, the problems of herbicide resistance drove the level of adoption of TT canola in Western Australia to basically 100% and in the eastern states around 50%. The remainder of canola types in the eastern states was around 50:50 ‘Clearfield’ (IT) canola varieties tolerant to the imidazolinones and ‘conventional’ with no introduced herbicide tolerance. The difference in uptake of IT varieties between east and west is that in Western Australia, Group B resistance in ryegrass and wild radish is so near complete. The herbicide of choice for the Clearfield varieties, ‘Intervix’ (imazamox plus imazapyr), as a Group B product is of little value where there is an alternative.

Under these circumstances, there was a high incentive for canola growers to take up Roundup Ready varieties – but also for the industry as a whole to ensure that they were introduced within a herbicide resistance management framework. When the bans were lifted in New South Wales and Victoria in time for the 2008 season, the first year plantings were restricted to demonstration trial plots to refine and demonstrate the effectiveness of the segregation, identity preservation and coexistence protocols that would become part of the contracts to be signed with Monsanto. Monsanto were ready to go in 2009 with product available and contractual details in place. The contracts included growers signing up to the Crop Management Plan and where appropriate attending briefing/training sessions to ensure understanding and commitment. There was also a Resistance Management Plan which encouraged farmers to carry out a PRAMOG – a Paddock Risk Assessment Management Options Guide to maximise the strategic use of the product to contain herbicide resistance risk, including to glyphosate.

With the leadership of the Australian Oilseeds Federation, the grain handling industry ensured that the post-farm segregation system was well organised to ensure they could deliver to market specifications. The industry and both State and Federal Government systems accepted the European Union definition of non-GM to have less than 0.9% ‘adventitious presence’. For the bulk of production there are but two grades:

- CSO1-A (non-GM canola) and

- CSO1 (commodity canola)

All bulk handlers signed on to the Australian Oilseeds Federation protocols to set in place the segregation facilities, the quality assurance systems and the organised testing and sample retention systems designed to deliver the necessary outcomes. Outside the two standard grades, the supply chain is free to set up ‘closed loop’ systems, but as with specialty oil canola, the protocols and practices as they differ from the CSO1/CSO1-A segregation are at their own discretion, cost and responsibility. This allows specialist marketers to supply demand for non-GM product meeting more rigid purity standards.

The uptake of Roundup Ready canola is shown in Table 4. The growth has been steady rather than spectacular. In keeping with the levels of herbicide resistance, Western Australia has seen the highest growth but TT canola still predominates in that state – 70% in the current season. In the eastern states a comprehensive study of adoption patterns from the first three seasons was carried out by Hudson and Richards and reported in GM Canola Impact Survey (2014). The authors completed some 1300 grower surveys and examined the agronomic, economic and environmental impacts and the effectiveness of coexistence protocols.¹⁰

The study found that there were economic reasons holding back adoption – the Monsanto technology licence fee added a cost and there was a premium for non-GM product of the order of 5 to 10%. The price differential varied across the season depending which market the bulk handlers were actively seeking at the time. When they were loading a shipment of CSO1 canola there tended to not be a great difference as long as other quality criteria were met. Notwithstanding the gross margin differences, the study found that all growers recognised the premium weed management that the Roundup Ready product offered and anticipated using it into the future.

Because of the massive problems caused by herbicide-resistant weeds, the Australian adoption pattern seen so far is likely to hold. While Roundup Ready canola offers higher levels of weed control than the TT, IT or conventional canola, most farmers have so far and likely will in the future grow both GM and non-GM strategically – reserving the Roundup Ready for paddocks needing the greater levels of weed control. The management of GM and non-GM canola as a regular occurrence heightens the coexistence challenge at the farm level, requiring higher levels of segregation in paddock planning, storage, in equipment clean down and transport and storage.

