Betting the Farm

Economic Impacts of Introducing GM Grasses

Overview

If New Zealand chose not to approve the use of GM grasses developed by Pastoral Genomics, no economic penalty is expected as a non-GM technique could provide the same projected gains. Marker Assisted Selection (MAS) could deliver equal economic benefits without the risk of triggering the type of consumer resistance that GM food has provoked.

Rather than fading, market resistance to GM foods has become entrenched in GM-sensitive countries and has widened in Europe. A European Commission survey reports "declining support across many of the EU Member States – on average opponents outnumber supporters by three to one".

The message from GM proponents in recent years has been that New Zealand must nonetheless pursue the outdoor use of GM or be overtaken by other food exporters and be left behind. GM grasses are an attempt to lower the risks of this course by taking an indirect path to consumers and their food through animal feed.

However, the first detailed analysis of the economics of GM grasses to become public reveals how surprisingly thin the projected benefits are even when just considering this as an investment. Tens of millions of taxpayer dollars have so far been staked on three groups researching GM grasses, with around $20 million going to the Pastoral Genomics consortium. Documents from its deferred application for a conditional release provide a glimpse into how well that investment stacks up.

Pastoral Genomics' consultants estimate that the value today of all the costs and revenues from GM grasses is likely to be in the range of $25 million to $379 million. Yet the peak value drops to a lowly $107 million if three assumptions are altered to less rosy ones used by another consultant that reviewed Pastoral Genomics' work. This involves bringing the time horizon back from 50 years to a more realistic 25 years and raising the discount rate to 10% so the peak value is a third of that otherwise projected. The low end of the range is negative.

Even this is on the basis that the uptake rate will be as high as 50% when a 20% rate was seen as appropriate in the second study. If a 20% uptake is also factored in, along with the technical risks in the four new cultivars that "in some cases have not even been developed", then the peak value of the investment would fall to a range of small to negative.

That is before considering factors excluded from the estimates - particularly costs arising from market resistance. These costs could be suffered directly by the farmer using the GM grass if producer disclosure requirements meant it became routine to label for the use of GM grass feed in high value markets. In Europe, there is already a strong trend towards voluntary labelling for the use of GM animal feed and three countries are considering making this mandatory. However the potential costs would depend on which farms servicing which markets adopted GM grass and how markets evolved over time.

A wider risk arises through the difficulty of preventing GM grasses jumping the fence and becoming established in neighbouring properties. If non-GM production is contaminated in this way - or is simply perceived to have been – there is the potential for price premiums to be lost.

Government officials describe grass pollen as "notoriously difficult to contain" and warn of GM grasses becoming "irreversibly established in the environment" and "permanent components of New Zealand's pasture and dairy production systems". Ultimately it is labelling standards set by supermarket chains that would determine whether products from GM contaminated pasture were no longer GM Free.

If labelling were to be triggered by even trace levels of GM grass in animal feed, then the potential for lost earnings extends across the entire pastoral sector. Take as an example New Zealand's meat exports that earn around $5 billion a year. Some 35% of those sales by value are destined for Europe - versus 23% by volume (a ready indication of that market's importance). If all this product was supplied from farms either growing GM grass, or deemed to be contaminated by it, then if prices for GM Free and other stock separated by as little as 10% this would result in an opportunity cost of $180 million a year. That annual cost is greater than the total benefits that Pastoral Genomics' consultant expects to be generated by the best of its GM cultivars in any year ($155 million).

The choice however is not simply between GM grasses and the status quo, as GM is not the only way to apply new knowledge gained from gene science. MAS is every bit as high tech as GM but the processes it uses to actually create a new plant variety are the same as conventional breeders have long relied on. Pastoral Genomics rates MAS sufficiently highly that a little over half its budget is devoted to research employing MAS (and the balance to GM).

The GM cultivar estimated to have the highest value is expected to provide a 20% gain in biomass – exactly the same as Pastoral Genomics expects it can obtain using MAS to achieve the same outcome. In consequence, no economic penalty would be expected if the nation chose not to permit the release of Pastoral Genomics' GM grasses, on the basis of information disclosed to date.

The Bottom Line on GM Grasses:

- Considered simply as an investment, the projected returns are surprisingly thin. There is little to nothing in it for the nation once rosy assumptions are stripped out.
- There is a risk of price premiums being lost on non-GM production and those costs could be of a scale that easily overwhelms all economic benefits.
- MAS offers a non-GM technology that is expected to deliver a similar level of benefits without the market risks and should be the preferred investment to the extent it stacks up against other means of raising agricultural productivity.

Published June 2011, Sustainability Council of New Zealand, www.sustainabilitynz.org

1. Big Idea, Big Risks

The proposition is to take the forage that covers half New Zealand's land surface and powers the bulk of the nation's food exports, and convert at least half of it to GM grass.

The big idea promoted by the scientists driving this is that such a conversion will significantly raise farm productivity and shore up the nation's future competitiveness. The big gamble is the proposal to favour GM techniques over other ways of accessing knowledge newly available from gene science. The risk is large because a decision to commercially release GM grasses would amount to 'betting the farm'.

To be clear, not all GM grass developers have this as their only plan, nor would they expect all farmers to adopt it. Pastoral Genomics, one of the three groups developing GM ryegrasses with the assistance of New Zealand government funding, is essentially betting a research buck each way - on the GM side and the non-GM side.

At bottom however is the question of whether the regulator, ERMA, will give this and other consortia the right to commercially release a GMO that would profoundly affect the image of the nation's pastoral agriculture and have flow on impacts to other sectors that draw on Brand New Zealand. And such is the difficulty in containing grasses that government officials doubt that even outdoor trials would allow New Zealand a reversible test.

Market Resistance

A key risk recognised from the start by those developing GM grasses is market resistance to GM foods. Shortly after the technology's introduction to food crops in the mid 1990s, genetic modification was shown to be anything but just another mechanism to enhance agricultural production. Consumer resistance that first erupted in the UK soon spread to Europe and a number of other high value food markets.

