



appendix 2

Outcomes of Consultation: Submissions from Interested Persons

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3.6 Where, how, and for what purpose ...

Introduction

Warrant item (a) asked for investigation into and representation on:

where, how, and for what purpose genetic modification, genetically modified organisms, and products are being used in New Zealand at present

Fifty-seven submitters made substantial comment on this Warrant item. Within this group, 28 submitters had economic and productive issues as their main sectoral focus. Seven had environmental issues as a principal focus and six had health issues. Most submitters were from industry associations or networks (14 submitters), research organisations (13 submitters), other advocacy networks (nine submitters) and private companies (seven submitters).

Of the 57 submitters, 41 were identified as being ‘strongly for’ or ‘tending to be for’ genetic modification; 12 were considered to be ‘strongly against’ or ‘tending to be against’. Four were assessed as ‘neither for nor against’ the use of genetic modification technology.

Many submitters expressed concern about the public availability of the information specified in this Warrant item. This issue is discussed more fully in other sections (eg, sections “Statutory and regulatory processes” and “Areas of public interest: an introduction”).

Submitter responses to the Warrant item provided a wide range in the level of detail. Responses indicated the following:

- The terms “where”, “how” and “for what purpose” were interpreted in various ways. Submitters who were not actively involved in research or in the use or application of any genetically modified products or processes usually did not provide specific details of what was currently happening in New Zealand.
- Submitters clearly had differing levels of access to information about genetic modification activities and products.
- It was unclear whether all the examples provided by submitters related specifically to activities and uses “in New Zealand at present” (the wording

of the Warrant item). Several witnesses noted activities that had been undertaken in New Zealand in the past; they noted research or use that was based on overseas experience; or they mentioned work that was planned for the future.

- Although individual submitters cited the research that they believed was being conducted in their own organisations, no one submitter purported to provide a complete picture of all the research being undertaken in a particular industry or sector.

Responses to Warrant item (a) are described according to:

- Types of response to “where”, “how”, and “for what purpose”
- Uses of genetic modification technology in New Zealand
- Specific examples of use of genetic modification technology
- Extent of information on the use of genetic modification.

Types of response to ‘where’, ‘how’, and ‘for what purpose’

Most submitters gave a general outline of current undertakings in their own organisations with respect to research or product development using genetic modification techniques or their perception of what was happening in their industry sector. Some submitters noted their support for other organisations’ research activities. The remainder tended to express reservations about the use of genetic modification techniques.

The more detailed information about the process and overall purpose for using genetic modification was usually supplied by those organisations that were actively involved in using genetic modification processes and products. This group included several research facilities (research institutes, universities and Crown Research Institutes) and private companies. Several references to specific projects were provided.

Where genetic modification is used

Submitters variously interpreted “where” genetic modification technology was used, usually as a broad geographical location or a general industry or sector. Most submitters indicated the general industry or range or type of activity in which genetic modification, genetically modified organisms and products were employed. Relatively few submitters gave specific geographic locations where genetic modification techniques were used. Typical references included: “medical research”,

in the “biological industries”, in the “environment sector”, “in the apple industry”, “in New Zealand research institutions”, “in contained field trials”, “in containment laboratories and containment greenhouses” and “throughout New Zealand at various organisations”.

Some submitters noted specific locations. For example, AgResearch [IP13] mentioned its main research and development sites at Ruakura, Grasslands (Palmerston North), Wallaceville, Lincoln and Invermay (Mosgiel).

How genetic modification is used

In response to “how” genetic modification technology was used, most comments came from submitters whose organisations were actively involved in using or investing in genetic modification technology. They usually gave detailed information and examples of the processes and products involved. These activities embraced basic or fundamental research and, to a lesser extent, the product from use of this technology. Many of the comments were incorporated into their comments on the purpose of use.

Typical of more detailed categorisation were the comments in a witness brief from Foundation for Research, Science and Technology (FRST) [IP21], which identified three broad areas of research: “proof of concept” studies (see below), research targeted at producing genetically modified products, and research aimed at understanding and addressing the key effects associated with genetic modification.