So far, the canola supply chain has been 100% effective in meeting market demand. Two thirds of Australian production is exported and the majority is non-GM product exports to Europe (see Table 5). There have been no reported cases of shipments being found to be off-specification and so coexistence can be seen to be working well in Australia. Moreover, the rapid growth of sales of non-GM product to Europe can be viewed providing a bonus marketing advantage over the Canadians who dominate canola exports overall.

3. Future Challenges to GM/Non-GM Canola Coexistence

3.1 *Herbicide Resistant Weeds*

To varying degrees, the entire broadacre temperate farming system in Australia is under threat from herbicide-resistant weeds. Clearly, there are differences of degree, with Western Australia having a longer history of more intensive reduced tillage being ahead of areas in the eastern states where, in the early stages of cropping intensification had soils capable of coping with weed control by intensive tillage. Those days are gone and the steady growth of herbicide resistance requires all farming systems to adopt integrated weed management systems. Despite decades of use of Roundup as the preferred pre-sowing knockdown herbicide, the levels of glyphosate resistance is still low.^{13,14} However, it is on the increase and increasingly farmers are either alternating with Roundup and Spray.Seed for knockdown or using both sequentially as the 'Double Knock'. As the bipyrldyls work best on smaller weeds, the application needs to be earlier than may be the normal option with Roundup - pre-tillering for grass weeds and still in the rosette stage for broadleaf weeds. Roundup is applied first and Spray.Seed two to five days later to 'finish off' any survivors.

Canola growers are encouraged by all parties to undertake the PRAMOG (Paddock Risk Assessment Management Option Guide) to understand their risk potential paddock by paddock. Newer varieties are now available with resistance to both glyphosate and triazines and spread the risk a little further. Monsanto have also set up the Glyphosate Sustainability Working Group with a website offering data on resistant populations and advice on the best management response <http://www.glyphosateresistance.org.au/>

The team associated with the Australian Herbicide Resistance Initiative (AHRI), are investigating every aspect of the resistance challenge from field surveys through to management techniques, working closely with producers to ensure that the problems are understood and addressed. The most recent paper by Ashworth *et al*¹⁵ detailed results of intensive survey of glyphosate resistance levels in Roundup Ready paddocks across Western Australia. Glyphosate resistance was identified in eight annual ryegrass populations, but only in one population of wild radish. None of the tested populations of capeweed, barley grass, brome grass, wild oat or small-flowered mallow were found resistant. The results were encouraging, but if glyphosate is to be the mainstay of weed management for decades ahead, then Roundup Ready canola will need to be managed as part of an integrated strategy - and as things look now it would seem that Roundup Ready wheat and barley would be a step too far.

3.2 *Politics*

In common with most of Europe, and in contrast to most of the Americas, GM technologies have not been universally welcomed by the general public in Australia. Notwithstanding the fact that GM cotton had been an outstanding success in saving an important industry and delivered massive reduction in insecticide use, the general public was either uninformed or tended to set cotton aside as a non-food crop. Despite the marked similarity between the products of canola - oil and meal - to the by-products of cotton, GM canola seemed more important to oppose. As in Europe, the opposition in Australia was stirred up by NGO's such as Greenpeace and then taken up by those of a 'progressive' left of centre political orientation rather than political conservatives. It was four out of five Labor Party State Governments which imposed the blocking

legislation to GM canola and it has been conservative Liberal/National Parties that lifted them. It took a change of Government in Western Australia to belatedly lift the Moratorium in that State. South Australia has had a continuous Labor Government over the GM canola period and they steadfastly maintain the ban, despite the grains industry entreaties that the rural economy would be better with GM canola than claims that 'GM-Free' status delivers any marketing advantage. The Greens Party, which has minor representation in State and Federal Parliaments maintains a policy that Australia should be GM-Free.

In Western Australia, where GM canola uptake is greatest and where herbicide resistant weeds represent the major target for Roundup Ready canola, the Liberal/National Party in Government is seeking to repeal the Genetically Modified Crop Free Areas Act, passed by the former Labor state Government in 2003, banning the growing of all GM crops in the State. While the Gene Technology Act 2006 permitted the Agriculture Minister to issue permits for specific crops (as was eventually the case with GM canola) the Labor Party Opposition has declared their policy to return to the 2003 Act and phase out GM canola altogether. The Liberal/National Party – with massive support from the grains industry – is seeking to pre-empt that outcome but the future looks uncertain at the least.