By 1999, Deutsche Bank analysts pronounced food GMOs "dead".[1] Against earlier predictions of GMOs pervading all areas of food production, the bank foresaw the development of a two-tier market, with a distinct GM-free supply chain and the term 'GM' becoming a liability.

The factors underlying consumer resistance go far deeper than food safety fears that are sometimes highlighted. In depth surveys reveal a spread of concerns including: risk to the environment, risk to human health, degree of narrow corporate control of the technology, and ethical issues. For a number of years, industry representatives forecast that this market resistance would fade away as acceptance of the new technology grew.

In Europe, the trend has gone the other way. The European Commission, a biotech supporter, has tracked public attitudes on GM foods since their introduction there and its most recent report begins its assessment with the statement that "GM food is still

[1] Deutsche Bank, *GMOs Are Dead*. August 21 1999.

the Achilles' heel of biotechnology". Viewed across the period 1996-2010: "The wider picture is of declining support across many of the EU Member States – on average opponents outnumber supporters by three to one, and in no country is there a majority of supporters".[2] Overall, Europeans see no benefits in GM foods and perceive them to be unsafe, inequitable and unnatural. Even supporters, the study says, are "only marginally convinced that GM food is equitable and worry-free".[3]

After four attempts to rein in various EU member states from simply banning the cultivation of GM crops (in contravention of EU treaty arrangements), the European Commission last year began a process of devolving decision making on GM crops to individual countries under terms still being discussed.[4] Japanese, South Korean, and Australian consumers similarly remain resistant to GM foods.

However it is not just export markets that must be negotiated: developers recognise that all major local producers must be convinced. "ERMA is not likely to accept an application for a GE forage project till the industry is 'fully supportive', AgResearch science and technology manager Jimmy Suttie said."[5] Unspoken but also critical is that any outdoor work attains political support because GM has proven to be a political hot button issue. Before giving a *de facto* green light to make an application to ERMA, ministers will want to be convinced that public opinion will not result in another 'unmanageable' backlash of the form that emerged in 2002.

An Indirect Route to the Consumer

The message from GM proponents in recent years has been that New Zealand must nonetheless pursue the outdoor use of GM or be overtaken by other food exporters and become an agricultural backwater. GM grasses are an attempt to lower the risks of this course by taking an indirect path to consumers and their food through animal feed.

The closer a GM variety comes to being directly consumed by humans, the greater the market risk. GM wheat was pulled from regulatory assessment, such is the market resistance to GM whole foods.[6] The GM varieties of corn, soy and canola that account for over 90% of land cultivated in GM food crops globally is dominantly fed to animals.[7] The remainder goes to various uses including biofuels and starch, and much of what does make it to human mouths is highly processed by the time it arrives there. GM grass for animal feed is squarely targeting the indirect consumption route.

---

2 European Commission, *Europeans and Biotechnology in 2010. Winds of change?* Eurobarometer, European Directorate-General for Research, October 2010.

3 The continuing pariah status of GM crops is underscored by the US Foreign Agricultural Service's survey of European Union member state policies on GM. US Department of Agriculture Foreign Agricultural Service, *EU-27. Agricultural Biotechnology Annual Report 2009. Global Agricultural Information Network.* July 24 2009.

4 Bridges Trade BioRes, *EC Draft Outlines Possible Grounds for GM Crop Bans*, 7 Feb 2011.

5 Stringelman H, "GE needs 'hearts and minds'". *New Zealand Farmers Weekly*, June 28 2010.

6 See Sustainability Council. 2003. *GM Wheat Fails Market Test.* http://bit.ly/iwMq6F

7 James C, "Global status of Commercialized biotech/GM Crops: 2009". ISAAA Brief No. 41. Around 95% of the area cultivated in GM crops is accounted for by GM corn, soy, canola and cotton.

A second response strategy adopted in particular by Pastoral Genomics is to focus on 'cisgenic' forms of GM, rather than transgenic GM**.** Cisgenic GM varieties are said to be derived only from genes contained within the original plant (or near relatives) and so do not involve crossing the species barrier. This does address one of the values-based concerns about transgenic GM plants. However Pastoral Genomics has attempted to expand the significance of this variation on the GM method by implying that the resulting varieties are "naturally" bred and stating that they are most likely not detectable using conventional testing methods.[8] Yet cisgenic varieties are indisputably created using GM techniques and any inability to detect them (to the extent this does prove to be the case) would rely on both the developer withholding the code that would allow this, and the regulator failing to make disclosure of it a condition of release.[9]

Returning to the first strategy, in the past there has clearly been less market resistance to GM varieties that are only indirectly consumed by humans. Yet the ground is already shifting - down the supply chain. A good deal of the difference in consumer response to indirect consumption appears to amount to the consumer not being aware of the GM input. If end products are labelled for use of GM feed as an input, this is a game changer.

Three European governments are already investigating making this a regulatory requirement – France, Switzerland and Austria.[10] These countries are among those at the forefront of nations seeking to ban GM cultivation and there is already strong retailer involvement in screening GM content from the shelves in these countries. At least four French supermarkets have own brands that are certified as being GM animal feed free and the largest, Carrefour, has adopted a "fed without GMOs" label for animal products on around 300 of its own brand products.[11] In Switzerland: "Coop, with 35% of the market, … prohibits any GM ingredients or additives in its store-brand products, and endeavors to keep other products containing GM off its shelves, including meat that may have been fed GM feed. Migros, the largest food retailer with 37% of the market, has similar policies".[12]

Such is the role of this 'gatekeeper effect' that even if state-driven labeling regulations do not emerge in a particular nation, private market standards are a well-established trend with equally serious implications. As KPMG states: "there has been a shift from the 'green consumer' to the 'responsible retailer'" and retailers are assuming responsibility for ensuring that consumers can buy products that are consistent with their expectations and values.[13]

---

8 For details see: Sustainability Council, *Semantically Engineered Language*, June 2011.

9 Detection may also require the regulator to insist on the GMO being released with a unique marker if a detection primer would not otherwise be capable of recognising it. See: Sustainability Council, *Hide and Seek: Developers Skirt Around Detectability of Cisgenic GMOs*, June 2011.

