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# CONSUMER DILEMMAS: THE RIGHT TO KNOW, SAFETY, ETHICS AND POLICY OF GENETICALLY MODIFIED FOOD*

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The recent rejection by the drought-stricken Southern African countries of genetically modified ("GM") food donated by the United States[1] mainly on safety grounds and the divergent scientific views on the propriety of their objection, have rekindled the debates on public health implications of GM food consumption and cast shadows on agricultural biotechnology's prospects. This paper examines the disparate scientific views on GM food safety, the place of consumer's choice, legal, and ethical issues in GM food governance in the context of Singapore, which relies entirely on food imports.

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1 In August 2002, five Southern African countries of Lesotho, Malawi, Mozambique, Zambia, and Zimbabwe rejected US offer of genetically modified food aid. Erratic weather conditions and the resultant drought in the region had precipitated the worst food shortages in nearly 60 years, exposed some 14 million to famine, and threatened 300,000 with starvation. The Bush administration had shipped or pledged nearly 500,000 tons of food aid valued at about US$230 million. See David Gollust, "Africa Raises Questions on 'Biotech' Food Aid" *VOA NEWS* (21 August, 2002) available at http://www.voanews.com/article.cfm?objectID=258B5A3C-7421-4711-83EAEE89C000D23&title=Africa%20Raises%20Questions%20on%20%27%20Food%20Aid&catOID=45C9C787-88AD-11D4-A57200A0CC5EE46C&categoryn (last accessed 2 October 2002).
The countries were afraid that GM grains were not safe enough for human consumption, and that if the crops found their way into their agricultural systems, they could blight their crops and livestock exports, particularly in the EU See James Lamont and Daniel Dombey, "Brussels refuses to back US over GM food for Africa" *Financial Times* (23 August 2002) at 4. See also Jon Jeter, "Famine Sweeps Southern Africa: Millions Suffering in Crisis Created by Nature, Exacerbated by Man" *The Washington Post* (10 May 2002) at 7. Though Lesotho, Malawi, Swaziland and Zimbabwe later reneged on their refusal, and

## I. INTRODUCTION

"Genetically modified food" is defined by the joint FAO/WHO Expert Consultation on Biotechnology and Food Safety as follows:

> Genetically engineered foodstuffs are food organisms that have been genetically engineered, foodstuffs that contain an ingredient of a genetically engineered organism or foodstuffs that have been produced using a processing aid made with the use of genetic engineering.[2]

Article 3 (h) of the 2000 Cartagena Protocol on Biosafety defines "living modified organism" as "…any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology."[3]

As with biomedical and other industrial spheres, genetic engineering techniques[4] in the field of agriculture have the potential of enabling the

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agreed to accept an estimated 60,000 tons of US genetically modified food aid; Zambia, which had about 1.7 million people facing famine, was adamant in its refusal of the food aid. See James Lamont, "Zambia turns away GM food aid for its starving" *Financial Times* (19 August 2002) at 4. Zimbabwe's condition for accepting US GM corn was that it should be allowed to shoulder the cost of milling the maize to prevent it from being replanted, and avoid a possible contamination of locally grown crops. See David Gollust, *ibid*. See also "Zimbabwe eases GM stance" *BBC News* (6 September 2002), available at http://news.bbc.co.uk/I/hi/world/Africa/2240487.htm (last accessed 2 October 2002). See also Thabo Thakalekoala, "Away With Genetically Modified Organisms" *The Survivor* (5 September 2002), available at http://www.lesoff.co.za/ (last accessed 2 October 2002). This was credited by the reporter to small farmers, who came from Africa and across the world to Johannesburg during the August 2002 Earth Summit. The farmers who were opposed to GM crops on public health and environmental grounds had called on their governments to ban or place a moratorium on GM crops.

2 FAO/WHO, joint FAO/WHO, *Expert Consultation on Biotechnology and Food Safety*, Rome 1995. Cited in Dominique Lauterburg, *Food Law Policy & Ethics* (London: Cavendish Publishing Limited, 2001) at 160.

3 The 2000 Cartagena Protocol on Biosafety was made pursuant to Article 19, paragraphs 3 and 4, and Articles 8(g) and 17 of the 1992 Rio Convention on Biological Diversity, available at http://www.biodiv.org/convention/articles.asp (last accessed 5, October 2002) following the "decision 11/5 of 17 November 1995 of the Conference of the Parties to the [Rio] Convention to develop a Protocol on biosafety, specifically focusing on transboundary movement of any living modified organism resulting from modern biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity, setting out for consideration, in particular, appropriate procedures for advance informed agreement." See Preamble to Text of Protocol at http://www.biodiv.org/biosafety/articles.asp?/g=o&a=bsp-00 (last accessed 5 January 2003) Article 11 of the Protocol governs the transboundary movement of living modified organism intended for direct use as food or feed, or processing. The FAO/WHO definition of GM foodstuffs is in substance similar to the Cartagena Protocol definition though the former uses "genetic engineering" whilst the latter uses "modern biotechnology".

4 These involve methods of moving genes from one type of plant to another type. If a gene is successfully transferred from one plant to the other, the chemical normally made by the gene in the first plant will now be expressed or made in the host plant to which the gene is transferred. Inevitably, the desired trait will also manifest in the host plant. See Michael J

introduction of desirable traits into food crops,[5] cash crops,[6] and livestock.[7] These include the abilities to resist diseases, drought conditions, increase yield, fend off pests and weeds, slow down fruits ripening, raise nutritional value of crops, obviate or reduce the use of herbicide or pesticide,[8] *etc*.

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Reiss and Roger Straughan, *Improving Nature? The Science and Ethics of Genetic Engineering* (Cambridge: Cambridge University Press, 2001) at 1-2; Dominique Lauterburg, *supra*, note 2 at 159; George Wei, *An Introduction To Genetic Engineering, Life Sciences and The Law* (Singapore: Singapore University Press, 2002) at 1-53. The same techniques have been applied to micro-organisms, animals and man. For instance, a General Electric biochemist, Ananda Chakrabarty, genetically engineered a bacterium to consume oil. See *Diamond* v *Chakrabarty*, 447 US 303 [1980].

Similarly, researchers at Harvard Medical School genetically engineered a mouse with a cancer gene by exploiting transgenic technology to insert the myc oncogene tied to a mammary-specific promoter into the new embryo of a normal mouse. See *Ex Parte Allen*, 2 USPTQ 2d (BNA) 1425 [1987].

5 For example, scientists at Cornell University in the United States have created bananas that contain a vaccine for hepatitis B. See "Feeding the Five Billion: New Agricultural Techniques Can Keep Hunger at Bay" *The Economist* (8 November 2001), available at http://www.economist.com/PrinterFriendly.cfm?Story_ID=841826&CFID=2134030&12/6/2001 (last accessed 12 October 2002).

6 A good example is *Bacillus thuringiensis (Bt*) cotton. It is so called because the cotton has been genetically engineered by Bt, a bacterium that makes insecticidal chemicals. When ingested by insects, the bacterial spores grow and produce lethal toxins which eventually kill the insect. There are two method of applying Bt. One is to genetically engineer the plant by inserting the gene for making Bt directly into the plant. Bt genes have been inserted into tomatoes, tobacco, corn, cotton, and potatoes to produce pest resistance varieties. The other method is the use of dead Bt in pesticide sprays. The major advantages of Bt over conventional pesticide are that: their toxins are target-specific, *i.e.*, they do not harm other untargeted insects; moreover, they are quickly broken down by sunlight, and do not endure to pollute soil and water or get into the food chain. Scientists have however discovered new strains of pests that are resistant to Bt, probable evidence of the difficulty of completely wiping out pests on the farmlands. See Eric S Grace, *Biotechnology Unzipped: Promises and Realities* (Washington: Joseph Henry Press, 1997) at 117-121.