While Greenpeace was active for a period back in the eighties, the main NGO opposition to GM canola in Australia has come from local activists unconvinced of the human health and environmental safety of GM technologies but also with elements of anti-globalisation, anti-Monsanto. There are three ideologies behind the three main groups:

- Conservationists

The most active has been the 'Gene Ethics Network' <http://www.geneethics.org/> begun in 1988 by Bob Phelps from an Australian Conservation Foundation background.

- Small scale farmers

The Western Australian centred 'Network of Concerned Farmers', a farmer based lobby group led by farmer/commercial seed cleaner Julie Newman became active in that state as GM canola neared OGTR clearance. Details are available on the MADGE - Mothers are Demystifying Genetic Engineering website <http://www.madge.org.au/source/network-concerned-farmers>

- The organic food industry

The 'Safe Food Foundation' <http://safefoodfoundation.org/> is very much linked to the organic food industry and led by Scott Kinnear the founding Chair of the Organic Federation of Australia and proprietor of two retail outlets 'Organic Wholefoods' in Melbourne.

The organic food industry represents the main protagonist and could justifiably stand accused of deliberately creating controversy for some free publicity. The Organic Federation has declared a zero tolerance of GM presence in organic produce. In 2014, the value of organic grains and oil crops production in Australia totalled \$43 million, well up on 2011 figures but only 0.25% of the returns on conventional grains and oilseeds of \$15.67 billion in 2013/14.¹⁵ There is no production of 'organic canola' as weed management is impossible so there is no formal coexistence protocols for organic canola.

The demonstrations against GM crops are frequent and make the news, whereas good news about any aspect of farming doesn't and the average city consumer/voter is way out of touch with the facts of farming and the science of GM technology. The Agricultural Biotechnology Council of Australia (ABCA) <http://www.abca.com.au/> founded by AusBiotech (biotechnology industry), CropLife Australia (agrochemical industry), Grains Research & Development Corporation and the National Farmers' Federation is striving to balance out the communications to the media and to politicians.

3.3 *The Law*

From the earliest stages of negotiations over the framework for GM canola introduction, the grains industry has put the case that once health and safety issues were dealt with by the Office of the Gene Technology Regulator, then the operational issues, including coexistence, did not require on-going Government regulation but could be managed by the industry as are cases with varietal and quality segregations. Where disagreements arose that could not be settled by negotiation then the law of the land could resolve disputes. In the first few years after GM canola introduction, the States maintained a level of control under the various Gene Technology Acts but there being no call for intervention, at least unofficially, the management of coexistence was left with the industry and common law.

After seven years of coexistence, only one case has emerged and brought on legal proceedings. The dispute arose in Western Australia in 2010, the first year of GM production in that State. In the district of Kojonup, an organic farmer, Steve Marsh, who grew organic oats, spelt, rye and wheat and grazed organic sheep, brought the case against his conventional farmer neighbour, Michael Baxter over the presence of 245 swaths of GM canola that had allegedly blown over avenue of gumtrees along a road that separated their properties. As a key part of the case, Marsh criticised Baxter's decision to swath his crop rather than desiccate and direct harvest. Marsh sued Baxter for A\$85,000 as loss of income in that Marsh's organic certification company decertified 70% his entire operation and this penalty was to last for two cropping years. Although the incident occurred in 2010, it did not come to court until 2014 – after Baxter had grown three further years of GM canola without further incident. Key points that arose were:

- Marsh had gained his organic certification in 2004 and was the only organic grower in the district. He was aggressive with neighbours from the outset, demanding that they respected his rights to not have any chemical spray drift. As 2010 approached and GM canola was permitted in the State, Marsh visited Baxter and threatened him with prosecution if he was to take up GM canola and if it found its way to his property.
- Baxter was an experienced canola grower over many years and made the decision to adopt Roundup Ready canola because his weed management needed the boost that could be achieved. He had not previously swathed his canola, but had used Roundup to desiccate the crop prior to direct heading. Clearly this was not possible with this material and so he elected to swath respecting the buffer strips that the coexistence protocols specified.