10 Harris Consulting, *Economic Impacts: Adventitious presence of genetically modified forages*, a report prepared for MAF, November 2010, p 25. Hereafter: Harris Consulting, November 2010.

11 Anon, "FRANCE: Carrefour launches 'non-GM' labels". just-food.com, October 25 2010. Also see: http://www.carrefour.com/cdc/responsible-commerce/product-safety-and-quality/

12 Harris Consulting, November 2010. p 25.

13 KPMG New Zealand, *Sustainability in the Agribusiness Sector*. KPMG Agribusiness Green Paper, November 2010.

2. GM Grass as an Investment

At least one of the three research groups investing in GM grasses has reached the stage of developing documentation for a conditional release application.[14] Pastoral Genomics appeared set to make such an application in early 2010, having received government grants to date totalling nearly $38 million – roughly half of which has been devoted to GM research.[15] Part of the documentation prepared for an ERMA hearing involved an economic analysis by Harris Consulting. While the consortium deferred its application, that report and related material obtained under the Official Information Act provide the first detailed information on the value of a GM grass investment.

Harris Consulting's median estimate of the present value of Pastoral Genomics' GM investment is a range of $25 million to $379 million.[16] That is the estimated value today when account is taken of all the costs and revenues associated with the venture (discounted to recognise the time value of money).[17]

The uncertainty driving the spread of these results is whether one, two or all four of the cultivars modelled will prove to be technically possible to produce to the specifications assumed. The significance of the authors' disclaimer on this point is plain and it reads: "the new cultivars have not in any meaningful way been tested, and in some cases have not even been developed".[18]

So bearing in mind that two or more of the cultivars under consideration are apparently hypothetical and the assumed gains are based solely on indications from lab work, we now consider three assumptions which have a significant impact on the projected results: the discount rate, the time over which the investment is assessed, and the historic costs incurred to get to the current position.

A separate evaluation of Pastoral Genomics' programme was undertaken by Nimmo-Bell a few months earlier. This time the client was on the investor side: it was prepared for Meat and Wool New Zealand as part of a study examining the full suite of investments made by the sector body using funds collected as farmer levies. The results are not directly comparable as Nimmo-Bell's assessment covered both the consortium's GM investments and the non-GM research while considering only the benefits to sheep and beef farmers.[19] However it is instructive to compare the assumptions adopted in that study with those used by Harris Consulting.

---

14 An application for a conditional release is one that generally seeks to use a GMO in the outdoors in a way that would not contain altered genetic material within the site or remove it afterwards, as is he requirement for a field trial.

15 Sustainability Council, *New Zealand GM Pasture Grass R+D*, June 2011.

16 This median or expected range is based on a 50% adoption rate. At a 20% adoption rate, the range is negative $1 million to $141 million. At an 80% adoption rate, the range is $51 million to $618 million; p 32.

17 Formally, this is the project's net present value (NPV). Harris Consulting, *Assessing the Economic Impact of Cisgenic Technologies in Ryegrass*, a report prepared for Pastoral Genomics Ltd, December 2009, p 32. Hereafter: Harris Consulting, December 2009.

18 Harris Consulting, December 2009, p 11.

19 Nimmo-Bell's median estimate was $112.6 million and the range was between $22.7 and $248.3 million at a 95% confidence level. Nimmo-Bell, *Strategic Programme Evaluation: Summary of Twelve Projects*, A report prepared for Meat and Wool New Zealand, July 2009,

Pastoral Genomics' investments are sensitive to the discount rate as it is a long time before any income is expected (2019). Harris Consulting uses 8% while Nimmo-Bell adopts a 10% rate (in line with the Treasury's default rate of 10%).[20] If the Harris Consulting results are altered for this alone, then the peak value of the GM programme roughly halves to $218 million.

Another assumption that has a similar impact on the results is that returns can reasonably be counted over a 50-year period. The Harris Consulting estimates presume income from the investment will peak around 2030 and will still be flowing at that level half a century from now.[21] Predicting returns with any reliability 50 years out is hazardous even for a stable business sector. In a field as fast changing as gene science, it is difficult to believe that even a breakthrough cultivar developed today would not be overtaken by another in far less than 50 years. Indeed, Pastoral Genomics strategy is not to target such a one off gain but to constantly innovate to keep ahead of the competition, and it does not foresee any one cultivar being dominant for so long.[22] Nimmo-Bell assumes a 25-year time horizon and if this factor alone is altered, it halves the peak value to $191 million.

Harris Consulting makes no allowance for costs already incurred to advance the project to its current point. In contrast, Nimmo-Bell identifies historic costs of $42 million, roughly half of which can be attributed to the GM side of the work if the current spending split is used as a guide.

If the Harris Consulting assumptions are unaltered other than to simultaneously:

- Raise the discount rate to 10% from 8% (in line with Nimmo-Bell);
- Constrain the time horizon to 25 years instead of 50 (in line with Nimmo-Bell);
- Include an estimated historic spend of $21 million (in line with an adjusted Nimmo-Bell figure);[23]

then the following results emerge under a 50% uptake rate scenario:[24]

- If only the lowest value GM cultivar fully proved up, the investment would hold a present value of negative $22 million (meaning that the money would have been better allocated elsewhere under those assumptions).

---

p 13. Interestingly, Nimmo-Bell estimated that most of the benefits to the meat and wool sector (adjusted for their chance of success) lay with the non-GM side of the programme, Personal communication, former Nimmo-Bell analyst, 14 June 2011.

20 "There is no single rate of return that is appropriate for every project. The Treasury uses a 10% real discount rate whenever there is no other agreed sector discount rate for costing policy proposals." The Treasury, *Cost Benefit Analysis Primer*, December 2005, p 27.

21 No time period is stated in the text and the attached printout of the spreadsheet suggests that the time series ends in 2035, as this is the last entry shown. However, it becomes clear that the time series only solves to the terminal values stated when it is extended out to 50 years.

22 Personal communication, Zac Hanley, Manager Pastoral Genomics, 7 June 2011.

23 This is based half the historic costs of $42 million estimated by Nimmo Bell being allocated to the GM programme, an allocation that roughly mirrors the current split in spending.