7 For example, Aqua Bounty Farms, based in Massachusetts, recently applied for Food and Drug Administration (FDA) approval of a genetically engineered salmon that is six times the size of the normal fish. See Sharon Tisher, "Frankenfish and the FDA", Bangor Daily News (15 Feb 2002), available at http://www.bangornews.com/editorials/article.html?ID=51024 (last accessed 12 October 2002).

In livestock production, one of the earliest genetically engineered products available to farmers was *bovine somatotropin* (BST) or *bovine growth hormone* (BGH). It is made naturally in the pituitary gland of cattle. It stimulates growth in calves and regulates milk production in mature dairy cows. The hormone was genetically engineered to increase a cow's milk by up to 30 percent. It was approved in 1993 by the FDA's Centre for Veterinary Medicine as an animal drug. See "BST Increases Feed Intake and Milk Production", File G 1041 under: DAIRY A-29, Feeding and Nutrition, electronic version issued in June 1996, available at http://www.ianr.unl.edu/pubs/dairy/g1041.htm#BST+FEED&MKP (last accessed 12, October 2002). See also Eric S Grace, *supra*, note 6 above, at 96-105.

8 These potentials are well within the specific remit of Agenda 21, Chapter 16 of the United Nations June 1992 Rio Declaration on Environment and Development. The Chapter is titled "Environmentally Sound Management Of Biotechnology". It aims to harness the great promise and potentials of modern and traditional biotechnological practices and forge a strong international co-operation with a view to increasing the availability of food, feed and renewable raw materials, improving human health, enhancing protection of the

Genetic engineering[9] has been widely acclaimed as having the potential to boosting agricultural production and tackling myriads of intractable diseases such as Parkinson, Alzheimer, diabetics, malaria, *etc*.[10]

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environment, enhancing safety and developing international mechanisms for cooperation, and establishing enabling mechanisms for the development and the environmentally sound application of biotechnology. See text of document at http://www.un.org/esa/sustdev/agenda21chapter16.htm (last accessed 12 October 2002) More than 178 Governments at the Conference had adopted a 300-page plan for achieving sustainable development in the 21st century. See generally http://www.un.org/esa/sustdev/agenda21.htm (last accessed 12 October 2002) See also Mila Avramovic, *An Affordable Development? Biotechnology, Economics and the Implications for the Third World* (London: Zed Books, 1996) at 19. For instance, Monsanto, one of the foremost agricultural biotechnology companies, invented a pest-resistant mechanism which obviated the use of pesticide for tomatoes by genetically transforming tomato plants to exhibit toxicity towards the pest (lepidopteran larvae). See *Monsanto/Insect-resistant tomato plants (Opposition by Agrigenetics)* (Technical Board of Appeal) [2002] EPOR 45-52. See also *Plant Genetic Systems* v *Greenpeace* [1995] EPOR 357-373 where the European Board of Appeal upheld the validity of a patent granted for genetically modified herbicide resistant plants.

9 Biotechnology has been applied in food and agricultural settings for centuries. Writers have categorised practices in the field that predated the 1970s, such as the use of microorganisms in the manufacture of beer, wine, bread, yoghurt and cheese, as "traditional biotechnology". While scientific advancements involving cutting-edge genetic engineering in embryo transfer, molecular biology and tissue culture in the field from the 1970s till today are termed "modern biotechnology". See Michael J Reiss and Roger Straughan, *supra*, note 4 at 2-5; John E Smith, *Biotechnology*, 3rd edition (Cambridge: Cambridge University Press, 1996) at 1-2.

10 One of the latest plant genetic revolutions is "pharming". Scientists are experimenting with a revolutionary way of delivering drugs through fruits and vegetables. It involves the insertion of certain genes which will instruct a plant to manufacture pharmaceutical compounds. Two years ago, ProdiGene, a biotech company, received a US$300,000 grant from the US National Institutes of Health to research the possibility of a plant-based vaccine against the HIV virus. The company is currently conducting field trials on a strain of transgenic corn that has been spliced with hepatitis B antigen. See "Pharm Phresh: The Latest in Frankenfoods more dangers!", an e-mail newsletter posted on the web on 22 October 2002, by biotech_activists@iatp.org. On file with the author.

Furthermore, a hundred years after the discovery that mosquitoes transmit the malaria parasite, the complete genetic code of both the human malaria parasite and the mosquito that spreads it has been deciphered. It is hope that the genome sequences would accelerate the search for solutions to the deadly malaria disease that is predominant in sub-Saharan Africa, and kills over a million people (mostly children) per year. See Don Kennedy, "Malaria genome cracked" *BBC News*, 2 October 2002, available at http://www.news.bbc.co.uk/1/hi/health/2294061.stm (last accessed 15 October 2002) The genome project cost eighteen million pounds, and was sponsored by the Wellcome Trust (UK), Burroughs-Wellcome Fund (US), the National Institute of Allergy and Infectious Diseases (UK) and the US Department of Defense. See The Wellcome Trust Press releases, "Double success in fight against Malaria" (30 September 2002) available at http://www.wellcome.ac.uk/en/1/awtprere/1002n272.html (last accessed 12 October 2002). See also Dean D Murphy, "Biotechnology in International Law" [2001] 42 No 1 *Harvard International Law Journal* at 44-135; Eric S Grace, *supra*, note 6 at 96.

In the same vein, while underscoring the shift in the perception of developing countries as the sole beneficiaries of biotechnology; Philippe Goujon noted the technology's increasing relevance to the developed economies when he wrote that "…during the 1960s and 1970s, biotechnology was promoted as the use of rich countries' scientific resources to solve poor countries' problems. It brought to mind a new industrial revolution and represented a

Speaking of the promise and potential of the application of genetic engineering to agriculture, Norman Borlaug, a Nobel-laureate agricultural scientist posited as follows:

> With the technology that we now have available and with the research information that's in the pipeline and in the process of being finalised to move to production, we have the know-how to produce the food that will be needed to feed the population of 8.3 billion people that will exist in the world in 2025.[11]

This is a comforting assurance in the face of the world's growing food insecurity.[12] But then, not everyone shares Norman's optimism.[13] There is

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symbol of hope and an answer to famine, sickness and dwindling resources. It was not only felt that it would provide solutions for the third world, but increasingly be the fundamental technology for the development of even industrialised countries". See Philippe Goujon, *From Biotechnology To Genomes: The Meaning Of The Double Helix* (Singapore: World Scientific, 2001) at 56-7.

[11] See Borlaug Norman's interview, "Reason", available at http://www.Agbioworld.org (last accessed 15 October 2002) He was of the view that, unlike conventional farming; organic farming could not help feed the hungry in the developing world since organic food was too expensive and well beyond their reach. According to him, "while the affluent nations can certainly afford to pay more for food produced by so-called 'organic' methods, the one billion chronically undernourished people of the lowest income, food-deficit nations cannot." (Quoted by Brian Halweil in "Organic Gold Rush", *World Watch Institute* (May/June 2001) at 30, also available at www.worldwatch.org (last accessed 15 October 2002) See also Bourlaug Norman, "Ending World Hunger: The Promise Of Biotechnology And The Threat Of Antiscience Zealotry" *Plant Physiology* 124 (2), at 487-490.