- In actual fact, there was no GM presence in any of Marsh's crops or produce intended for certification. The canola swaths were present in pasture or more rarely in crops not eligible for certification. The certification company made their decision to decertify 70% of the property for three years on the basis of the presence of GM material on the ground.
- The Department of Agriculture was called to sample and test the canola material for GM presence. Not unexpectedly it was found to be Roundup Ready. At the same time the Department officers offered to bring in a team and immediately remove all canola material from the property. Marsh refused and the canola was left *in situ* with GPS locations and portraits taken and in some cases fenced off to stop them blowing away. They were finally removed by Marsh after five months.
- In the following year, eight volunteer canola plants were found on the Marsh property – the limit of any ongoing problem. In this case Marsh pulled them up. There was no action by the certification company to reconsider given the scarcity of GM material in the 2011 cropping year.
- In the trial, both sides produced technical experts from Australia and other parts of the world and the case regularly made the mainstream news as THE test case that the anti-GM lobby was hoping for. The legal costs for each party were over \$750,000.

The case was heard by Judge Kenneth Martin of the Supreme Court of Western Australia. The Judge's finding was clearcut.¹⁶ Marsh's case was rejected on the grounds that the financial damages sustained were inflicted by Marsh's certification authority exceeding its brief. Judge Martin also noted that:

- "There was no evidence at all adduced at this trial of any physical dangers, toxicity or risks of harm to persons, animals or property, by reason of contact with GM canola."
- There was no prospect of any pollen mediated transfer as Marsh grew no canola.
- In terms of seed mediated transfer, the evidence is that this was trivial given that it amounted to eight volunteer plants – even after Marsh had deliberately left the plant material in place when it could have easily been removed.

In rejecting the case, the judge awarded costs against Marsh – to the amount calculated at A\$804,000. Undeterred, Marsh appealed against the decision and the case came to court in March 2015. The basis for the appeal was that Judge Martin failed to fully understand the significance of swathing over direct heading. Clearly, the cutting and swathing exacerbated the potential transfer – but the coexistence guidelines allow swathing provided there is a buffer strip – which Marsh observed. The Appeals Court decided against Marsh on a 2: 1 majority with the Judges in the majority declaring that "the Marshes put their land to an abnormally sensitive use" and they could not "unilaterally enlarge their own rights" and "impose limitations on their neighbours to a greater extent than would otherwise be the case."¹⁶ Marsh is now considering a new appeal.

While the Western Australian legal system has rejected the case twice – at considerable expense – Marsh was not without friends. He has been awarded hero status by the anti-GM lobby, with supporters turning up at court each day of the hearings. The Safe Food Foundation has basically made the Marsh case as their

cause célèbre with the website publicising every move and calling for ongoing financial support. The Safe Food Foundation declared in February 2014 that they had raised a million dollars in support of the case. As the call for financial support has been ongoing, it is fair to anticipate that Marsh would still be in front even after paying his and Baxter's costs.

After the initial finding against Marsh, the Organic Industry Standards and Certification Council, the official body of the Organic Federation of Australia that sets the rules for organic certification reviewed Judge Martin's findings for potential impact on their rules. They considered two aspects in particular:

- They supported Judge Martin's findings that Marsh's certification company was wrong in decertifying the property. They confirmed that their existing rules necessitated GM presence in crop or produce, which was not the case. They discussed whether to go further and adopt international standards that allowed for low level presence as long as it was not the fault of the organic producer - but decided against this step.
- They considered a proposal from largest of the certification companies, Australian Organics Ltd., to adopt the international 0.9% low level presence standard. This also was rejected and the organic standard is still zero.