24 The Harris Consulting paper provides year by year cash flows for the 50% adoption rate scenario that allow the revised assumptions to be tested.

- If only the middle value GM cultivar fully proved up, the investment would hold a present value of just $17 million.

- Only the highest value cultivar would retain much present value at $107 million if it proved up. (The target for this programme is to increase ryegrass biomass by 20%.)[25]

In other words, taking all the assumptions used by Pastoral Genomics's consultants other than for three that are changed to match the less rosy Nimmo-Bell ones, the best gain that is expected (median scenario) is still a lowly present value in the vicinity of $100 million - even when all the technical risks are overcome and the new GM grasses perform as well as projected. The full set of results is set out below.

Present Value of Pastoral Genomics' Cisgenics Programme
(Assuming 50% adoption rate of cultivars and other Harris assumptions)

Cultivar Scenario	Harris Consulting median estimates ($m)	Discount rate rises from 8% to 10% ($m)	Time horizon drops from 50 to 25 yrs ($m)	Discount rate, time horizon, & historic costs all altered ($m)
Drought Tolerance	104	61	60	17
Increased Biomass	349	211	192	107
High Sugar Grass	25	9	5	-22
All above in one grass	379	218	161	82

However that all assumes a 50% uptake rate will be achieved: Nimmo-Bell assumes only a 20% adoption. At an 8% discount rate, Harris Consulting shows that a 20% uptake rate for the highest value cultivar would alone result in a huge drop in value - from $348 million to $129 million. If a 10% discount rate and 25 year time horizon is assumed in addition to the low 20% uptake rate, then this cultivar's present value would fall far below the $107 million calculated at the higher rate of adoption.[26] So the uptake rate is critical and the grass's profile as a GM product will not help.[27]

Further, the discount rate does not factor in the technical risk that the cultivars will fail to prove up as expected – so the value of the investment will be slashed further

[25] The fourth scenario also modeled by Harris Consulting involved a cultivar with all three targets combined into one grass and results for this were tested too but due to the longer time before returns are in, the additional gains from this mean it performs less well than the highest earning single cultivar and the NPV is $82 million.

[26] The Harris Consulting report does not provide enough information to calculate the impact of a 20% uptake at a 10% discount rate.

[27] Even if the GM grass performed as well as expected and delivered significant gains to farmers, the fact that it is genetically modified will alone reduce the rate of uptake compared to a non-GM variety offering the same performance. A Lincoln University survey of farmer intentions indicated that around half of all farmers seek to be organic in the long term and also GM Free and so at least some could be expected to put this ahead of the enhanced commercial returns. Fairweather J R, Maslin C, Gossman P and H R Campbell. 2003. *Farmer Views on the Use of Genetic Engineering in Agriculture*. AERU Research Report No. 258.

still once this is accounted for such that the peak value will be in the range of small to negative.

Sitting above all of the detailed assumptions however is a simple question: could the investment be expected to result in significantly better grasses relative to other ways that grasses could be improved? Harris Consulting addresses this issue only obliquely, stating that "there is no reason to consider that the absence of a cisgenic programme would speed up the rate of progress likely to be made under … other plant breeding programme[s]".[28] However, as set out in the final section of this briefing, there is a non-GM alternative means of accessing the same expected level of gains without the market risks associated with GM. It is the availability of such a counterfactual that is critical to assessing the overall net benefits associated with GM grasses.

What the results reviewed here strongly suggest is that even before considering such competition, Pastoral Genomics' GM grass programme is not even in the game unless uptake rates are high. There is precious little chance of that unless the new cultivar demonstrates a real step change from existing grasses.[29] So even a moderately successful piece of science could still turn out to be a poor investment.

A key factor lowering returns is the long lead times before enough pasture is converted to bring in significant income. Although new high performance non-GM grasses may be able to get to market a few years before their GM counterpart, the above results also hold important messages for any investment strategy targeting improved cultivars. If the end goal of public investment is to deliver the highest gains for the nation with each dollar spent, then those advocating continued levels of funding for grass development will increasingly be up against other forms of agricultural productivity enhancement including: water efficiency, greenhouse gas efficiency, milk solids yield enhancement, and so forth.

Such 'hard science' applications will also be increasingly up against what is sometimes called 'soft' science - tools that target optimisation and management of everything from the application of nutrients to traceability systems and brand support. Maintaining competitiveness will increasingly be a matter of securing soft science gains as much as progressing the hard science.

---

28 Harris Consulting, December 2009, p 20.

29 Nimmo-Bell notes that: "Discussions with forage seed experts indicate that if the perceived benefits are compelling enough adoption will be relatively high although we have estimated that approximately 20% of farmers will adopt PG cultivars". This comment was however made in relation to non-GM grasses as well as GM ones and greater farmer caution over uptake could be expected for GM grasses. Nimmo-Bell, *Strategic Programme Evaluation: Summary of Twelve Projects,* A report prepared for Meat and Wool New Zealand, July 2009, p 14.

3. Effects that Spill Over the Fence and Beyond

If the results of the investment analysis above were not already cautionary enough, Harris Consulting notes an important exclusion: they do not account for any 'externalities'. While the list of externalities indeed includes some positives such as a reduction in nitrate runoff, the weight of these is clearly negative on balance. In order to move beyond the more limited analysis assessed in the previous section, and to get some understanding of the overall economic impacts, it is necessary to look at these externalised factors.

Some negative externalities tend to arise no matter what method is used to improve grasses. Harris Consulting notes that: "we can expect that the intensification of farming that is associated with higher producing properties will result in a greater loss of nitrates, phosphates, and microbes to waterways and an increase in greenhouse gas emissions".[30] Certain grass varieties already commercially available can mitigate a number of these factors. In particular, high sugar grasses reduce nitrogen losses, thus lowering nitrate runoff and greenhouse gas emissions.[31] One of the cultivars Pastoral Genomics is targeting is a GM version of such high sugar grasses, so that too would mitigate some of the intensification if the variety were to prove up.