[12] For instance, Paul Ehrlich had predicted that "…the battle to feed humanity was over" and that "…in the 1970s, hundreds of millions of people will starve to death". See Paul Ehrlich, *The Population Bomb* (New York Cutchogue, Buccaneer Books, 1971) at 14. However despite the "Green Revolution" two decades ago, Ehrlich's prediction is a living reality for most of the developing world where some 840 million people were undernourished and approximately half of the 40,000 daily malnutrition deaths are infants and children. While an estimated two billion do not get enough iron in their diets; more than 100 million children suffer from vitamin A deficiency, and 600 million suffer from iodine deficiency. See CGIAR, "Food in the 21st Century: Science to Sustainable Agriculture" (Consultative Group on International Agricultural Research, 2001) available at http://www.cgiar.org/publications/index.html (last accessed 16 October 2002)
According to Hartwig de Haen of the Food and Agricultural Organisation, if the current food crisis was not reversed, the agreed target of halving world hunger by 2015 would be missed. See John Mason, "Hunger reduction slows to dismal level" *Financial Times* (16 October 2002) at 4.
Similarly, according to the United States Department of Agriculture's 2001 Reports, as many as 67 poor developing countries (mostly in sub-Saharan Africa and Asia) would face a growing food gap in the next ten years. See *USDA/ERS*, (April 2001). See also John Jeter, *supra*, note 1.

[13] However, this high hope has been described as nothing short of a myth. In the words of the UK Director of Soil Association, Patrick Holden, "[p]erhaps the greatest achievement of the biotechnology industry has been in creating a myth and then transforming it into a political orthodoxy. It has managed to persuade some of the world's most powerful

as much opposition to the science as there is support. Perhaps, there is arguably no other area of modern science that is as much beloved as dreaded as agricultural biotechnology.[14]

Apart from numerous patents battles,[15] the increasing protests against

governments that the 'white heat of biotechnology' can bring benefits of higher yields, lower chemical use, food security and, critically, profitability for farmers." See Soil Association, *Seed of Doubts* (Bristol, September 2002), available at http://www.soilassociation.org (last accessed 30 October 2002).

[14] See Mila Avramovic, *supra*, note 8 at 19-21. The author noted the huge gap in terms of biotech R&D and commercialisation between agriculture and health care. She wrote that the top ten ag-biotech companies had revenues of only US$312 million in 1995 in contrast to the top ten bio-drugs which, in 1993, commanded net sales of US$4.3 billion. She attributed this gross discrepancy partly to "greater environmental concerns and regulatory uncertainties in agriculture".

[15] More of the patents squabbles in this field have been on the propriety of life-forms patents than on corporate patents infringements litigations; *infra*, note 17. In *JME Ag Supply* v *Pioneer Hi Bred Int'l* 122 S Ct 593 [2001], the Supreme Court of the United States, in a 6-2 decision, ruled that plants are eligible subject matter for protection under the Patent law, though there is in existence some form of limited protection under the Plant Variety Protection Act. For a detailed analysis of this judgement, see Mark D Janis & Jay P Kesan, "Intellectual Property Protection for Plant Innovation: Unresolved Issues after *JEM v Pioneer*" *Nature Biotechnology*, November 2002, Volume 20, Number 11 at 1161-1164, also available at http://www.nature.com/cgi-taf/DynaPage.taf?file=/nbt/journal/v20/n11/full/nbt1102-1161.html (last accessed 30 October 2002).
Similarly, in March 2001, Monsanto, a multinational agro-biotechnology company, successfully sued an elderly Saskatchewan farmer in Canada, Percy Schmeiser, for patent infringement. The company contended that the farmer had illegally planted and sold harvested seed containing the gene and cells covered by Monsanto's patent on Roundup Ready Canola. The canola had been genetically engineered to be resistant to Monsanto's Roundup herbicide which was designed to eliminate unwanted weeds but spare the canola. In his defence, the farmer had contended that the genetically engineered characteristics of the plants he grew were the result of pollen that had drifted from the neighbour's field, and that he never sprayed his crop with Monsanto's Roundup herbicide to which the crop was resistant, and which by contract must be purchased with Monsanto's Roundup Ready Canola. In dismissing this defence the court held *inter alia*: "In my opinion, whether or not that crop was sprayed with Roundup during its growing period is not important. Growth of the seed, reproducing the patented gene and cell, and sale of the harvested crop constitutes taking the essence of the plaintiffs' invention, using it, without permission. In so doing the defendants infringed upon the patent interests of the plaintiffs". See *Monsanto Canada, Inc* v *Schmeiser* [2001] FC 265, available at http://www.decisions.fct-cf.gc.ca/fct/2001/2001fct256.html (last accessed 30 October 2002). This judgment was later affirmed on appeal to the Federal Court of Appeal at Ottawa, Ontario, on 5 September 2002. See *Percy Schmeiser and Schmeiser Enterprises LTD* v *Monsanto Canada Inc and Monsanto Company* [FCA 2002] 309. See also *Plant Genetic Systems* v *Greenpeace* [1995] EPOR 357-373, *supra*, note 8; "The Knowledge Monopolies: Patent Wars Better get yourself armed. Everybody else is" *The Economist* (April 8, 2000) at 85-89.
Similarly, in August 2001, there was a strong protest from India to the US Patent Office when an American company was granted a patent for varieties of rice similar to basmati. India had earlier won a partial victory by getting the US Patent Office to restrict the broad patent on basmati granted in 1997 to the Texas firm, Rice Tec. See Barnaby Mason, "Patent laws cause diplomatic uproar" *BBC News* (23 August 2001), available at http://news.bbc.co.uk/1/hi/world/south-asia/1505527.stm (last accessed 30 October 2002).

the inexorable expansion of intellectual property over life forms,[16] and the attendant ethical and legal concerns,[17] agrobiotechnology companies have

See also Jill McGivering, "Rice row unites India and Pakistan" *BBC News* (23 August 2001), *ibid*. It was reported that both India and Pakistan had agreed to form a common front in the war against basmati rice patents. Basmati rice had been traditionally grown in the region for centuries. See also Vandana Shiva, *Protect Or Plunder: Understanding Intellectual Property Rights* (London: Zed Books, 2001) at 11-33 and Michael Perelman, *Steal This Idea*, (New York: Palgrave, 2002) at 123-161.

[16] The first patent on life form was said to be issued in Finland in 1843, while the second was in the US in 1873, when the United States Patent No 141,072 (claiming pure yeast) was granted to Louis Pasteur for isolated yeast. See Li Westerlund, *Biotech Patents: Equivalency and Exclusions under European and US Patent Law* (New York: Kluwer Law International, 2002) at 1. Since then, hundreds of patents have been granted for life forms ranging from microorganisms, plants, to mammals. Recent genetic engineering breakthroughs for which patents were obtained include: a bacterium genetically engineered to consume oil spills (*Diamond* v *Chakrabarty*, *supra*, note 4), a mouse genetically engineered to express cancer gene (*Harvard Onco mouse*, *Ex Parte Allen*, *supra*, note 4), a cloned sheep (Dolly) (see I Wilmut *et al*, "Viable Offspring Derived From Fetal And Adult Mammalian Cells" (1997) 385 *Nature* 810; see also KHS Campbell *et al*, "Sheep cloned By Transfer From A Cultured Cell Line" (1996) 380 *Nature* 64). Cotton, tobacco, tomatoes *etc* have been genetically engineered by Bt, a bacterium variant, to resist pests. See Eric Grace, *supra*, note 6.