On balance, so far the law has come out in support of reasonable behaviour rather than the extremist views of Marsh and his supporters. However, the dissenting Judge in the appeal declared that Baxter had caused "interference with the appellants' use and enjoyment of their property was both substantial and unreasonable and constituted a private nuisance", so the margin between commonsense and extremism is not that wide. The fact that the organic industry official bodies refuse to line up with international standards even in the face of the Marsh vs Baxter findings means that the legal scene is not finally settled. Notwithstanding, the grains industry as a whole has taken heart from the Marsh vs Baxter case so far and there is a broader consensus that coexistence works.

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Table 1. Winter crop area and production

Crop	Area ('000 ha)			Production (kt)		
	2013–14	2014–15 s	2015–16 f	2013–14	2014–15 s	2015–16 f
Wheat	12 613	13 810	13 793	25 303	23 666	23 598
Barley	3 814	3 836	3 986	9 174	8 014	8 249
Canola	2 721	2 712	2 347	3 832	3 414	2 961
Chickpeas	508	425	677	629	555	845
Faba beans	152	164	210	328	284	337
Field peas	245	237	204	342	290	254
Lentils	170	189	229	254	242	258
Lupins	387	443	497	626	549	638
Oats	715	678	798	1 255	1 096	1 384
Triticale	80	125	105	126	228	143

f ABARES forecast. s ABARES estimate.

Source: ABARES (2015) - Australian crop report September 2015 ¹¹

Table 2. Australian canola production by State

Year	New South Wales		Victoria		South Australia		Western Australia	
	'000ha	Prod kt	'000ha	Prod kt	'000ha	Prod kt	'000ha	Prod kt

2013/14	673	922	439	710	297	419	1,307	1,777
2014/15 ^e	650	904	453	600	285	328	1,322	1,630
2015/16 ^f	555	833	365	485	225	281	1,200	1,548
5 yr ave to 2014/15	711	1,044	456	668	284	387	1,195	1,344

e ABARES estimate, f ABARES forecast

Source: ABARES (2015) - Australian crop report September 2015 ¹¹

Table 3. Australian canola production/exports/domestic use

'000 tonne	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Production	1,844	1,907	2,359	3,427	4,142	3,832
Exports	1,067	1,187	1,549	2,557	3,512	2,863
Domestic use	778	721	810	871	631	969

f ABARES forecast

Source: ABARES (2015) - Australian crop report September 2015 ¹¹

Table 4. GM Canola production by State

Area Sown (ha)	2009	2010	2011	2012	2013	2014	2015
NSW	13,930	23,286	28,530	40,324	32,573	52,000	51,870
Victoria	31,186	39,405	22,272	19,012	21,232	37,000	47,137
Western Aust.		86,006	94,800	121,694	167,596	260,000	337,527
National	47,125	150,707	147,613	183,042	222,414	349,000	436,534
Total Canola	1,165,000	1,390,000	1,590,000	1,815,000	2,480,000	2,480,000	2,000,000

% GM	2009	2010	2011	2012	2013	2014	2015
NSW	6%	8%	7%	5%	5%	9%	11%
Victoria	13%	16%	6%	3%	5%	9%	13%
Western Aust.		10%	12%	13%	14%	21%	30%
National	4%	11%	9%	10%	9%	14%	22%

Source: ABCA (2015) GM Canola Uptake ¹²

Table 5. Australian canola export volume by destination '000 tonnes

Destination	2011/12	2012/13	2013/14
China	0	453	884
Belgium	453	829	668
France	45	281	359
Germany	276	178	354
UAE	35	360	200
Pakistan	78	496	154
Japan	47	100	151
Netherlands	871	605	120
Other	87	126	86
Total	1,891	3,015	2,976

Source: ABARES (2015) - Australian crop report September 2015 ¹¹

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Foster, K. A., Mwanaumo, A., 1995. Estimation of dynamic maize supply response in Zambia. *Agric. Econ.* 12, 99–107.

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