However, the externalities that separate GM grasses from others and have the potential to be very large stem from the market resistance accompanying GM products. The resulting economic harm may be suffered directly by the farmer using the GM grass. It may also result from so called "spill-over" effects as food-related GMOs have a well-demonstrated ability to cause economic harm to third parties far beyond the farms that cultivate them. This can arise through trace GM contamination appearing in non-GM produce, or simply the perception that this has occurred.

Either way, as GM grass is a feed rather than an ingredient of the final product, the issue of GM content is one of market responses to indirect consumption.

Risks for Adopting Farmers

Looking first at farmers who choose to plant GM grasses, the issue for them is the likelihood that some combination of requirements for producer disclosure and testing will mean that it becomes routine in high value markets for animal produce reared on GM feed to be labelled for this. Such requirements appear to be part of a strong trend towards enhanced producer disclosure. When polled on the topic of GM animal feed, respondents in high value food markets consistently say they want to be informed of its use in food products and in the France, the UK, and Australia polls have recorded 89% or more in favour of such labelling.[32]

---

30 Harris Consulting, December 2009, p 33.

31 The high sugar grass provided by Germinal Seeds are shown to reduce nitrogen related emissions in: Gerald Cosgrove et al, *Ryegrasses with increased water soluble carbohydrate: evaluating the potential for grazing dairy cows in New Zealand*, NZ Grasslands Conference Proceedings, 2007.

32 National Centre for Social Research, *Exploring attitudes to GM Foods. Final Report.* Social Science Research Unit, Food Standards Agency. November 2009; Friends of the Earth UK,

The first question this raises is whether retail chains will then use it as a basis for exclusion of the product from their shelves. Harris Consulting notes that in a number of trading blocs, mandatory labeling for GM ingredients in food (as opposed to the use of GM feed) "has the equivalent impact to a ban".[33] Private labeling has essentially the same impact - it is just across retail chains instead of within easily defined political borders.

Assessing whether labelling for GM feed has the same impact as labelling for a GM ingredient depends on being able to separate out reactions to direct and indirect consumption, and on market characteristics that are still evolving. In the countries where retailers have been most active in clearing shelves of GM products, including France and Switzerland, labelling for GM feed has not even been needed to cause the reaction. In the UK, there is a solid trend among the big five supermarket chains to source non-GM fed produce for many of their own brands. This is almost universal for certain lines of produce across each of the chains but not so common for other types of produce.[34]

If products associated with GM feed were excluded from supermarket shelves in GM sensitive markets, this would require New Zealand exporters to find substitute markets and these would be expected to deliver lower returns. The basis for this expectation is that the higher end supermarkets that charge higher prices are closely correlated with those leading the screening of products for sustainability criteria, and GM content is one of the 'food values' that is usually attended to.

Exclusion from the shelves is not required however for the price premium to be lost. Even if the goods still sit in the best shops alongside produce that is GM free, if any form of two tier pricing distinction opens up for the products New Zealand is most concerned about – dairy and meat – then again, it is the loss of the price premium that is at stake.

Scenarios for the losses that would be suffered by farmers and the nation in the event of such discrimination depend a good deal on the extent to which GM grasses are adopted by each of the meat and dairy sectors and the extent to which farms not using GM grass can be used to supply GM sensitive markets. It is the second of these that brings into sharp focus the issue of GM contamination of farms that do not adopt the grass.

Spill-over Effects

GM contamination – actual or perceived – opens up a much wider set of exposures. In the high value food markets that discriminate on the basis of GM content, the issue is not whether the product is generally or even 98% non-GM. The issue is whether there is a high degree of confidence that the product does not contain any meaningful

"Two thirds want GM to be kept off their plate - new opinion poll". Media release, June 15 2010; "9 out of 10 Australians want all GE food labeled", September 22 2008.

33 Harris Consulting, *Economic Impacts: Adventitious presence of genetically modified forages*, report prepared for MAF, November 2010, p 18.

34 See Harris Consulting, November 2010, p 24.

level of GM material, and certainly none that can be detected. Routine sample testing for GM content is the norm in these markets, and this is often accompanied by requirements for declarations from producers attesting to the nature of the ingredients and supply chain integrity procedures. Again, when it comes to GM feed, the question is how the market patterns set in relation to GM ingredients translate for indirect consumption.

Harris Consulting was separately engaged by MAF to examine the potential economic impacts of GM grasses physically contaminating non-GM production (known technically as 'adventitious presence'). The report estimated likely annual costs as follows:

> The most significant costs are associated with market access issues – primarily loss of premiums, separation distances, and testing costs to assure customers of the GM-free status of production systems. Costs under the main estimate are approximately $3.1 million, rising to $12.0 million in the high scenario. [35]

The report also separately considered the exposure of meat exports and produced indicative results for this sector of costs totalling $2 to $36 million a year. So in all, Harris Consulting estimates that if GM grasses were released in New Zealand, the costs resulting from both trying to contain them and from the loss of market premiums would be $3 to $12 million a year, with perhaps another $2 to $36 million a year impacting on the meat sector. However these figures are based on market conditions today rather than scenario analysis of what could be expected in 10 years time when the first GM grass is scheduled for commercial release.[36]

The overall effect of this and related assumptions is that the study's quantitative work significantly understates the reasonable range of costs that could be imposed by the widespread commercialisation of GM forages in New Zealand through adventitious presence. It concentrates on highly likely costs that are relatively small at the expense of seriously investigating the potential scale of economic costs to the nation from scenarios that it considers "have lower likelihood". Yet the report states that of those outcomes it considers less likely:

> … the loss of market premiums or market access in the meat and dairy sectors is potentially the most significant. Any figure on such an impact is very difficult to determine because there is no obvious basis on which to make assumptions. However given the size of the industries, **if such an impact were to arise and serious market restrictions arose, costs could range between hundreds of millions and over $1 billion**.[37] (Emphasis added)

Those scenarios are unlocked the moment it is recognised that GM grasses would not be contained. Government officials have been clear in their briefings that contamination would be inevitable were any type of GM grass release to proceed. Briefings to the relevant ministers warn of cisgenic ryegrass varieties or the GM traits becoming "**irreversibly established** in the environment" (original emphasis) and

---

35 Harris Consulting, November 2010, p 9.

36 Harris Consulting, November 2010, p 8. "The impacts are modelled at 50% of landholders adopting GM forages, with the current size and state of each industry and the current state of the regulatory and market environment".