The conventional patent regime recognises that all inventions are patentable upon the satisfaction of the standard requirements. Article 27 (1) of the WTO Agreement on Trade Related Aspects of Intellectual Property (TRIPS 1994), available at http://www.wto.org/english/docs_e/legal_e/27-trips.doc (last accessed 16 October 2002) makes it possible to get patents for inventions in all fields of technology, provided they are new, inventive, capable of industrial application, and are not caught by the *ordre public* or morality exception provision under Article 27 (2). These provisions are *in pari materia* with Section 13 (1) & (3) of the Patents Act, Chapter 221 of the Statutes of the Republic of Singapore. For similar provisions in the UK, see section 1 (1) (a), (b) & (c) of the Patent Act (1977). Note that section 1 (2) section 1 (2) (3) (a) & (b) of the UK Patent Act (1977) were amended to conform to the European Directive 98/44/EC on Biotechnology Patents. They replaced the UK patentability definition which had been the basis of Patent Law in the UK for over 350 years, going by the definition in the Statute of Monopolies of 1623. See Chartered Institute of Patents Agents, *CIPA Guide to the Patents Acts*, 5th ed (London: Sweet & Maxwell, 2001) at 13. See also similar provisions in Articles 31 & 32 of Japan Patents Law, no 121 of 1959 (as amended by Law No 220 of 1999) In the United States, Section 101 of the Patent Act 35 USC Sections 101-375 (1976) provides that "[w]hoever invents or discovers any new and useful process, machine, manufacture, composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title." This section was interpreted by the United States Supreme Court in *Diamond* v *Chakrabarty* (*supra*, note 4), to cover "anything under the sun made by man". This is in conformity with article 27 (1) of the TRIPS, *ibid*. In Singapore, the restriction on patentable inventions was removed to reflect the TRIPS and US position, with the repeal in 1995, of section 13 (2) (a), (b), (c), and (d) which prohibited the recognition of the following as inventions: a discovery, scientific theory or mathematical method; a literary, dramatic, musical or artistic work or any other aesthetic creation, a scheme, rule or method for performing a mental act, playing a game or doing business, or a program for computer; or the presentation of information. In the UK however, the prohibition is still retained under section 1 (1) (d) of the Patent Act, *ibid*.

[17] Life form patents have been decried as unethical. In the biomedical field, for example, the propriety of gene patents has been queried. Critics are of the view that the so-called inventions are no more than mere discoveries and therefore are unpatentable subject

had to contend with mounting charges of biopiracy from developing countries and NGOs.[18] While GM food protagonists continually extol the

matters. In fact, the borderline between what constitutes an invention, and what is a discovery is often imperceptible and extremely complex. In the absence of a definitive statutory conceptualisation of what constitutes an invention, delimiting the fine line between an invention and a discovery could involve arbitrary and divergent measures. In *Biogen Inc* v *Medeva Plc* [1997] RPC 1, Lord Hoffmann would rather gloss over the vexing issue of what was an invention, and concentrate on the presence or absence of the standard requirements of novelty, inventiveness, industrial applicability and *ordre public* bar in determining patent eligibility. On the contrary, Mustill LJ felt that ascertaining the distinction between invention and discovery was a worthwhile exercise; especially when the subject matter of patent was a life form rather than a mechanical or chemical invention. For Mustill LJ's views, see *Genentech Inc's Patent* [1989] RPC 147.

Besides gene patents propriety, it is widely feared that proprietary agricultural biotechnology would create unprecedented corporate control over food supply, invade farmers' rights to save and own seeds, and aggravate food security problems. A good example is the "terminator gene" a technology which effectively destroyed farmers' right to save and replant harvested seeds. See generally Vandana Shiva, *supra*, note 15, and Michael Perelman, *supra*, note 15 at 127-128.

Besides the grant of patents for technical advancements in plant biotechnology, some countries also protect such inventions under the *sui generis* plant variety protection law. In the United States, for example, the US Department of Agriculture issued certificates of protection to developers of 18 new varieties of seed-reproduced and rubber-propagated plants on 3 September 2002. The said plants include corn and soyabean. The 18 certificates were issued under the Plant Variety Protection Act of 1970, 7 USC Sections 2321-2582. The certificates required that the varieties be new, distinct, uniform and stable. The owners will have the exclusive right to reproduce, sell, import and export their products in the United States for the duration of the period. See Kathryn Mattingly, "USDA Grants Protection to New Plant Varieties" *AMS News Release No 185-02* (Washington, 3 September 2002), available at http://www.ams.usda.gov/news/185-02.htm (last accessed 28 October 2002).

In the United States, it is possible to have patent and Plant Variety Protection simultaneously by virtue of 35 USC Section 161of the Patent Act, Sections 1-376, 1976. See *Asgrow Seed Co v Winterboer*, 513 US 179 (1995); Martin J. Adelman, *et al*, *Cases And Materials On Patent Law* (St Paul, Minn., West Group 1998) at 1304-1305. See also Joseph A McMahon (ed.) *Trade & Agriculture: Negotiating A New Agreement?* (London: Cameron May Ltd, 2002) at 85.

Singapore does not have a separate plant variety protection law. Inventions in the field are patentable in Singapore, subject to the standard patent eligibility requirements. See section 13 (a), (b) & (c) of the Singapore Patent Act (1994), *supra*, note 16. See generally Huib CH Ghijsen, "Property Rights On Plant Varieties: An Overview" in Niels P Louwaars, *Seed Policy, Legislation and Law: Widening A Narrow Focus* (ed) (New York: The Haworth Press, Inc, 2002) at 195-212.

[18] Agricultural biotechnology depends primarily on plant and animal genetic resources which predominate in developing countries. It was estimated that genetic materials traceable to developing countries account for more than 95% of the global output of humanity's top twenty food crops. See Jim Chen, "Diversity and Deadlock: Transcending Conventional Wisdom On The Relationship Between Biological Diversity And Intellectual Property" (CASRIP Publication Series: Rethinking Intellectual Property No 6, July 2001) available at http://www.law.washington.edu/casrip/ (Accessed on 28 October 2002)

Biotech companies have been under fire for the alleged habit of freely preying on valuable genetic resources from developing countries, enclosing the resultant inventions in patents firewalls and making "bioserfs" out of developing countries' farmers in the name of bioprospecting. For instance, a British drug group, "Phytopharm", recently agreed to a

science as safe enough for human consumption and the environment,[19] the thrust of the case against GM food are public health and environmental safety concerns, lack of adequate consumer information for an informed choice, and the ethical implications for the society.[20] Using a comparative analysis, this paper examines organic and GM food regulations in the US, EU and Singapore, the attendant GM-specific legal issues and the underlying forces that are shaping GM food governance in other jurisdictions. While examining the role of the consumer in GM food regulation, it is argued that no GM regulation is complete if visibility is not given to the consumer's right to know the GM components of their food, even if such food had passed public health or environmental safety muster.

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legal settlement of a compensatory claims filed by the Khomani people from Southern Africa. The drugs company had patented an anti-obesity drug made from "hoodia cactus" and then licensed the patent to Pfizer, a US pharmaceutical group for US$29 million in licence payments. The said cactus had been nurtured and used by the Khomenis to stave off hunger on hunting trips for centuries. See "Bushmen want a slice of obesity drug" *The Sun Herald*, (11 November 2001), available at http://old.smh.com.au/news/0111/11/world/world14.htm (last accessed 30 October 2002). See also Celestous Juma, *The Gene Hunters: Biotechnology and the Scramble for Seeds* (Princeton, NJ: Princeton University Press, 1989). The author documented biotech companies' hunt for wild varieties of plants to improve crop varieties.

