SUSTAINABILITY COUNCIL of NEW ZEALAND

Hide and Seek

Developers Skirt Around Detectability of Cisgenic GMOs

Summary

- Lack of transparency by the GM food industry has been a driver of market resistance to its products. Research in New Zealand and in the nation's key export markets has repeatedly shown that consumers want any use of GM in the food chain to be visible so that they can exercise choice.

- The ability to detect the presence of GMOs is fundamental to consumer choice, just as it is essential for proper governance of the outdoor use of GMOs. Detectability allows the use of GMOs to be traced through the supply chain and non-GM producers to assure their output meets GM Free purity standards. It also facilitates the regulator's ability to act on safety concerns.

- Yet in New Zealand, a consortium of producer boards are among those pursuing a type of GM that they say will not be detectable.

- Pastoral Genomics – whose members include Fonterra, Beef and Lamb New Zealand, Deer Industry New Zealand and AgResearch – is developing a range of GM pasture grasses using a technique called "cisgenics". This, it says, does not mix genetic material from unrelated species, but engineers plants using their own genetic material. With this development, Pastoral Genomics declares it is responding to public concerns about the use of GM.

- How easily cisgenic GMOs will be captured by existing detection methods remains the subject of speculation as no cisgenic products have made it to market. However, while expert opinion suggests that existing techniques may struggle to detect cisgenic GMOs, it is thought that if details of the genetic profile of the GMO are disclosed by the developer, detection will be possible.

- Regulatory requirements will therefore play an important role in determining whether cisgenic GMOs are readily identifiable.

- Yet Pastoral Genomics has objected to traceability regulations that would require the ability identify unique GMOs, in part on the grounds that cisgenic products will be difficult to detect.

- Thus, even before the technical challenges of 'blind' testing for cisgenic products comes into play, assuring that the regulator will stand up for the consumer's right to know comes into sharp focus.

- If ERMA were not to require such information, New Zealand consumers would be denied the information that is a basic disclosure requirement in Europe. That is offensive to good governance and highlights the commercial exposure GM grasses present.

- The implication of Pastoral Genomics' positioning is that consumers cannot have it both ways: if the species barrier is to be left intact, then the resulting GMOs will not be detectable. However, it is developers that cannot have it both ways: creating undetectable GMOs would eliminate consumer choice. This directly contradicts the claim that cisgenics addresses consumer concerns.
- If market acceptance relies on an inability to identify cisgenic products, then the developers are setting up a tradeoff between commercial success and the public's right to know.
- The Pastoral Genomics consortium is investing considerable state and industry funds to develop products that, due to the difficulty of meaningfully containing grasses, will expose to contamination those pastoral farmers who do not wish to use GM varieties.
- Even if cisgenic GMOs are not detectable using existing testing methods and regulators somehow fail to uphold the public's right to know, developers would be unwise to make the commercial viability of the cisgenic strategy dependant on invisibility. There is no reason to believe that cisgenic products are assured of invisibility in future even if a blind test may not find its mark today.
- Regulatory and market requirements have driven the development of increasingly sophisticated technologies for identifying current GMOs. This poses a high level of risk to any pastoral agricultural strategy based on invisibility of a GM product.
- Transparency is a baseline requirement for an industry seeking to restore trust with consumers around the use of GM in the food chain. Failure to ensure that cisgenic GMOs are detectable – either by design or by omission – is not transparent and is not consistent with the cisgenics 'narrative' and its implicit promise.

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1. Cisgenics: a Cloudy Agenda

Despite widespread market resistance to genetically modified (GM) foods, significant state-funded R+D programmes to bring GM foods and feeds to market are underway in New Zealand.

A considerable portion of the domestic research effort is experimenting with a variation on existing GM techniques, called "cisgenics". This uses standard GM procedures to create new plants varieties. However, according to developers, the resulting GMOs differ from GM food and feeds already on the market in that only genes from within the same species are introduced into food and feed varieties.

Three separate pasture grass R+D programmes are using cisgenics to create GM ryegrass and clover (described more fully in the accompanying backgrounder, *New Zealand GM pasture grass R+D*). Of these, a drought-resistant ryegrass being developed by Pastoral Genomics – a consortium of pastoral industry producer boards - is the most advanced cisgenic GMO. Experimental lines are currently being field trialled in Australia, and application for a conditional release in New Zealand in the near future has been mooted.