Purpose of genetic modification

Submitters also treated variously the notion of “for what purpose” genetic modification techniques were being used. The majority interpreted the Warrant item to mean current uses in New Zealand. Most of those submitters who had direct involvement in a particular research activity (or used products or processes using genetic modification technology) interpreted purpose to mean the sector in which the genetic modification activity occurred. They usually gave information that scoped the nature of activities undertaken.

Several provided details of a representative selection of the activities being undertaken. For example, Landcare Research [IP12] noted the use of genetic modification in possum fertility control for the purpose of solving a major environmental pest problem. Landcare Research detailed the project in an accompanying witness brief.

Submitters noting examples of specific projects in specific industry sectors gave details of work in four main areas: land-based production (including animal and plant production), environment, human health, food for human consumption. To a

lesser extent, application of this technology in veterinarian medicine and animal feed was mentioned, as well as its industrial uses.

Most organisations focused on one particular activity (for example, medical applications or horticulture). However, some organisations’ research activities spanned several sectors (for example, Crown Research Institutes were involved in the agricultural production sector and also the environment sector).

Uses of genetic modification technology in New Zealand

Most submitters responded to the Warrant item’s “where, how, and for what purpose” in terms of the current use of genetic modification. From information provided by submitters, the overall impression about the extent and range of activity involving genetic modification technology in New Zealand in 2000 may be summarised as follows:

- Genetic modification technology was widely used in university and other research institutions in New Zealand as an integral part of ongoing research activities.
- Genetic modification-related research had been conducted for many years.
- Many organisations (including those in the productive sector, private companies and patient advocacy groups), which did not themselves use genetic modification techniques, acknowledged that they either actively supported and/or directly benefited from research using this technology.
- “Use” included basic or fundamental research (for example, where genetic modification was used as a tool in a research process) and applied research (for example, development of a particular genetically modified product).
- Continuing use of genetic modification technology was clearly anticipated by most submitters.
- Genetic modification technology was applied in a wide range of New Zealand’s productive base. Its use spanned land-based production (including horticulture, agriculture, forestry), human health applications (for research and specific products, especially vaccines), in animal welfare and animal feed, in the environment (including bioremediation, maintenance of biodiversity and pest control), as well as industrial applications.
- There was no commercial production of genetically modified food, although some food products or food ingredients imported from overseas could contain genetically modified material.

- Research being undertaken using this technology was with the express approval of Environmental Risk Management Authority (ERMA).
- Despite ERMA's requirements, unauthorised experiments had been conducted. Green Party of Aotearoa/New Zealand [IP83] identified that 15% of experiments under way in August 2000 were unauthorised.
- Submitters identified specific projects that were known to involve use of genetic modification technology. A complete list of all current projects was generally perceived to be not readily available.

Specific examples of use of genetic modification technology

Specific examples of what submitters stated was currently happening in New Zealand in the use of genetic modification technology are outlined below. Comments from 13 submitters were selected to illustrate the responses. Information from two government agencies involved in the funding and approvals for genetic modification research (FRST [IP21] and ERMA [IP78]) is outlined first. Then comments of 11 submitters from the major industry groupings (universities, Crown Research Institutes, private companies and sector organisations) illustrate a range of genetic modification uses: Carter Holt Harvey/Fletcher Challenge Forests [IP17], Institute of Molecular BioSciences, Massey University [IP15], Crop and Food Research [IP4], AgResearch [IP13], Monsanto New Zealand [IP6], Landcare Research [IP12], University of Auckland [IP16], Malaghan Institute of Medical Research [IP10], Auckland Healthcare Services [IP91], New Zealand Grocery Marketers Association [IP54] and New Zealand Vegetable and Potato Growers' Federation/New Zealand Fruitgrowers' Federation/New Zealand Berryfruit Growers' Federation [IP75].