In the same vein, the government of India had on several occasions, joined issues with the US Patent Office on patents granted for basmati rice and the neem tree. See *Nature* 377, 95; (1995) The neem tree, which had been used in India pharmaceutically and agriculturally for centuries, became the subject "of sixty-five patents filed by the US and European companies". Specifically, in 1997, the Indian government hired a US patent lawyer and spent US$15,000 to revoke a contentious patent the US Patent and Trademark Office (PTO) granted to two US researchers on the use of powdered turmeric (*Curcuma longa*) for wound healing. The India's Council of Scientific and Industrial Research (CSIR) successfully argued that turmeric, a native Indian plant, had been used for centuries by its people for wound healing; and consequently lacked patent eligibility requirement of novelty. See KS Jayaraman, "US patent office withdraws patent on Indian herb" (1997) *Nature* 389 at 6. For further readings, see Lori Andrew and Dorothy Nelkin, *Body Bazaar: The Market For The Human Tissue In The Biotechnology Age* (New York: Crown Publishers, 2001) at 71; Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* (Boston: South End Press, 1997); Vandana Shiva, *supra*, note 15.

[19] See Anthony Trewavas, "Much food, many problems: A new agriculture, combining genetic modification technology with sustainable farming is our best hope for the future" (1999) *Nature*, vol., 402/18 November, at www.nature.com (last accessed 30 October 2002). See also Lloyd T. Evans *Feeding the Ten Billion: Plants and Population Growth* (Cambridge: Cambridge University Press, 1999). Furthermore, a recently published US government report concluded that foods produced using biotechnology are as safe as conventional foods, and that there was no scientific evidence to suggest that they posed a long-term health risks to consumers. See the General Accounting Office (GAO) Report to Congressional Requesters, "Genetically Modified Foods: Experts View Regimen of Safety Tests as Adequate, but FDA's Evaluation Process Could Be Enhanced" GAO Reports (May 2002), available at http://www.gao.gov/new.items/d02566.pdf (last accessed 30 October 2002). See also Council For Biotechnology Information, "Safety and Regulation: Biotech Foods are Safe, Say Regulators and Medical Experts", available at http://www.whybiotech.com/index.asp?id=1975 (last accessed 30 October 2002).

[20] See generally Vandana Shiva, *supra*, note 18.

This argument is premised on the proposition that consumer empowerment in this respect is as much a human right as an ethical or moral imperative.

The central argument in this paper is that the consumer should be empowered through the labelling of GM food. The paper is divided into six parts. The first part explores the regulation, benefits, limits, and prospects of organic farming and food in the EU and US, and the consumer's role in organic food policy formulation. The second part deals with the regulation, benefits, limits and prospects of agricultural genetic engineering and "genetically modified food" in the EU and US as well as the consumer's influence in shaping GM food policy. The third part reviews the history of food production in Singapore, her vulnerability as a food importer and her GM food policy in the context of a broader pro-biotechnology policy. The fourth part takes a critical look at GM food labelling, and the emerging GM-specific legal and ethical issues and how they affect the consumer, while the fifth part explores consumer's choice as a human right and ethical imperative. Finally, the sixth part appraises the circumstances that delimit consumer's choice in a world that is increasingly characterised by high-tech food.

## II. Organic Farming and Food: Going Back in Time

Organic farming is as old as agriculture itself. It involves the traditional way of farming without artificial chemicals. Agro-chemical abstinence is the defining and core element of organic farming, and it is so reflected in its regulatory and scientific conceptualisations.[21] The FAO/WHO Codex Alimentarius Commission's definition of organic farming encapsulates public health and environmental protection objectives:

> Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system."[22]

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[21] It should be noted that subsistence farming is organic, and that humans have always used "genetic engineering" through the simple choosing of the best seed for re-planting initially, and then for deliberate selection of desired characteristics. Organic farming is an "artificial" return to not using specific 20th century chemicals. For further readings, see Jacqueline French, *Organic Control of Common Weeds* (Flemington, Vic: Aird Books 1989); Philip Conford (ed) *A Future for Land: Organic Practice from A Global Perspective* Green Books (Biddeford: England, 1992).

[22] See the definition in the Codex Alimentarius Commission's proposed International Guidelines For Organic Food. See http:www.fao.org/WAICENT/FAOINFO/ECONOMIC/codex/CAC23/a199_01e.htm (last accessed 2 November 2002).

Similarly, the Preamble to the European Union Council Regulation (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products provides *inter alia* that:

> …organic production methods entail significant restrictions on the use of fertilizers and pesticides which may have detrimental effects on the environment or result in the presence of residues in agricultural produce."[23]

In the United States, section 205.2 of the Organic Food Production Act 1990[24] defines "organic production" as:

> A production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.[25]

Dominique Lauterburg cited UK Soil Association's definition of "organic agriculture" as follows:

> … [A] safe, sustainable farming system producing healthy crops and livestock without damage to the environment. It avoids the use of artificial fertilizers and pesticides on the land, relying instead on developing a healthy, fertile soil and growing a mixture of crops. In this way the farm remains biologically balanced, with a wide variety of beneficial insects and other wildlife to act as natural predators for crop pests and a soil full of micro-organisms and earthworms to maintain its vitality. Animals are reared without the routine use of the army of drugs, antibiotics and womers which form the foundation of most conventional livestock farming.[26]

The United Kingdom Register of Organic food Standards (UKROFS) defines organic production systems as being

> …designed to produce optimum quantities of food of high nutritional quality by using management practices which aim to avoid the use of agro-chemical inputs and which minimise damage to the environment

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[23] See Official Journal L 198, 22 July 1991 at 0001-0015, available at http://www.home.prolink.de/~hps/organic/consolid-en.html (last accessed 3 November 2002).

[24] Title 7 Subchapter M of the United States Code as amended by (7 USC 6501 *et seq*)

[25] Jacqueline French, *supra*, note 21; Philip Conford, *supra*, note 21.

[26] Dominique Lauterburg, *supra*, note 2 at 130-131.

> and wildlife.[27]

These definitions are unanimous on the biodiversity preservation relevance of organic farming. But then there is no such general consensus in the scientific community. As would be shown later in this paper, organic farming's environmental credentials have been queried by opponents as much as conventional farming's environmental records (especially genetic engineering techniques in agriculture) have been deprecated by opponents.[28]

Undoubtedly, organic farming is the oldest agricultural system known to man. Farmlands are enriched by dead plants and animals residues adding organic matter[29] to the soil for plants to thrive on. It is an intricate web of mutually beneficial, self-sustaining ecosystem that needed no artificial supplements other than man's prudent managerial practices.[30]

The above system is captured in the expectations of 15 (6) Regulation (ECC) No 2092/91[31] on organic production which provides that:

> In order to avoid environmental pollution, in particular of natural resources such as the soil and water, organic production of livestock must in principle provide for a close relationship between such production and the land, suitable multiannual rotation systems and the

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[27] UKROFS is charged with the responsibility to apply the 1991 European Community Regulation 2092/91 (Council Regulation 2092/91 on organic production, OJ 1991 L198/1) as amended by Regulation 1804/99 to include livestock. The EC Regulation stipulates rules governing organic farming. To fully implement the EC organic directive, the UK established Organic Products Regulations 1992 (as amended) by the Organic Products (Amendment Regulations 1993 (SI 1993/495), the Organic Products (Amendment) Regulations 1994 (SI 1994/2286) and the Organic Products (Amendment) Regulations 1997 (SI 1997/163). See generally Dominique Lauterburg, *supra*, note 2 at 130-157.