Cisgenics has been identified by developers as a means of developing new forages for pastoral farmers. Interest in cisgenics also appears to have been aroused by:

- The belief that cisgenic GMOs will sidestep the market resistance that has plagued other types of GM foods. Some developers believe they will be able to convince consumers that the GM industry has reformed, by listening carefully to public concerns about using GM in the food chain. The claim that their GMOs will not cross the species barrier is offered as evidence of that reform.

- The hope that cisgenic GMOs will not be subject to the same regulatory scrutiny as GMOs made by existing techniques, and lobbying efforts by developers are underway in New Zealand to secure that regulatory discount.

- The belief that GMOs developed from this technique may prove difficult to detect and could thus be invisible to regulators and consumers.

The tension between these motivations are readily apparent. The desire for GM foods to be invisible in light of consumer insistence upon transparency about the use of GM is clearly at odds with pledges to realign GM to meet public misgivings about the technology. Similarly, removing cisgenic GM foods from regulatory scrutiny eliminates a primary mechanism of delivering on the "public's right to know" about the introduction to the food chain of foods developed by new technologies.

Developers may have considered it unnecessary to resolve such fundamental tensions in the early phases of R+D, but now that experimental release looms, the incoherence of cisgenics as a commercial strategy as currently framed is evident.

Perhaps more than any other issue, the detectability of cisgenic food and feed GMOs in the supply chain - the focus of this briefing - highlights the troubled nature of the cisgenics proposition.

2. The Importance of Detectability for GM Food and Feed

The ability to physically detect the presence of GMOs in the food chain has become a cornerstone in regulation and supply chain management. It underpins traceability, and is a mechanism for making GM developers and adopters accountable to the wider community – farmers, food producers, consumers and regulators. In particular, detection of GMOs enables:

- **Environmental monitoring:** identifying and tracking the interactions of the GMO with the wider environment.
- **Segregation on-farm and throughout the supply chain:** providing a basis for protecting non-GM production from farm to food processor, as part of supply chain integrity measures.
- **Consumer choice in the market place:** providing the technical basis for assuring the availability of non-GM food options for consumers.

The GM seed and cropping industry has now acknowledged that detectability is desirable as it smooths the trade in GMOs and an international association of GM seed and crop companies has recently launched an online database to make detection methods for approved GM traits widely available.[1]

Technology to detect the presence of GMOs has advanced rapidly in the fifteen years since GM food crops first entered the marketplace. It is expected that tests, particularly for known GMOs, will become increasingly faster, affordable and portable for on-site use throughout the supply chain – on the farm as well as during processing.[2] Today, it is possible to determine the identity of the GMO if present (qualitative testing) and the level of GMOs (quantitative testing) for commercially released GMOs. Testing methodologies are so sensitive that the presence of GMOs can be detected at levels as low as 0.01% in raw materials and 0.1% in foodstuffs with reasonable confidence (i.e., 99.99% and 99.9% purity).

3. Issues for the Detectability of Cisgenic GMOs

How amenable cisgenic GMOs will prove to existing methods for detecting the presence of GMOs is unclear. As no cisgenic organisms approved for commercial release anywhere in the world, there has been no demand for relevant methods from regulators or the market place and the detection of cisgenic products has remained a matter of scientific speculation.

Three distinct issues are likely to determine whether cisgenic GMOs will be detectable:

i) the nature of the genetic modification, including the genetic material used

ii) the availability of detection methods, and

iii) whether the regulator can and will require from developers information or methods that allow for detection.

3.1 The Nature of the genetic modification and genetic material used

The extent to which cisgenic GMOs will be detectable without prior disclosure is uncertain in large part because it is not yet clear what biological constraints the term ‘cisgenic’ refers to. Colloquially speaking at least, it is used by most developers to refer to a type of genetic modification where the introduced traits/genetic material and the recipient organism are from the same ‘species’. Considerable scope for interpretation lies in 1) whether *all* the genetic material used to introduce new traits to an organism is from within the species and 2) what is meant by species:

> ***Source of genetic material:*** Creating new plant varieties via GM typically involves several components, including vectors (often a virus or bacterium), markers, promoters and the genes/genetic material that will express the desired traits. All these biological components must be sourced from somewhere, and this is where the different understandings of cisgenics arise. Some developers maintain cisgenics refers to the origin of the introduced traits, and that the source of genetic material for vectors or promoters is irrelevant; other developers are working on GMOs where all the genetic material is allegedly from within the crop to be modified and use the term “intragenics” to distinguish this approach from the more porous category, “cisgenics”.
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> ***Species:*** The term “species” is itself open to interpretation, and is the subject of ongoing discussion within biology.[3] This definitional fluidity allows cisgenic developers potentially wider scope for sourcing new traits than popular understandings of ‘species’ might entertain. Indeed, much cisgenic activity may take place in the blurred zone which is the species barrier. Even the source of DNA within a naturally occurring organism might surprise lay understandings and give developers licence to a wider range of options than would at first be expected. Genetic material found in any plant may originate from another, wholly unrelated species such as a virus or bacteria. For example, *agrobacterium* is a soil organism that has a symbiotic relationship with certain classes of plants and can be found in their genomes.[4] It is also routinely used by GMO developers as vehicles for introducing new genetic material to organisms.[5]
>
> Further, some commentators suggest that the material may come not only from the same species, but also from “a crossable donor plant” – that is, another species, but one “at least genetically close enough to make natural crosses possible.”[6]
>
> ***Arrangement of the introduced genes*** – particularly the issue of whether the original flanking sequences of a gene are maintained – is another area of debate around the definition of cisgenics. Under Pastoral Genomics’ scheme, the original regulatory flanking sequences of the genetic material to be introduced are maintained, whereas under Plant and Food’s approach (dubbed intragenics), the regulatory sequences can be shuffled.[7]

Scientific literature on cisgenic detection suggests that the source of genetic material is of import to the ability to identify a plant or food ingredient that has been modified using cisgenics. According to a European expert on GM detection, cisgenic GMOs may present a challenge to certain types of testing (such as protein-based or polymerase chain reaction (PCR) methods), although other approaches may be more suitable.[8] However, if *agrobacterium* is used in a ‘cisgenic’ approach to introduce genetic material to a plant, the resulting GMOs should be readily detectable. This is because use of the bacterium for this purpose will leave identifiable footprints. Conversely, if truly ‘native’ vector systems are used – ones that are constructed from within the plant variety being modified - then existing detection techniques might struggle to identify the GMO. As noted by Schubert and Williams:

> If it is indeed possible to create a truly cisgenic plant free of all transgenic DNA sequences, then it would be difficult to characterize such a plant at the genomic level because of the lack of markers and, more importantly, it would be problematic to track the inserted genes once the plants are released.[9]

The Unique Biology of PR

Pastoral Genomics’ descriptions for lay audiences portray its cisgenic ryegrass R+D as operating within strict biological boundaries. In its brand of cisgenics, “only ryegrass DNA is (re-)introduced into the ryegrass genome”[10] and the result “101% ryegrass”[11].

However, this simplified biological depiction may not faithfully reflect the nature of the R+D. In the laboratory, the consortium has been using DNA from wholly unrelated species to develop GM grasses. This is, it suggests, a transitional strategy:

> to enable ViaLactia to realize their eventual aim, they may at times use genetic elements that are not derived from the same grass species. These elements include genes, from other species, involved in plant development or used as selection markers, including but not limited to double enhancer 35S CaMV promoter, NoS 3’UTR, CaMV 35S Poly A region, bacterial gene coding for hygromycin resistance, bacterial gene uidA, bar gene, Novel Fluorescent Proteins from jellyfish or reef corals[12]

While the use of marker genes – such as the abovementioned fluorescence conferred by jellyfish genes – may be phased out in later stages, the use of *agrobacterium* may be used for cisgenic end products (commercial varieties).[13]

Agrobacterium-mediated engineering would tend to make resulting cisgenic GMOs more easily detectable. However, the consortium hopes that later generations of the GM grasses (when these are bred for market) will be marker-free.[14] This is expected to be achieved by removing those elements that also function as tags for detection.[15]

Despite some misgivings about the applicability of current methods for detecting truly cisgenic GMOs, it is thought that knowing the location or the insertion site of the introduced genetic material will provide the basis for identifying cisgenic GMOs. This is because there will typically be unique border (flanking) sequences surrounding the insertion site that will allow for detection, as Professor Jack Heinemann explains:

> If the "cisgene" is indeed an exact replica of an endogenous gene (including promoter elements, introns, and no extraneous vector components), then it would be impossible to detect without knowing flanking regions (i.e. where it has been inserted) - since it would be identical to an already existing gene. Actually, with some work, one could probably figure out what the flanking sequence is, and therefore develop a straight-forward PCR assay for the presence of the cisgene.[16]

This has been confirmed by Plant and Food scientists experimenting with the technology, who explain that "each integration event has a unique fingerprint across the border junction of the GM event and the host genome".[17]

It is also likely that the inserted DNA would be located at a different site than it would normally occupy in the plant's genome.[18] This would facilitate detection:

> As long as the insertion site differs from the native genomic site, an event-specific PCR reaction can be developed with one primer that anneals to the inserted sequence and another primer that anneals to flanking DNA. The flanking DNA can be sequenced by using commonly available genome walking kits.[19]

New Zealand developers' positions on detection of cisgenic products

Messages from some state-funded cisgenic developers in New Zealand about the detectability of cisgenic GMOs have been mixed, if not contradictory. Since embarking upon a related type of GM called intragenics, Plant and Food developers have stated in some forums that such GMOs will not be detectible. They argue that the absence of 'foreign' DNA makes cisgenic GMOs difficult to distinguish from conventionally bred counterparts and thus makes the job of enforcing rules on cisgenic GM activities difficult.[20] Indeed, cisgenics "compromises the concept of GM testing"[21] such that it will reportedly be "virtually impossible to tell whether GM technology has been used".[22]

Elsewhere, Plant and Food scientists have confirmed the opposite: that if regulators have the necessary information (such as of the promoter used) detection of cisgenic GMOs would indeed be possible.[23]

Meanwhile, Pastoral Genomics has taken the position that cisgenic GMOs would, by their very nature, be difficult to detect. In 2008, the consortium objected to a proposed traceability framework intended to provide greater security for New Zealand's non-GM food and feed production. Ostensibly, the reason offered was one of feasibility: the consortium argued that cisgenic GMOs would be technically difficult to detect, thus making traceability impossible (see box).[24]

Two years later, the consortium intimated that detection may be technically possible but that a unique marker to cisgenic GMOs would need to be introduced to allow for their identification. That, Pastoral Genomics ventured, was not necessarily its responsibility.[25]

Pastoral Genomics' Objection to Traceability

The Pastoral Genomics consortium was among GM developers objecting to the proposed traceability regulation. It did not support making explicit ERMA's mandate to require information from developers for two reasons.

Firstly, the consortium argued that the regulations would likely be redundant as cisgenics would result in undetectable GMOs. As such, traceability would be "impractical to enforce".

The second was traditional fare from GM developers and directed at the suite of measures proposed: such requirements (designed to achieve transparency, increased accountability and greater public openness on the part of developers) would act as a significant deterrent to ongoing investment and commercialisation and would likely cost the country "billions" in foregone opportunities.[26]

Meanwhile, officials have proposed to do away with a mechanism that was to assist in informing growers and the wider community of GMO releases – a public register (see Appendix 1).

Within government, a thorough policy discussion has yet to occur on the detectability of cisgenic organisms and whether ERMA could and would require from the developer the necessary information as a condition of a release approval. However, documents the Sustainability Council has obtained suggest that the prevailing view amongst officials is that it would be technically difficult, if not impossible, to detect cisgenic GMOs and that this, in turn, will make regulation and enforcement of releases involving cisgenic GMOs problematic (in absence of the regulator requiring prior disclosure of a primer).[27]

Detectability of the Use of GM Feed in Animal Products

New Zealand GM pasture grass developers are looking to animal feed as a safe harbour for GM ingredients. This is because the use of GM feed has apparently been far less controversial than GM foods (most probably because the use of GM feeds has gone largely unlabelled thus far and is only indirectly consumed by humans). Challenges in detecting the presence of GM ingredients in food products from animals reared on GM feed also provides a shield from market scrutiny. Indeed, Pastoral Genomics has stated that because forages are not consumed directly by humans, they are not traceable through to the end product.

France's "Fed without GM" label for meat, milk and other animal products

Testing capabilities for the use of GM feed in the rearing of livestock for food are less advanced than detection methods for GM foods for direct human consumption. For feed that is harvested, processed and provided to livestock, routine tests will apply. However, complexities arise in testing final products such as meat, milk and eggs to determine whether GM feeds were consumed by the animal.

The European Food Safety Authority has taken the view that in tests thus far, "recombinant DNA fragments or proteins derived from GM plants have not been detected in tissues, fluids or edible products of farm animals".[28] A report for New Zealand's Commerce Commission reviewing much of the same literature finds differently: that while DNA from GM animal feeds was inconsistently detected, there is nevertheless "substantial and credible literature that reports the detection of DNA and protein unique to GM plants within animals and animal products".[29] Further, the report's author, Professor of Genetics and Molecular Biology at Canterbury University, Jack Heinemann concludes that the literature thus far "leaves no reasonable uncertainty that GM plant material can transfer to animals exposed to GM feed in their diets or environment, and that there can be a residual difference in animals or animal-products as a result of exposure to GM feed."