37 Harris Consulting, November 2010, p 10.

"permanent components of New Zealand's pasture and dairy production systems".[38] Officials describe grass pollen as "notoriously difficult to contain"[39] and consider even a decision to conduct small-scale field tests that would allow flowering "could not be reversed".[40]

Policy discussions over the last decade have underscored this. A botanical expert brought to New Zealand to advocate for the release of GM crops on behalf of the GM lobby categorized GM ryegrass and other pasture grasses as leading to "substantial and widespread gene flow [that] will not be controllable by any means". In his view, GM varieties of these pasture grasses should not be released under any conditions.[41] Very few open air trials of GM grasses have been conducted but one for GM bentgrass that was monitored by the US EPA showed wide dispersal from the test site.

> The researchers found that plants growing within about 2km of the test plot were extensively contaminated with genes from the GM grasses. But the team also found evidence of transgenic seed formation up to 21km downwind in potted sentinels and up to 14km away in wild plants.[42]

In 2005, HSNO containment controls on indoor GM activities were increased for GM ryegrass experiments in view of the risks to the economy from any escape. The justification for the increased security was the species' "potential for weediness, its pollen dispersal method (wind), its widespread presence in the environment and the fact that a GM ryegrass would not be easily identified in the event that it escaped containment."[43]

Making GM pasture varieties commercially available to New Zealand farmers is effectively a bid for the eventual mass conversion of New Zealand pastures to GM or their contamination by it - an estimated 10 million hectares covering almost half the country.[44] The pace and persistence of the conversion are unknowns at his stage, and would depend in part on how successfully a GM grass competes with established

---

38 Respectively: Gluckman P, A memorandum to the Prime Minister, Hon Dr Nick Smith, Hon Mr David Carter, Hon Dr Wayne Mapp, Department of Prime Minister and Cabinet. Office of the Prime Minister's Science Advisory Committee, September 16 2009; Ministry for the Environment, *Upcoming Meeting with Prime Minister re potential application to release cisgenically modified crops*, October 13 2009.

39 MfE, Status Report, Minister for Environment, Minister for Climate Change, Week beginning March 9 2009.

40 Ministry for the Environment, Upcoming Meeting with Prime Minister re potential application to release cisgenically modified crops. October 13 2009.

41 Ammann K, Witness brief to the Royal Commission, October 2000, p. 25. The scheme was designed for risk assessment of GM release in Switzerland.

42 BBC News, *GM grass pollen has long reach*, 21 September 2004, http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/3675706.stm

43 Institutional Biosafety Committee Decision, HortResearch & Landcare joint IBSC Auckland, Technical Amendment to GMO03/HRA080 (Update of GMO02/HRA064 & GMO03/HRA074) April 14 2005.

44 This is the second largest proportion of grassland in OECD countries. Ministry for the Environment, "Land: Land Use". *Environmental Snapshot*, January 2010. Ministry for the Environment figures cover low and high producing grassland, some of which will be used for conservation or recreational purposes. Pastoral Genomics estimates that there are around half a sextillion (500,000,000,000,000,000,000) ryegrass plants in New Zealand pastures. Zac Hanley, *GM approaches without GM outcomes*, May 1 2008.

varieties in the filed. However, it would not take anything like a complete physical takeover in order to deliver a market image makeover.

For regardless of the threshold levels set for labelling regulations generated by governments, it is ultimately private standards set by retail gatekeepers that determine what is classed as GM free and what is not. Miss the cut and the price premium is at stake. Different retailers may well adopt different standards, making the market even more unpredictable as New Zealand is simply a standards taker in this, not a standards setter.

One of Pastoral Genomics' responses is that its GM grass could be made invisible to detection.[45] That would first require ERMA to be complicit in denying consumers the information they seek by failing to insist that a condition of release is the ability to detect it. Invisibility is however ultimately a lose lose tactic because to the extent sales of the GM grass achieve anything like the penetration that is needed to make the product a success, knowledge of such uptake would lead gatekeeper retailers to simply class all New Zealand pasture as GM grass, or contaminated by it (in absence of a discriminating test). So the implied proposition - that a GM grass can be a commercial success and users could escape retailers revealing its GM content - does not hold water. Invisibility is illusory.

However, the outcome at the gatekeeper level also depends on the nature of the assurance that retailers perceive customers are seeking. If the assurance sought became "largely without GM content", then that would offer considerable leeway. However, to date the central proposition has been "GM Free" and for that, the minimum threshold would be no GM content detected in the grass that fed the animal. All the indications are that meeting such a standard in New Zealand would be uneconomic to implement even if it were possible, and any notion that it would be assured by buffer zones is fanciful.[46]

If retailer standards for GM feed do track such a course, then the entire pastoral sector is exposed. Meat exports to Europe are one of the most vulnerable sections and the following example demonstrates the scale of the impacts that would be unleashed.

New Zealand's meat exports earn about $5 billion a year.[47] Around 35% of those sales by value are currently destined for Europe (versus 23% by volume - a ready indication of that market's importance).[48] If all that $1,800 million worth of product

---

45 Sustainability Council, *Hide and Seek: Developers Skirt Around Detectability of Cisgenic GMOs*, June 2011.

46 Buffer zones of 100 to 300 metres have been identified, based on distances used in seed reproduction facilities. However, unlike these, working pastoral farms regularly carry a variety of machinery that also leave the farm and act as a carrier for dispersal of seeds and pollen, as can other agents such as shoes and sheep's wool. "Control systems applied in seed production areas are unlikely to be effective once GM grasses are released to the environment." Sue Mayer, *Non-Food GM Crops: New Dawn or False Hope? Part 2: Grasses, Flowers, Trees, Fibre Crops and Industrial Uses*, GeneWatch UK, March 2004, p 12.

47 $5.2 billion for 2010; Beef and Lamb New Zealand Ltd Economic Service, *Compendium of New Zealand Farm Facts*, p 19.