[28] See note 38, *infra*, for Anthony Trewavas's viewpoint against organic farming's acclaimed environmental merits and note *supra*, note 11 for Brian Halweil's views on GM farming. See note 38, *infra*, for the analysis of the opposing views.

[29] The term "organic matter" is defined by Section 205.2, Subpart A of the US National Organic Programme Rules (which is made pursuant to the US Organic Food Production Act, 1990, *supra*, note 24) as "[t]he remains, residues, or waste products of any organism". See http://www.ams.usda.gov/nop/nop2000/Final%20Rule/reg-definition.htm (last accessed 19 October 2002). The rules become fully operational from 21 October 2002.

[30] See Mort Mather, "What is organic food? *Mother Earth News* (August-September 1998), available at http://www.findarticles.com/cf_dls/ml279/n169/20973085/pl/article.jhtml?term= (last accessed 19 October 2002). Furthermore, according to paragraph 1.2 to Annex 1, "Principles of Organic Production at Farm Level" of the EU Organic Council Regulation" (EEC) No 2092/91 (as amended, *supra*, note 23): "Livestock production must contribute to the equilibrium of agricultural production systems by providing for the nutrients of crops and by improving the soil's organic matter. It can thus help establish and maintain soil-plant, plant-animal and animal-soil interdependence. As part of this concept, landless production is not in conformity with the rules of this Regulation." Paragraph 1.3 of the Regulation (*ibid*) provides that: "By utilising renewable natural resources, (livestock manure, legumes and fodder crops), the cropping/stockfarming system and the pasturage systems allow soil fertility to be maintained and improved in the long term and contributes to the development of sustainable agriculture."

[31] See Official Journal L 198, 22 July 1991, *supra*, note 23.

> feeding of livestock with organic-farming crop products produced on the holding itself.[32]

Crop rotation, crop cover and the use of manure, allowed farmers to maintain soil nutrients balance. Old farmlands are left to fallow while farmers cultivate new areas.[33] "Crop pests, weeds and diseases are controlled through cultural, biological, and mechanical management methods."[34]

Studies have shown that organic farming is labour-intensive and "requires significantly greater labour input than conventional farms"[35] due mainly to the characteristic crops diversification systems which in turn helps stabilise employment.[36] Proponents of organic farming usually hinge their supports on documented benefits ranging from "soil fertility, increased sequestration of carbon in the soil, health, cleaner environment, reduction in food miles, self-sufficiency for farmers and both financial and social enrichments of local communities."[37]

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[32] See Official Journal L 198, 22 July 1991, *ibid*. In practice, it is extremely difficult to raise livestock on entirely organic feeding stuffs due to the dearth of such products. However, the regulation acknowledges this limitation, and allows for provisional authorization of "a limited number of non-organically produced feeding stuffs to be used in restricted circumstances" See Regulation 15 (13), *ibid*. This also explains why EU farmers still import modified soy meal from the US despite the continued EU GM food and feeding stuff moratorium. See Gregg Burns, "Europe shows little taste for US biotech crops" *Chicago Tribune* (30 October 2002) at 3.

[33] See Mort Mather, "What is organic food?" *Mother Earth News*, *supra*, note 30

[34] See Carolyn Dimitri and Catherine Greene, "Organic Food Industry Taps Growing American Market" Economic Research Service/USDA Agricultural Outlook (October 2002) at 4 available at http://www.ers.usda.gov/publications/agoutlook/oct2002/ao295b.pdf (last accessed 30 October 2002) Similarly, Annex 1, 15 A. "PLANTS AND PLANT PRODUCTS", paragraph 3 of the EU Organic Regulation (*supra*, note 23), provides that: "Pests, diseases and weeds shall be controlled by a combination of the following measures:

- Choice of appropriate species and varieties,
- Appropriate rotation programme,
- Mechanical cultivation procedures,
- Protection of natural enemies of pests through provisions favourable to them (e.g. hedges, nesting sites, release of predators),
- Flame weeding..."

However, "in cases of immediate threat to the crop", recourse may be had to approved pesticides, insecticides or herbicides listed in Annex 11 to the Regulation.

[35] See FAO magazine, "Organic Farming" available at http://www.fao.org/ag/magazine/9901sp3.htm (last accessed 3 November 2002)

[36] See Mort Mather, "What is organic food?" *Mother Earth News*, *supra*, note 30.

[37] See Institute of Science in Society, "ISIS Condemns Prime Minister's Scoping Note", available at http://www.i-sis.org.uk/critiqueofscoping.php (last accessed 2 November 2002), on file with the author. According to Brian Halweil, organic farmers usually substitute chemicals and pesticides for "ecological processes—such as using diverse planting patterns or attracting beneficial insects—to raise yields, reduce pest pressures, and build soil fertility." The resultant "conservation benefits" include "reduced groundwater pollution, fewer greenhouse gas emissions, increased carbon sequestration, improved soil

However, the widely held faith in organic farming's environmental credentials has been challenged. According to Anthony Trewavas, organic farming practices do not "necessarily conserve the environment. Competitive organic farmers keep their fields clear of weeds through frequent mechanical weeding—a method that damages nesting birds, worms and invertebrates—and high use of fossil fuels, which greatly increases pollution from nitrogen oxides."[38]

Then in about 1840, Justus Yon Liebig identified certain nutrients that plants needed.[39] This led to the manufacture of the first chemical fertilizer[40] and marked the advent of industrialisation in agriculture.[41] According to Jeffery Burkhardt, the next major "significant change in agriculture occurred with the development and widespread adoption of mechanical technologies, especially the gasoline-powered tractor."[42] This was the harbinger of modern intensive farming which peaked during the "green revolution"[43] while the latter was the precursor of the revolutionary genetic engineering techniques in contemporary agriculture.[44]

But advocates of organic farming continue to fight back at the advent of science in agriculture. According to Anthony Trewavas, the organic farming philosophy started as a movement simply to eliminate pesticides from food.[45] Apart from its opposition to pesticides however, contemporary organic movement is completely opposed to genetic engineering techniques in agriculture. Their reasons range from public health, environmental to

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health, and enhanced biodiversity and habitat provision." See "Organic Gold Rush", *supra*, note 10.

38 See Anthony Trewavas, "Urban myths of organic farming" (2001) Nature 410 at 409-410. This is an obviously valid point. The practice itself could also increase soil erosion. There however seems to be nothing that makes this practice inherently peculiar to organic farming. It has more to do with the ideal practice of sustainable farming which organic, conventional and high-tech farmers must strive for. These opposing views are characteristic of pro-organic and pro-GM foods advocates. As will be shown in this paper, neither side lacks the "evidence" to denigrate or disparage the other in a food fight that leaves the consumer entangled in a maze of conflicting advice. Consequently, the need for consumer education to facilitate informed choice; and the right to choose between organic and non-organic (including GM food) could not be more imperative.

39 See Mort Mather, "What is organic food?" *Mother Earth News*, *supra*, note 30.

40 *Ibid*.

41 See Jeffery Burkhardt, "Agricultural Biotechnology, Ethics, Family Farms, And Industrialization" in Thomas H Murray and Maxwell J Mehlman, (ed) *Encyclopaedia Of Ethical, Legal And Policy Issues In Biotechnology*, vol. 1 (New York: John Wiley & Sons, Inc, 2000) at 9-11.

42 *Ibid*.

43 *Ibid*.

44 *Ibid*.