Thus far, the presence of GM animal feed has not enjoyed the same market profile as GM foods for direct human consumption. That appears to be changing, with moves by some governments and market gatekeepers to introduce measures that will make the use of GM animal feed more visible to consumers. France and Germany are among European Governments that have pledged to make mandatory labeling for the use of GM animal feed.[30]

Germany's "GM Free" food label, which includes products from animals reared on GM animal feed

The German Government has also introduced a GM Free labeling scheme to close the gaps in European Union law – such as the lack of requirement to label use of GM animal feeds. According to the German Federal Ministry of Food, Agriculture and Consumer Protection, the scheme "provides consumers with the certainty that foodstuffs with this label contain no genetically modified ingredients, not even traces of it."[31]

Meanwhile, the French National Consumers Council – a government body – has also introduced a "fed without GMOs" label for animal products. At least four French supermarkets have own brands that are certified as being GM animal feed free. Most recently, the largest of these, Carrefour has adopted this label for around 300 pork, poultry, eggs and farmed fish own brand products.[32] Major retailers in other countries have similarly 'free of GM animal feed' own brands include: Italy's largest food retailer, Coop Italia; Migro and Coop in Switzerland, Tescos, Sainsburys, Marks and Spencers and Budgen Stores in the UK.[33]

3.2 Regulatory Requirements for Detectability

Until 2008, the type of information requirements likely to attend a conditional release approval in New Zealand were unspecified. Controls that ERMA could set down as part of an approval included:

> (b) requiring any monitoring, auditing, reporting, and record-keeping
>
> (c) imposing any obligation to comply with relevant codes of practice or standards […]
>
> (d) requiring any contingency plans to be developed to manage potential incidents
>
> (e) limiting the dissemination or persistence of the organism or its genetic material in the environment (HSNO s38D)

In 2008, regulations on information requirements for tracking and segregation of conditionally released GMOs were introduced to HSNO.[34] Their purpose was to introduce greater "transparency, increased accountability and greater public openness of GM crop management". This would seem to require ERMA to insist on traceability so that "non-GM growers have a heightened level of assurance about the integrity and marketability of their product" and to help them "satisfy their markets of the non-genetically modified status of their products." The regulation was also intended to make clear ERMA's mandate and discretion "to require relevant information to be provided in applications for the conditional release of GM crops" and to flag to applicants and the wider community "that ERMA will specifically consider controls relating to segregation and traceability during consideration of applications to conditionally release GMOs."[35]

The regulations leave little doubt that detectability would be necessary for any approval for conditional release of a GMO as the cornerstone of segregation and traceability is the ability to detect the GMO under controlled release. Without this, demonstrable segregation and traceability - "the ability to trace GMOs and products that are or contain GMOs at all stages of their placing on the market through production and distribution chains" - are not possible. As identified in the Cabinet paper:

> Such information is integral to enabling ERMA to make decisions on controls (conditions) that it considers appropriate for ensuring an appropriate level of

segregation and traceability of a conditionally released GMO in order to facilitate coexistence between GM and non-GM production systems.

The additional information requirements are reflected in the form of conditional release applications, which require applicants to provide sufficient description of the GMO to allow it to be "uniquely identif[ied]" for inclusion on the public register of GMO releases.[36]

Regulator Must Uphold the Public's Right to Know?

In light of developer responses to the issue of detectability, assuring that the regulator will stand up for the consumer's right to know comes into sharp focus.

While the HSNO Act and traceability regulations clearly support ERMA requiring the necessary information for detection as a condition of a release of a GMO, ERMA would not be drawn on this question when approached by the Sustainability Council. It has not adopted high-level principles as to whether (or how) it would uphold the right to know for non-GM farmers and consumers, or whether it would give de facto approval for developers to cloak the presence of cisgenic GMOs. Instead, the regulator stated that this would be decided on a case-by-case basis.[37]

If ERMA did not to require a means to detect a GMO as a condition of release, this would be offensive to good governance and implies that New Zealand consumers should be denied the information that is a basic disclosure requirement in Europe.

A second issue is if a detection method were required, to whom ERMA would make available the genetic profiles that allow detection of cisgenic GMOs.

GMOs currently used as animal feeds are annual crops (soybean, maize, canola) that are harvested and processed, with several centralised points through the supply chain that allow for routine testing. Forage grasses, however, are perennial - effectively permanent crops - consumed by livestock in the field. While samples can be taken in the field and sent off-site for testing, on-site testing would be the easiest way for non-GM farmers to monitor their crops for the presence of GM contamination, providing there was prior disclosure of the primers needed to undertake the testing. It would also facilitate testing further down the supply chain, as required.