Examples cover four broad sectoral areas:

- land-based production (including animal and plant production)
- environment
- human health
- food for human consumption.

Some of the activities identified span more than one sector. For example, "proof of concept" research (FRST [IP21]) had implications for both agriculture and the environment. Some activities involving food were in both plant research and production of food for human consumption.

Government funding and approval agencies

The activities of two government agencies involved in the funding and approvals for genetic modification research span the broad sectors identified.

Foundation for Research, Science and Technology

FRST [IP21] said that it was the primary investor in research, science and technology in New Zealand investing around \$383 million on behalf of the New Zealand Government. It estimated that approximately \$130–135 million (or 33–35% of the Foundation’s total investment) was invested in research programmes that used or were associated with gene technology. In an accompanying witness brief, three types of research were identified:

- “Proof of concept” research. Approximately \$27 million was invested in research where genetic modification and other gene technology techniques were being used as “proof of concept”. Such research was aimed at extending scientific understanding and might or might not lead to genetically modified products or solutions. Examples included: the recent discovery of a gene in Inverdale sheep that causes increased fertility; use of genetic modification in research to understand the effect that a plant growth regulator or hormone has on the storage and shelf-life of vegetables.
- Research involving development of genetically modified products or solutions. Approximately \$6.4 million was invested in research targeted at producing a particular genetically modified product or solution. Examples included: producing a genetically modified crop plant with increased pest resistance to improve plant performance; generating genetically modified cows with improved casein content in their milk; developing vaccines against bovine tuberculosis; and producing novel, high-value, ornamental species.
- Research aimed at understanding the issues and addressing the effects associated with genetically modified organisms. Approximately \$1.4 million was invested in research in this area. Specific examples provided included: research to better understand characteristics of the target organism (eg, pollen release and movement); and research to better understand how genetic modification tools work and to develop new tools to help minimise risks (eg, vectors that do not include antibiotic resistance markers).

Environmental Risk Management Authority

ERMA [IP76] noted:

No approvals by the Authority or by any other agency to the Authority’s knowledge have been given for the release of a viable GMO. This includes current applications put before

the Authority and approvals carried over from the previous regime. Current use of GMOs has therefore been restricted to teaching, research and developmental work carried out in containment in the main by Universities and the Crown Research Institutes.

Much of the GMO development work has been in understanding the function of specific genes. Such research has been for the purposes of modelling diseases and possible treatments and for understanding the fundamental mechanisms controlling plant growth. Once the gene function has been understood attempts have been made to shift genes firstly within and then between species. This work has included the development of agronomically important characteristics in plants and the development of biopharmaceuticals.

ERMA further noted that its comments on current usage of genetic modification technologies in New Zealand were derived primarily from the applications put before it for importation or development of genetically modified organisms. However, the Authority was aware that pharmaceuticals derived from genetically modified organisms (such as insulin and hepatitis vaccine) were already in use in New Zealand.

Seven approvals by ERMA for field tests with controls are listed below, namely approvals to:

- PPL Therapeutics for the establishment of a manufacturing flock of sheep genetically modified to contain a copy of a human gene, so as to produce a biopharmaceutical in the milk of the sheep
- Crop and Food Research for genetically modified petunia for altered plant form or pigmentation, to assess field performance of the vegetative plant
- Kimihia Research Centre to evaluate agronomically important characteristics of genetically modified sugarbeets for herbicide resistance
- Pioneer New Zealand for genetically modified, herbicide-tolerant and insect-resistant maize for breeding purposes
- Crop and Food Research to evaluate resistance and yield performance of individual lines, over a five-year period, of potato cultivars genetically modified for increased resistance to bacterial soft rots and tuber moth
- AgResearch to perform large-scale fermentation of genetically modified *Escherichia coli* to obtain registration of the hydatids vaccine by the Animal Remedies Board and maintain hydatids vaccine supplies for trial and future commercial overseas markets
- Carter Holt Harvey to study factors influencing gene expression and to assess the influence of genetic modification involving the insertion of marker genes on growth and morphology of pine trees.