45 Anthony Trewavas, "Much food, many problems: A new agriculture, combining genetic modification technology with sustainable farming is our best hope for the future", *supra*, note 19.

ethical concerns.[46]

But then, genetic engineering techniques and agro-chemical based agriculture are not about to go away any time soon. Apart from droughts, floods, and other natural vicissitudes over which farmers have no control,[47] pests, weeds and diseases could not be completely eradicated on the farmlands, and have shown a remarkable resilience by continually evolving variants that are resistant to and undermining the successes of even the most potent genetically engineered herbicide, pesticide or antibiotics.[48] Yet the crop and livestock protection industry remains vibrant. For instance, the *Financial Times* issue of 14 October 2002 put the current annual value of crop protection (excluding livestock) market at US$26 billion.[49]

One of the greatest challenges of organic farming therefore, is how to

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[46] See Jacqueline French, *Organic Control of Common weeds*, *supra*, note 21; Philip Conford, *A Future for Land: Organic Practice from A Global Perspective* Green Books, *supra*, note 21; and 15 (6) of Regulation (EEC) No 2092/91, *supra*, note 23.

[47] Some parts of Africa, the United States and Australia have recently succumbed to intense droughts. See John Jeter, "Farming Sweeps Southern Africa: Millions Suffering in Crisis Created by Nature, Exacerbated by Man", *supra*, note 1. For instance, the Australian Bureau of Agriculture and Resource Economics announced on 29 October 2002 that it now expected a wheat crop of just 10.1m tonnes this year, down from an estimate of 13.45m tonnes in its last crop report in September, and from last year's 24m tonnes due to a six-month drought which was estimated to cost the national economy A$5.4bn, up from A$3.8bn it had previously predicted. See Virginia March, "Australia lowers sights on Winter wheat crop" *Financial Times* (30 October 2002) at 24. See also Caroline Daniel, "Monsanto losses triple on drought in US" *Financial Times* (31 October 2002) at 17. The report showed how severe drought in the US had exacerbated Monsanto's net losses from $45million in 2001 to $145million in 2002.

[48] For instance, there is ample evidence that a new strain of pest has emerged which is resistant to *Bacillus thurringiensis*, (Bt) a bacterium that naturally makes insecticidal chemicals, and which has been genetically engineered with food and cash crops such as potatoes, tomatoes, tobacco and cotton to combat associated pests. See Eric S Grace, *Biotechnology Unzipped: Promises and Realities*, *supra*, note 6 at 117-121. In the same vain, there is documented evidence that new varieties of weeds have evolved and become resistant to Monsanto's herbicide Roundup (glyphosate) and Aventis' herbicide Liberty (glufosinate): see Benbrook C, "Do GM Crops mean less pesticide use?" *Pesticide Outlook*, (October 2001) available at www.rsc.org/is/journals/current/pest/pohome.htm (last accessed 30 October 2002) Similarly, therapeutic and nontherapeutic use of antibiotics or antimicrobial in animal husbandry has been described as an ecological and health problem. Research has shown that resistance to animal drugs by the microbes can confer resistance to the similar human drug such as penicillin, tetracycline, microclines, streptogramins and sulfonamides. See David Wallinga, "Antimicrobial Use in Animal Feed: an Ecological and Public Health Problem" *Minnesota Medicine* (October 2002) Vol. 85. In the United States, the Congress is now working on a Bill—"Preservation of Anti-biotics for Human Treatment Act" [HR 3804] to amend the Federal Food, Drug and Cosmetic Act to ensure that use of certain anti-biotic drugs in animal agriculture does not compromise human health by contributing to the development of anti-biotic resistance. The Bill was sponsored by Rep Sherrod and introduced on 27 February 2002. It was referred to Senate Committee on 13 May 2002, has been read twice, and then referred to the Committee on Health, Education, Labour and Pensions House Bill. See http://thomas.loc.gov (last accessed 20 October 2002).

[49] Crops involved include cotton, tobacco, soyabean, and wheat. See David Firn "Big players poised to exploit biotech advances" *Financial Times* (14 October 2002) at III.

effectively ensure crop and livestock protection without the aid of conventional genetic engineering techniques, herbicides, pesticides or antibiotics in order to meet the burgeoning demands for organic food.[50] For instance, while highlighting research priorities in crops protection from weeds and diseases in UK organic agriculture, Audrey M Litterick posited that more research was "…urgently needed to determine strategies for control of key pests and diseases in organic systems if UK organic agriculture is to expand to meet increasing consumer demand."[51]

The inexorable rise in the application of modern farming techniques to agriculture to meet the needs of the ever increasing population[52] has overwhelmed and made organic farming an increasing rarity,[53] partly making organic food relatively more expensive than conventional food.[54]

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[50] It is moot to enquire into the obvious niche of conventional pests and diseases control mechanism vis-à-vis organic farming methods. Rather, the focus of the debate is the long term public health and environmental impact of the two systems on man and the ecosystem. The definitions of "organic farming" or system proffered by the EU, US and UK authorities above (see *supra*, notes 23 and 24) underscore environmental sustainability and protection as part of the system's long term goals and objectives. However for some consumers of organic products (whose growing interest is currently driving organic trade), it is not so much concern for the environment as it is for health and nutritional gains that drive their interests in organic purchases. For instance, according to the US Food Marketing Institute 2001 survey, 37 percent of those who bought organically grown food did so to maintain their health. The consumers who were surveyed in the 2000 Hartman Group reported multiple reasons for patronising organic products: health and nutrition (66 percent), taste (38 percent), environmental concerns (26 percent), and availability (16 percent). See Carolyn Dimitri and Catherine Greene, "Organic Food Industry Taps Growing American Market" (2002) *supra*, note 34.

[51] The authors stated that though pests were not as much a problem as weeds in organic farming, major pests' damage sometimes occurred. They identified "lack of effective, economic crop protection strategies" as one of the obstacles to organic agricultural expansion in the UK: see Audrey M Litterick, Christine A Watson, David Atkinson, "Crop protection in organic agriculture: a simple matter?" in Powell *et al* (ed), *UK Organic Research 2002: Proceedings of the COR Conference, 26-28th March 2002* (Aberystwth) at 203-206, available at http://www.organic.aber.ac.uk/library/Crop%20protection%20in%20organic%20agriculture.pdf (last accessed 30 October 2002).

[52] See Bourlaug Norman E, "Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry", *supra*, note 11.

[53] In the United States for instance, organic accounts for less than one percent of food production, acreage, and sales. See Environmental Working Group's FoodNews.org, "EWG's Perspectives on the New USDA Organic Seal", available at http://www.ewg.org/foodnews/perspectives.php (last accessed 25 October 2002). Similarly, in a recent study conducted in North America by the UK Soil Association, findings revealed that non-GM seeds varieties are increasingly difficult to buy, and there is evidence of contamination of non-GM farms (see *Monsanto Canada Inc* v *Schmeiser* [2001] FC 265, *supra*, note 15), while farmers' choice to non-GM crops has been substantially eroded due to the near absence of non-GM free option. See Soil Association, *Seed of Doubts*, *supra*, note 13 at 27-32. See also Kathy Kock, "Food Safety Battle: Organic *vs.* Biotech" *CQ Researcher*, vol. 8, (4 September 1998) at 763ff.

[54] For instance, in the 2001 Walmut Acres survey conducted in the US on Consumers, 64 percent did not purchase organic food every time because of the relative higher prices. See Carolyn Dimitri and Catherine Greene, "Organic Food Industry Taps Growing American Market" (2002), *supra*, note 34.