48 Statistics New Zealand estimate total meat sales to Europe for the year to March 2010 at $1.85 billion (Personal communication, Statistics enquires, 16 June 2011). Sales of lamb, mutton, beef and veal account for 85% of total meat receipts and 35% of these by value go to Europe,

was supplied from farms either growing GM grass or deemed to be contaminated by it, and a price premium as small as 10% were to open up, that implies an opportunity cost of $180 million a year on current revenue.[49] Sales to other GM sensitive markets that were affected would be an additional cost.

That annual cost of $180 million is greater than the total benefits that Harris Consulting expects to be generated by the best of Pastoral Genomics' GM cultivars in any year ($155 million). In other words, if the science for the best new grass fully met expectations and adoption rates were high, it could still produce a loss for the country if the only impact not assumed by Harris Consulting was that market prices for GM Free meat in Europe were 10% more than meat from animals deemed to be reared on non-GM feed or GM contaminated feed.[50] As price differentials between conventional and organic produce can be far higher, a 10% price separation is a comparatively low scenario. With each additional 10% would go another $180 million a year.

A particular concern for sheep and beef farmers is that although they are likely to be proportionately more exposed than the dairy sector to these market risks, they would receive only a small slice of the benefits of GM grasses being introduced.[51] The estimates produced by Harris Consulting show that on average, sheep and beef farmers account for only 11% of the total benefits – and dairy 86%.[52] In the case of the drought tolerant grass being developed, benefits to the sheep and beef sector are expected to be negative.[53]

The proportion of dairy products exposed to market reaction over GM content is at least currently lower because less is destined for markets that are currently GM sensitive and because so much is exported in the form of ingredients.[54] However, because of the volume of dairy exports (some $11 billion a year at present), even small slices of this market experiencing small price shifts can add up to a lot of money.[55]

Some commentators have suggested that unlike some traditional markets, New Zealand's expanding markets are less sensitive to GM so the issue will diminish over time. However, Trade New Zealand believes that sustainability values are a "new

---

along with 80% of venison sales (which make up a third of the earnings for the remaining meat products). Personal communication, Beef and Lamb New Zealand, 16 June 2011.

49 This could also be a direct cost to the nation if the premium product remained at current levels and the one labeled for GM feed dropped in price, as opposed to the premium price rising and leaving the other behind at its then current level. The example is for a time some 10 years hence when the GM forage is expected to be commercially available.

50 Naturally it represents foregone earning potential for the farmers as well, although their investment profile differs again.

51 The position is potentially even more acute for the deer industry with roughly 80% of its exports sold to Europe.

52 Harris Consulting, December 2009, p 32.

53 Harris Consulting, December 2009, p 60.

54 In particular, dairy exports to Europe accounted for 8% of total dairy receipts for the 2010 year. Personal communication, Statistics enquires, 16 June 2011

55 Cheese and butter exports worth roughly $3.5 billion a year are arguably the most exposed to a loss of price premiums. Personal communication, Statistics New Zealand, 16 June 2011; and Beef and Lamb New Zealand Ltd Economic Service, *Compendium of New Zealand Farm Facts*, p 19.

normal" for food exporters. As other markets also move to at least label for carbon content and similar yardsticks, the future labelling for GM content is a significant risk in these markets. A particular issue is that new markets become more sensitised to 'food values' as they get wealthier and as use of GM grass locks pastures in for the long term, taking the GM route at this point would be a high risk strategy with respect to those future market conditions.

Fonterra (a partner in the Pastoral Genomics consortium) recently put up a flag to warn that the attributes of Brand New Zealand that could be affected by a move to commercialise GM are not adequately understood. After having played little part in hearings over AgResearch's plans for GM cattle in earlier years, Fonterra took the interesting step in October 2010 of making the following points in a submission on Scion's proposed trial of GM pine trees:

> It is important that a decision to proceed with field testing is based on a clear understanding of the risk-benefit implications of any change to perceptions of New Zealand's GM status for the country as a whole.
> …
> Fonterra does not consider there to currently be a clear understanding within New Zealand of:
> - How the "clean and green" construct is interpreted or valued by customers for New Zealand products;
> - How it interacts with others sales drivers, such as quality and price;
> - What role New Zealand's GM-free status plays in this overall construct.[56]

Other major producers have been clear from the outset how they viewed threats to the nation's GM Free status. Heinz Watties told MAF in a 2002 submission that:

> The implications for any GM contamination, real or perceived, anywhere in our supply chain, or even just anywhere in NZ, are potentially damaging for all of our business, such is the level of sensitivity of many of our customers to this issue.[57]

Zespri believes that its market for premium kiwifruit is enhanced by the association with 'clean, green, GMO-free New Zealand' and that a decision on whether to adopt any GM product such as pasture grasses would need to consider the wider implications for New Zealand.[58]

How wide and deep the impacts on Brand New Zealand could go remain to be researched in detail but market researcher, Jonathan Dodd, believes the effects would extend well beyond the agriculture sector:

> Most New Zealand exporters stand to be negatively affected if New Zealand becomes known as a GM-using country, and this includes many of New Zealand's fastest-growing 'glamour' brands such as Orca, Icebreaker, and Karen Walker, as well as established stalwarts such as Canterbury, MacPac, Air NZ and the All Blacks

---

56 Fonterra, *Submission to ERMA concerning Scion's application to field trial genetically modified trees*, October 6 2010.

57 Heinz Watties, Submission to MAF on Paper 31, "Border Control for GM Seeds", 2002.

58 Dunahay T G, *Is the Grass Always Greener? Issues Affecting the Adoption of Genetically Modified Pasture Grasses in New Zealand*, August 2010.

> …
> If New Zealand becomes a recognized user of GM technology, then the brand equity of "New Zealand" will be degraded, creating problems of varying degrees for a wide variety of local brands and exporters.[59]

A further source of costs, some at least being additional to the above, would be liability claims made by farm enterprises that had GM grasses appear in their properties. New Zealand law is weak with respect to such liability claims and HSNO only opens up this prospect if a party using a GMO breaks a release condition set by ERMA.[60] However, just as change at the international level on GMO liability is advancing, it seems unlikely New Zealand law will remain static over the life of the GM grass investment.