However, it is feasible that a developer would claim information relating to the detecting primer for the GMO must be treated as commercially confidential by the regulator. Under this scenario, it is possible that ERMA would require identification details but restrict access to accredited laboratories, thus establishing a centralised detection system.

Notably, however, the potential argument for withholding such details is contradicted by the above-mentioned CropLife International detection methods database, which makes widely available GM construct details to advance commercial interests. Once again, in the interests of fulfilling the traceability regulations - to help non-GM growers "satisfy their markets of the non-genetically modified status of their products" – ERMA should allow open access to testing primers to facilitate decentralized on-farm testing by all farmers.

4. Hiding from the Consumers

When promoting cisgenic GM food and feeds, developers claim that things have changed. GM is now, they suggest, a technology reformed and aligned to meet the concerns and aspirations of consumers.

The apparent restriction of genetic modifications within the species is, it would appear, the limit of the cisgenic response to market concerns. Yet while crossing the species barrier has indeed given rise to consumer anxiety about new ecological risk driven by transgenic GM, it is well documented that the reasons for market resistance to GM foods in many countries extend much further.

Consumer choice – the ability to avoid GM foods if desired – has consistently ranked highly in consumer surveys in New Zealand and in the country's key export markets. Fundamental to consumer choice is developer transparency about the use of GMOs in the food chain and a commitment to eliminate or minimise the extent to which GM activities contaminate non-GM food production (see box).

Lie of the Land: Public Concerns about GM

Multi-year research by Lincoln University's Agribusiness and Economics Research Unit (AERU) identified that:

- GM research has "an air of secrecy about it that breeds mistrust" and that "[i]n order for scientific and government institutions to be trusted the research process should be rendered more transparent."[38]
- Public skepticism about science is such that "New Zealand science must address issues of integrity, trust and purpose in new technology developments and communicate these with the public."[39]
- The type of information available to consumers is key: "The lack of information *of the type they wanted* played a part in the dominant concern and distrust about the role of business in biotechnology products", according to AERU. (Emphasis added).

Work by Hortresearch delivered a similar picture. Dominant concerns amongst those it surveyed included:

- Lack of choice and control over consumption of genetically modified food, due to the lack of labelling regulations, and the resulting perception of being 'part of an experiment' without having given consent.
- The perceived monopoly big businesses have over the distribution of information, and policy/regulation formation, and hence the perceived lack of regulations and objective information available to the consumers. This adds to consumers' beliefs that they have no control over what they purchase and consume.[40]

AgResearch social scientists also found that even for "conditional supporters" of GM products (those who might support some types of GM, dependent on the benefits), "autonomy of choice" is critical. As ability to choose is facilitated be regulation, skirting around regulatory scrutiny is not advisable:

> Attempts to avoid these conditions by government policy makers and biotechnology companies will likely result in increased distrust and further strengthening of beliefs and

attitudes strongly related to increased resistance to GE food technology.[41]

More recently, research commissioned by Pastoral Genomics established that irrespective of whether they would willing eat products from animals reared on cisgenic feed, a majority of respondents wished to know whether GM was involved.[42] Honesty and transparency are baseline to building consumer confidence:

> Being open and honest about what is contained in food will add to consumer confidence and give people the information they need to make an informed choice. If consumers feel they have been deceived, then their level of trust in the product and brand, company and towards genetic modification as a whole, will be affected.[43]

Attitudes to cisgenic food and feed products in the market place is less well researched. Nevertheless, public opinion research commissioned by Pastoral Genomics has confirmed that irrespective of whether respondents would willingly eat products from animals reared on cisgenic feed, a majority wished to know whether GM was involved.[44] Research in other countries suggests consumers also want the food industry to be transparent about the use of GM animal feed (see box).

Market Signals: Consumers Want use of GM Feed Labelled

Internationally, consumer awareness about the use of GM feed in livestock farming appears to be low. A report commissioned by the Australian Federal Government urged further work be done to understand attitudes to the use of GM animal feed as existing research is scant and for some countries, provides conflicting results.[45]

Nevertheless, a number of surveys suggest that consumers would indeed prefer the use of GM animal feed to be labeled, as described below. Even if the situation is one of uncertain market reception, the strategic question for the pastoral industry is whether to take the risk of committing to use of a product that may be rejected.