Land-based production uses of genetic modification

Submitters provided examples of the use of genetic modification in research directed toward land-based production. A wide range of scientific investigations included studies in forestry, symbiosis, apomixis and resistance to pests, diseases or herbicides.

Carter Holt Harvey/Fletcher Challenge Forests

Carter Holt Harvey/Fletcher Challenge Forests [IP17] noted that it did “not have commercialised applications of biotechnology in use in forestry in New Zealand at the present time”. It confirmed that Carter Holt Harvey had obtained approval from ERMA in 1999 “to field test a strain of genetically modified radiata pine incorporating genetic markers”. It had subsequently produced 120 such seedlings. It also noted examples of possible applications in projects to increase wood yields, improve wood quality, reduce tree damage from the exotic fungus *Dothistroma* and reduce the survival of pests.

Institute of Molecular Biosciences, Massey University

Institute of Molecular BioSciences [IP15] noted that its staff members were “engaged predominantly in basic research using recombinant DNA techniques to address a wide range of questions in biological processes”. It noted eight examples of general types of research being undertaken and itemised some of the individual projects. For example, under the broad category of research into “host-microbe interactions including pathogens and symbionts”, it listed project “GMO99/MU/10” as “Evaluation of dothistromin production by the pine pathogen *Dothistroma pini*”.

Crop and Food Research

Crop and Food Research [IP4] noted seven areas of its research that currently used genetic modification. They were:

- modification of the biochemical pathways for carotenoids and flavonoids to introduce new colour combinations into ornamentals and improve food properties such as nutritional quality and colour
- modification of the biochemical processes of senescence to improve the shelf-life of perishable products such as vegetables and ornamentals
- introduction of new pest- and disease-resistance characters
- investigation of “apomixis”, a form of asexual seed production in plants with potentially worldwide benefits for plant improvement

- production of potential pharmaceuticals in plant tissue
- improvement of genetic modification techniques through the development of new vector systems and transformation methods for crops that cannot currently be transformed.
- gene discovery within crop plant species

AgResearch

AgResearch [IP13] advised that it used three major methods of research: traditional breeding, genetic marker-assisted selection for traits and genome manipulation (which results in genetically modified animals, plants or micro-organisms that either have new gene sequences inserted or the functions of particular genes modified). It provided examples of 14 projects involving a range of organisms, genetic modification techniques and applications. The organisms used included bacteria, parasitic worms, cattle, sheep, mice, and pasture plants (ryegrass and white clover). Among the techniques identified were: gene libraries, gene isolation and functional analysis, gene deletion and gene insertion techniques in bovine cells, transgenic mouse models (micro-injection and gene targeting techniques), bacterial cloning, and gene disruption by transposon mutagenesis.

Monsanto New Zealand

Monsanto [IP6] stated that it had evaluated several projects in New Zealand and, “owing to uncertainty of future direction”, put them on hold. These projects included: commercial release of ‘Roundup-Ready’ canola (canola that will tolerate applications of Roundup herbicide), a trial of herbicide-tolerant wheat and herbicide-tolerant radiata pine. It also noted “Monsanto-developed genetic material ... and processes (eg, promoters) are freely available to the scientific community and are in use in a number of scientific programmes.”

Environment-focused use of genetic modification

Landcare Research

Landcare Research [IP12] said that it was directly undertaking or subcontracting genetic modification work to the value of \$2.8 million in 2000-2001. About \$2 million was for research on development of potential products derived from genetic modification for improving environmental management. It gave details of research into 12 areas: conservation genetics, DNA typing for identification and monitoring of mammal pests, whakapapa of harakeke (New Zealand flax, *Phormium tenax*), horizontal gene transfer in bacteria, origins of nitrogen-fixing rhizobia, rapid assessment of plant pathogenic bacteria, possum fertility control, stoat biocontrol, new pest control toxins, wasp control, biosensors and bioremediation. It expected its genetic modification-related work “to rise slowly as we increase our

focus on describing, understanding and protecting genetic diversity of New Zealand's flora and fauna".