4. Gene Science Without the Market Risks

Descriptions of the promised power of GM to boost productivity frequently leave out something fundamental: that productivity gains can be delivered by a range of other mechanisms and that GM is rarely if ever the only route to this.

The remarkable gain that has occurred over the past few decades has been in gene science. GM is just one of the applied tools to have spun off from that expanded body of knowledge, and it is far from the only sophisticated technique for enhancing plant productivity.

Marker Assisted Selection (MAS) is another beneficiary of that expanded understanding and while its practice is every bit as high tech and arguably more demanding of scientific skill, the processes it relies on to actually create a new plant variety are the same as conventional breeders have long relied on. Also known as 'precision breeding', it uses gene science to take out a lot of the guess work in traditional breeding.

As it happens, Pastoral Genomics rates MAS sufficiently highly for the work it is undertaking that a little over half its budget is devoted to research employing MAS (and the balance to GM techniques).[61] Information disclosed in the Harris Consulting and Nimmo-Bell reports shows that both the GM and the MAS routes have been followed in parallel to a considerable extent. They show the following objectives being pursued under both techniques:

- Reducing nitrogen losses;
- Raising water soluble carbohydrates;
- Increasing biomass.

Of the cultivars declared in the two studies, only the objective of improving drought tolerance is identified as being explored through just one route (GM). The consortium indicates that the scope of study has changed since these reports were completed but

---

59 Jonathan Dodd, Research and Marketing Manager for Research Solutions, *GM allowance to hurt the 'New Zealand' brand?*, National Business Review, October 2003.

60 Chen Palmer and Simon Terry Associates, *Who Bears the Risk: GMOs and Liability*, October 2001.

61 Personal communication, Zac Hanley, Manager Pastoral Genomics, 7 June 2011.

does not elaborate or indicate that the peak performance expectations have been raised.[62]

When examining the projected financial returns from Pastoral Genomics' grasses earlier in this briefing, it was noted that unless the GM cultivar designed to increase biomass proved up well, the investment in GM grasses is unlikely to pass muster – even before considering marketing issues. That cultivar is projected to provide a 20% gain in biomass relative to current grass in the paddock.[63] As it happens, the MAS cultivar targeting the same objective is also projected to provide a 20% relative increase in biomass.[64]

Pastoral Genomics confirms that 20% remains an appropriate indicator of the performance improvement the consortium is envisaging from both the MAS and the GM routes.[65] For the purposes of the economic modelling used to present valuations of the consortium's GM cultivars, the MAS cultivar targeting increased biomass would carry essentially the same valuation, other things being equal. The key factors not equal are the absence of market risk with MAS cultivars, and their shorter lead time to market.[66] Although the time to develop a new cultivar is quite similar for both MAS and GM according to Pastoral Genomics, the process of field testing and gaining ERMA approvals adds about another four years to the time required to get a GM cultivar to market.[67]

In consequence, no economic penalty would be expected if the nation chose not to permit the release of Pastoral Genomics' GM grasses. The implication is that had the consortium pressed ahead in early 2010 with its plan to seek ERMA clearance to conditionally release, it seems likely that the application would have failed to show a net economic benefit - so it would need to have demonstrated that the ecological and other classes of risk were not significant to gain an approval. Were it not to gain an approval, Pastoral Genomics would still have a full pallet of MAS cultivars that it could pursue just the same.

AgResearch would likely have been equally exposed before ERMA on the economic net benefit question had it also applied as was intended at that time.[68] It is unclear whether it could equally easily switch course but there was early recognition by one of its social scientists of the risks of technology bypass:

> When more acceptable, less morally challenging biotechnology alternatives are capable of achieving similar goals, reasons for the use of GE technology are likely to be questioned by a public quite suspicious of the motives and social responsibility of big business.[69]

---

62 Personal communication, Zac Hanley, Manager Pastoral Genomics, 7 June 2011.

63 Harris Consulting, December 2009, p 12

64 Nimmo-Bell, p 13.

65 Personal communication, Zac Hanley, Manager Pastoral Genomics, 7 June 2011.

66 Development costs may also differ but this is unlikely to make a significant difference.

67 Harris Consulting, December 2009, p 59; and Personal Communication, Zac Hanley, Manager Pastoral Genomics, 7 June 2011.

68 It would have been less exposed only to the extent it reasonably expected to be able to delver a higher productivity, other things being equal.

69 Small B, Wilson J and T Parminter, *New Zealanders' Beliefs and Attitudes towards Genetic Engineering: Final Report and Interpretation*, AgResearch Client Report, June 2002.

There are a number of issues on which MAS and GM can be compared for direct equivalence, including the effectiveness of each on particular species, and the degree to which specific outcomes can be pursued with each. The answers to these are at times contested even amongst practicing GM scientists. Beneath the complexity however is the simple truth that even if some tradeoff in performance was required to go the MAS route, the scale of the market risks associated with GM products suggests that investment dollars destined for grass research are better targeted to MAS cultivars.

Which leads to the question MAF has raised with the Minister of Agriculture:

> It is important for investors (including government investors such as the Foundation for Research, Science and Technology) to determine whether there is a real path-to-market in New Zealand for their investments in biotechnology, GM ryegrass and other forages.[70]

The government's investment in three separate GM grass programmes suggests very high opportunity costs are involved. This and the absence of a clear "path to market" for GM grasses mean the agriculture sector and the nation stand to benefit from a review of the allocation of that funding.

The Bottom Line on GM Grasses:

- Considered simply as an investment, the projected returns are thin. There is little in it for the nation once rosy assumptions are stripped out.

- There is a risk of price premiums being lost on non-GM production and those costs could be of a scale that easily overwhelmed all economic benefits.

- MAS offers a non-GM technology that is expected to deliver the same level of benefits without the market risks and is the preferred investment to the extent it stacks up against other means of raising agricultural productivity.

[70] MAF, Briefing on Meeting with Fonterra and Pastoral Genomics on 14 December 2009.