Germany: Around 85% of German respondents do not want animals to be fed with GM feed, according to a survey conducted by market research company Forsa. In a further study by Forsa, 75% of German consumers want to see food producers and retailers make wider use of Germany's voluntary "GM-free" labeling scheme and would opt for products labeled "GM-free" if available.[46]

France: 93% of respondents in a French survey in October 2010 said that products from animals raised on GM feeds should be labeled as such. 90% said that knowing that GM animal feed were involved in the creation of the products would change their purchasing habits: 63% said they would stop buying products altogether, while 27% said they would reduce their consumption.[47] This follows a survey conducted a year earlier which found that 93% of respondents did not consider it acceptable that use of GM animal feed was not labeled on resulting products, and 71% would chose dairy products with a "not fed on GM" label. [48]

UK: Widespread support for labelling of *all* GM food products, including where GM is used as a processing aid or in animal feed was voiced in a survey for the UK Food Safety Authority. The principles of transparency and consumer choice were clearly a priority for people holding a range of attitudes towards GM foods and this shaped their views on regulation and labeling.[49]

Polling by NGOs found that less than 40 per cent were aware that GM animal feed was involved in animal products; 89% wanted such products labeled and that 72% would pay more for products where GM feed had not been used.[50]

Australia: Nine out of ten Australians surveyed in a Newspoll commissioned by Greenpeace wanted all GM food and food products labelled – including products from animals reared on GM feed.[51]

Transparency would appear to be the best policy for an industry seeking to restore trust with consumers around the use of GM in the food chain. Failure to ensure that cisgenic GMOs are detectable – either by design or by omission – is not transparent and is not consistent with the cisgenics ‘narrative’.

5. A Matter of Choice?

Developers have variously stated that detection of cisgenic GMOs is confounded by a lack of suitable methods (a technical deficiency) or constraints on what information regulators can require (a regulatory deficiency). Both are red herrings to the extent that they focus the attention disproportionately on external agents and away from developer choices, and what can easily be rewritten for regulators.

This is evident in respect of the effectiveness of existing testing methods for identifying cisgenic GMOs. The uncertainty as to whether certain types of modification will be more or less amenable to detection arguably places the onus on developers to modify food or feed plants in ways that will allow for detectability and traceability of their products.

It is, ultimately, a question of design choices. As such, Plant and Food’s identification of a “legal conundrum”[52] arising because cisgenic GMOs are characterised as undetectable and not amenable to regulation is somewhat of a science fiction: to the extent that any difficulties do arise for regulators, these would appear to be of the developer’s engineering.

The prospect of non-detectability of cisgenic pasture grasses may hold attraction for developers given that species such as ryegrass will be extremely difficult to contain. However despite the charms that invisibility may hold for GMOs intended for the food chain – whether directly or indirectly – detectability is fundamentally an issue of social accountability (rather than a narrow technical capability question). And it is around the question of the detectability that the narrative of the technology having been reformed comes unstuck. Indeed, given the prominence that choice has occupied in accounts of market resistance, one would expect such considerations of how to deliver choice to feature in the early phases of product design. Yet statements by Pastoral Genomics suggest that it does not consider this to be the consortium’s responsibility. As the CEO has explained, when asked if use of unique detection marker had been considered: “I don’t know I would see that as one of the things we should be spending a whole lot of time and effort on.”[53]

Markets may call the tune

A linked concern arises if the decision to pursue cisgenics instead of other methods for delivering new plant varieties rests on their remaining invisible in the food chain. To the extent that existing testing methods and regulatory requirements are less likely to pick up the presence of cisgenic GMOs in absence of disclosure, this is in part because such GMO products are not yet on the market. New Zealand developers of GM animal feeds would therefore be unwise to assume that GM animal feed will continue to attract comparatively little attention in the market place, or that cisgenic varieties will remain difficult to detect.

Should cisgenic GM varieties make it to market, regulatory and supply chain requirements will likely drive the development of detection technologies specifically tailored to cisgenic GMOs, just as European law and gatekeeper policies have brought about ever more sophisticated testing methods for existing GMOs.[54]

The future trends appear quite clear: traceability – underpinned by detection - is set to become a cornerstone of New Zealand food producers' relationships with their markets. KPMG's agribusiness survey reported:

> The "green consumer" and "responsible retailers" of today are demanding increased creditability, greater accountability and traceability in their suppliers' supply chain. To meet these expectations, New Zealand's agribusiness sector needs to adopt a sustainable supply chain approach, which entails a whole life cycle analysis from on-farm activities, processing and manufacturing, to end consumer engagement.[55]

The apparent failure to address the question of detection and traceability upfront shows a disturbing lack of interest in the market conditions that cisgenic GMOs are likely to face.