Human health-related use of genetic modification

University of Auckland

University of Auckland [IP16] said "genetic modification, genetically modified organisms and products are widely used in New Zealand at present. In the University's Schools of Biological Sciences and Medicine, GM, GMOs and products derived from GMOs are being widely used for medical research." It noted that the technology is used extensively in fields such as biochemistry, clinical biochemistry, molecular biology and medicine, as well as in some areas of engineering. Some specific therapies based on genetically modified products were detailed, including erythropoietin, growth hormone, granulocyte-colony stimulating factor (G-CSF) and plasminogen activator.

Malaghan Institute of Medical Research

Malaghan Institute [IP10] also confirmed it made "extensive use of GM, GMOs and GM products to achieve the objectives of its biomedical research programmes". It recounted developmental work over the 1970s and 1980s into protein hormones, growth factors, cytokines and immuno-modulatory agents, and noted: "Today, many hundreds of recombinant proteins are available for research purposes." Various research projects at the Institute made "wide use of interleukins, ... interferons, colony-stimulating factors, peptide hormones and other recombinant immuno-modulatory proteins". In addition, the Institute said that it employed extensive use of cell lines genetically modified to produce specific cytokines and frequently imported such genetically modified organisms into containment. Over the past five years, transgenic and gene knockout mouse models had been "increasingly used ... to facilitate research into cancer, asthma, tuberculosis and multiple sclerosis".

Auckland Healthcare Services

Auckland Healthcare Services [IP91] noted that genetic modification technology was currently being used for investigation and diagnosis of genetic disorders and congenital metabolic diseases in areas such as prenatal diagnosis, diagnosis confirmation, carrier detection, predictive testing, predisposition testing, diagnosis and treatment of congenital metabolic disorders in newborn babies. Predictive testing included DNA testing of individuals who are at risk of developing a late-onset genetic disorder such as Huntingtons disease before the onset of symptoms. Congenital metabolic diseases, for which Auckland Healthcare's National Testing

Centre screened newborn babies, included the conditions of phenylketonuria (PKU), maple syrup urine disease, congenital hypothyroidism and cystic fibrosis.

Food-related use of genetic modification

New Zealand Grocery Marketers Association

Grocery Marketers Association [IP54] summarised the situation for the food processing as follows:

- Derivatives from GM crops were being used as ingredients in food processing.
- Genetic modification was also useful to food processing in the production of enzymes and additives, potentially enabling more efficient production of such micro-ingredients.
- The extent to which genetic modification was used by the industry and its different uses was not recognised or appreciated by many consumers.
- The application of genetic modification in the food processing industry extended beyond products. The technology could be used to detect pathogens, toxins and chemical contaminants, as well as degradation of quality.

The Association also gave some examples of the processed foods in which genetically modified ingredients “may be used in New Zealand”. Its list included six genetically modified organisms such as forms of soybean, canola, potato and sugarbeet. Details were supplied of the ingredients, additives and processing aids that could be derived from these genetically modified crop plants. A list of the foods in which these products and processes were used was also provided. For example, information for soybean, cotton and potato is shown in Table 3.5.

Vegetable and Fruitgrowers Federations

New Zealand Vegetable and Potato Growers’ Federation/New Zealand Fruitgrowers’ Federation/New Zealand Berryfruit Growers’ Federation [IP75] confirmed that in New Zealand “there are no genetically modified fruit or vegetables grown commercially”. The Federations also stated that several trials were under way. These included: a trial to produce potato plants with genetically modified resistance to potato tuber moth; a trial to produce genetically modified resistance to alfalfa mosaic virus in peas; and a project breeding tamarillo plants with resistance to tamarillo mosaic virus. In addition, the Federations referenced HortResearch’s genomics programme involving sequencing genes from apples, kiwifruit and berryfruit, including the possibility “to introduce crop improvements via smart breeding and marker assisted selection”.