Appendix 1

Moves to Abolish Public Register of GMO Releases

A register to provide information on GM release approvals was introduced by the Government in 2008. It was a product of the Cooperation Agreement between the then Labour administration and the Green Party and one of a suite of provisions intended "to increase the certainty around the non-GM producers to maintain GM free production and be able to identify their products as such to meet market access requirements".[56] The register is to make known the details of the GMO, location of the release and any regulatory controls set by ERMA.

Some time after Pastoral Genomics began to lobby Ministers about the GM regulatory environment, officials floated with the Minister of Agriculture the idea of abolishing the register. Officials had opposed the register and other traceability measures when initially introduced, telling the then Minister for the Environment that they would restrict further GMO research and innovation in New Zealand. The Minister believed this was unlikely and underscored that their purpose was to "provid[e] a greater level of transparency, increased accountability and greater public openness of GM crop management, should GM crops be approved for use in New Zealand.[57]

In advice to their Minister, MAF officials put forward a number of arguments in support of abolishing the register:

- a public register is a "general broadcast" that does not support two-way communication between GM and non-GM growers;
- the "richness of information" required to inform crop management decisions by GM and non-GM growers is not provided;
- the "explicit" purpose of the register, when introduced, was never properly formulated; and
- making public the location of GM releases would make these activities vulnerable to vandalism, and deter operators from applying for conditional release approval.[58]

Officials also argued that the online register had hardly been used, with ten visitors to the site, on average, per month.[59] However given that there have been no conditional releases of GMOs and the register does not report details of field trials, it is of little surprise that the site had seen minimal traffic.

MAF recommended that instead neighbourhood notification and agreements should be introduced and proposed abolishing the register once they were ready.[60] Officials proposed to achieve this by the end of the 2010-2011 financial year, or in time for a conditional release application if this emerged earlier.

"And" not "or"

It is true that a register would not of itself be sufficient to provide growers with the information they might require to protect themselves from neighbouring GM cultivation, and that "more targeted communication" – such as neighbourhood agreements – would be necessary. However, the proposition that a public register could therefore be an "and" rather than an "or" was not discussed with the Minister. Further, expanding the information carried on the public register was discounted by officials as impossible or too costly to upgrade it to perform "all" the required functions.[61]

It is likely that the real driver for MAF officials to push for the removal of the register is the belief that outdoor GM activities would be vulnerable to vandalism if their location made known. Officials told the Minister that the register "represents a real risk for GM users whose crops are listed on it, as it broadcasts GM cropping information to a general audience"[62] and that this risk had been made known to them by developers:

> We have also heard informally from potential applicants to ERMA that the Public Register, in increasing the risks of vandalism and threats to growers, is a concern and may act as a disincentive for applying for a conditional release approval.[63]

This argument did not convince the previous Minister for the Environment. At that point officials acknowledged that there was no evidence to support these fears: locations of field trial activities have not been disclosed by ERMA such that "it is impossible to provide explicit evidence that publishing the locations of GM crops is correlated with an increase in intentional damage of those crops".[64]

Who are the neighbours?

A problem with officials' proposition that neighbourhood agreements will be sufficient to provide non-GM farmers and growers with the information they need to protect their production is the question of who is a neighbour in the context of a GMO release and who decides the boundaries of a "GM neighbourhood". In the event of an application for a GM release, officials would define which growers should be privy to the location of a GM release based on their determination of contamination pathways.

There may, however, be considerable difference of opinion, based on a range of research findings, on how far pollen, seed or vegetative material might flow – as is the case with pasture grasses - and which farms might therefore lie in the path of potential contamination. It remains to be seen how precautionary regulators would be in making that determination and whether, in the interests of good relations within the agriculture industry, developers of their own accord inform a wider circle of growers than the regulator requires. In the absence of a public availability of information, as would be set out by the current register, at-risk growers may not be given the information they require.

Finally, while the introduction of a public register as a means of facilitating traceability had been the subject of public consultation, the intent stated in the official documents was to abolish it without consultation.

Stay of execution

In November 2009, the proposal was taken to Cabinet and approval was received to put forward a Cabinet paper formalising the idea. (MAF was advised by the Cabinet Office that procedurally, a Cabinet paper was not necessary, but that given the "potentially controversial nature of the issue", a paper "might be advisable after all".[65])

As of mid-August 2010, the Minister had not agreed to the draft Cabinet paper and the abolishment of the register is not Government policy.[66]

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