Table 3.5 Ingredients derived from genetically modified crops and their use in foodstuffs

GM0	Ingredient, additives and processing aids	Used in following foods
Soybean	soybean flour	soy drinks, soy sauce, tofu
	soybean protein	processed meats/sausages/salamis
	hydrolysed vegetable protein	bread
	textured vegetable protein	dairy – drinks, yoghurts, desserts, ice cream
	soybean oil	baked goods – cakes, pies, pastries, biscuits
	lecithin	soups and sauces
	additive and flour carriers/diluents	cooking oils, salad dressings
	tocopherols – vitamin E	margarines and spreads, peanut butter confectionery, savoury snacks, infant food
Cotton	cotton seed oil	baked goods
		cooking oils
		salad dressings
		margarines
Potato	potato	soups
	potato starch	sauces, pickles and chutneys
	modified starch	confectionery
		savoury snacks

Source: Submission of New Zealand Grocery Marketers Association [IP54]

Extent of information on use of genetic modification

A few submitters noted that their organisations did not directly undertake genetic modification-related research but that they supported and benefited from such activities, or that their members were actively engaged in such activities. These submitters included Meat Industry Association of New Zealand [IP32], New Zealand Game Industry Board [IP33], Diabetes Youth New Zealand [IP60], Royal Society of New Zealand [IP77a (biological sciences)] and Lysosomal Diseases New Zealand [IP99].

A greater number of submitters expressed their concern at a lack of information on who was using this technology and for what purpose. Others were uncertain about, or against, the use of this technology. Several queried the reliability of the information on current use. This group comprised approximately a dozen submitters on this Warrant item. Specific comments included:

- “We ... are concerned that such information is not easily available” (Public Questions Committee (Methodist, Presbyterian, Churches of Christ, Quaker)[IP93]).
- “... at present GM experimentation is going on in New Zealand without public knowledge or consent” (Friends of the Earth (New Zealand) [IP78]).
- “Genetically modified food infiltrated the food supply in New Zealand with no agreement of the government or people of this country” (Pacific Institute of Resource Management [IP84]).
- “Trial crops are being grown regardless of risks, products are being imported and incorporated into unlabelled food” (Nelson GE Free Awareness Group [IP100]).
- “Maori Congress from reading the submissions to the Royal Commission has discovered that genetic modification has taken place [in a number of areas] ... The list is relentless and continues to be added to without the knowledge of Maori. ... [Biotechnology] companies have failed spectacularly in their efforts to advise us of their work. And it begs the question as to why?” (National Maori Congress [IP103]).
- “A survey of 433 members of the Association of Anglican Women has indicated a high level of uncertainty and lack of information upon which to make considered opinions.” (Anglican Church in Aotearoa New Zealand and Polynesia [IP42]).

- Green Party [IP83] expressed its concerns about research being undertaken without Environmental Risk Management Authority (ERMA) approval. It noted:

As at 16 August 2000 ERMA had approved:

39 applications to allow a genetically modified organism to be either developed in containment or imported into a contained facility. Such approvals include genetically engineered mice for medical research;

10 field trials of genetically modified organisms in containment (including three approvals for animals — goats, PPL Sheep and AgResearch cattle), several plant approvals — including sugarbeet, potatoes, petunias and maize, and one fermentation approval.

Of the genetically engineered field trials granted approval before the formation of ERMA, seven are still current although several are in the post harvest monitoring stage which was a condition of their approval. These trials were for sheep, pine trees and crops.

Earlier this year [2000] ERMA completed a nationwide check of 27 research facilities around New Zealand to find out what GM work was being conducted. ERMA found that of the 1065 GM experiments, 152 current experiments had not been approved and a further 39 were old work without approval where the material had since been destroyed.

In short, of the current experiments then under way in New Zealand labs and research facilities, around 15% were found to be unauthorised, or illegal. The absence of monitoring or approval for these experiments raises issues around the ethics of the projects, their safety, the containment of the organisms and the intent of the scientists conducting them.