This raises serious doubts on the feasibility and food security assurance capacity of organic farming if it were the sole system of global food production.[55]

The spiraling US$25 billion annual global organic market[56] continues to provoke a corresponding increase in global cultivated organic area. For instance, it is one of the fastest growing segments of US agriculture during the 1990s.[57] In the United States and Canada, cultivated organic area had grown "between 15 and 20 percent each year during the 1990s"[58] and now measures approximately 500,000 and 1 million hectares respectively.[59] The United States Department of Agriculture's estimates of the retail sales of organic foods in 1999 were approximately $6 billion.[60] By 2002 however, it has risen to US$10 billion out of about US$460 billion that Americans spend annually on groceries.[61]

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55 See generally the analysis in Section B, infra.

56 See Brian Halweil, "Organic Gold Rush", *supra*, note 11 at 22. The UK Soil Association however approximated the global organic market figure for 2000 at 15 billion pounds. See *Organic Food & Farming Report 2001*, Soil Association, (Bristol, 2001).

57 See Susan McAvoy, "Glickman Announces National Standards For Organic Food" *USDA News Release*, Washington (20 December 2000), available at http://www.usad.gov/news/releases/2001/12/0425.htm (last accessed 22 October 2002). According to Carolyn Dimitri and Catherine Greene, *supra*, note 34, "[c]ertified organic acreage is increasing to meet growing consumer demand, doubling between 1992 and 1997 to 1.3million acres. Preliminary estimates for 2001 indicate a similarly high rate of growth between 1997 and 2001. New organic products are also rapidly entering the market-over 800 in the first half of 2000. Desserts made up the majority of new products in 2000, while most new products introduced in 1999 were beverages." Similarly, India has recently decided to join the global organic market, by the proposed launch of US$19 million national project on organic farming. The country would establish 50 model organic farms; and create a regulatory body to formulate national organic standards in order to boost organic exports. See mritchie@iatp.org, "India: National project on organic farming announced", an e-mail newsletter posted on the web on 29 November 2002 (last accessed 29 November 2002), on file with the author.

58 See Brian Halweil, "Organic Gold Rush", *supra*, note 11 at 23.

59 "Organic crops now grow on 0.2 percent of U.S. croplands, and 1.3 percent of the fields in Canada." See Brian Halweil, *ibid*.

60 See Susan McAvoy, "Glickman Announces National Standards For Organic Food", *supra*, note 57.

61 See Samuel Fromartz, "Organic Food industry grew up in a decade" (Organic Issues, 17 October 2002) available at organic@iatp.org, on file with the author. The US organic industry is currently undergoing a dramatic phase that is marked by burgeoning demands. The new National Organic Programme which is effective from 21 October 2002 is said to be partly responsible for the surge in demands for organic products, *ibid*. According to USDA Agricultural Marketing Service, "…the number of farmers' markets in the U.S jumped from 1,755 in 1994 to 2,863 in 2000. The number of farmers and consumers using these markets approximately tripled during this period to 66,700 farmers serving 2.7 million consumers." See Carolyn Dimitri and Catherine Greene (2002), *supra*, note 34. There are different varieties of organic food. These range from strawberries, lettuce, carrots, broccoli, apples, grapes, bananas, to potatoes. These foods are sometimes processed. According to a 1997 survey of Organic Farming Research Foundation, 31 percent of organic farmers polled produced value-added products. They included "salsa, syrup, cider, pickles, preserves, vinegar, dried and canned fruits and vegetables, butter,

According to SPINS, a market research group, 68 percent of US consumers have tried organic food, while 25 percent have repeated their organic purchases. The shortfall was attributed partly to higher prices commanded by organic food.[62] According to Brian Halweil,[63] Europe now sets the pace in global organic mega growth with increase of "roughly 30 percent each year"[64] in organic area, which accounts "for nearly 3 percent of all the farmlands in the European Union."[65] Britain's annual retail sales of organic food is estimated at approximately one billion pounds, 10 times higher than 1993, and growing by 30 percent a year,[66] while annual organic spending by Europeans is approximated at US$10 billion.[67] Australia is said to have the world's largest organic area with 5.3 million certified organic hectares;[68] while Japanese annual organic market is now worth US$3.5 billion.[69] While buyers are willing, and often pay premium prices for organic produce,[70] there is now an army of farmers, independent groups and

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yogurt, cheese, milled flours, sausages and other processed meats, baked goods and wine", *ibid*.

62 According to the UK's Soil Association report of the account given by Minnesota (couple) farmers, Susan and Mark Fitzgerald, "GM-free soya receives around 50 cents/bushel more than GM, selling at $4.40/bushel (approximately a 13 per cent increase) and organic soya sells at $12/bushel, an additional premium of 200 per cent". See Soil Association, *Seeds Of Doubt*, (Bristol, 2002), *supra*, note 13 at 20. See also Carolyn Dimitri and Catherine Greene, (2002), *supra*, note 34.

63 See Brian Halweil, "Organic Gold Rush" *World Watch Institute*, *supra*, note 11

64 *Ibid*. For country-specific reports on the history, statistics, *etc*, of organic in Europe, see "organic-europe" at http://www.organic-europe.net/default.asp (last accessed 30 October 2002).

65 See Brian Halweil, "Organic Gold Rush", *supra*, note 10. According to the author, Sweden, Denmark, Finland, Italy and Switzerland have organic area of between 5 to 10 percent. Austria has 10 percent, while some of its provinces have organic area of 50 percent.

66 Britain imports three-quarters of its burgeoning organic food from as far afield as New Zealand Zambia, and United States. Britain's largest food retailer, Tesco, sources 75 percent of its organic produce abroad. See Sujata Rao, "Organic food-hungry Britons pile on the air miles" *Organic Issues*, (15 October 2002), available at organic@iatp.org, on file with the author. However, the 2001 Organic Food & Farming Report estimated UK's organic retail market at about 920 million pounds. See Soil Association, *Organic Food & Farming Report 2001*, (Bristol, 2001), *supra*, note 56.

67 See Brian Halweil, "Organic Gold Rush" *World Watch Institute*, *supra*, note 10.

68 *Ibid*.

69 *Ibid*.

70 Some consumers are generally wary of vegetables nurtured with pesticides, and are prepared to pay a premium for certification guaranteeing that minimum amounts of the safest pesticides are used on the produce. This is already taking place in South Korea, where "Syngenta" is piloting a low-input certification scheme for "Carrefour" the French-owned supermarket chain. The company charges a royalty, guaranteeing that minimum amounts of the safest pesticides are used on vegetables. See David Firn, "Big Players Poised To Exploit Biotech Advances" *Financial Times* (14 October 2002) at III.

Consumers are increasingly willing to pay higher premiums for food crops that are completely free of pesticides or genetic engineering techniques. For instance, in Alberta, Canada, the Pesticide Free Production Farmers' Co-operative recently bought pesticide-free grains from farmers at premium prices. Farmers had committed between

NGOs that are actively promoting organic farming and pushing for organic food labelling and regulations to distinguish them from non-organic food.[71]

### A. *Organic Food Regulation in the United States*

The growing organic market, consumer demands, and the passing off of non-organic as organic food, are some of the reasons for the enactment of the United States Organic Food Production Act 1990.[72] With effect from 21

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10,000 and 12,000 acres of production for sale. See "Pesticide—Free Grain Farmers Rewarded With Premium", *The Third Crop* (vol., 1, Number 10, 9 October 2002), e-mail newsletter from the_third_crop@iatp.org, on file with the author.

[71] Some examples of organic movements or promoters are: the Spanish Navarra Association of Organic Producers at http://www.aenavarra.com; Organic Alliance at http://www.organic.org; The Organic Trade Association, at http://www.ota.com; New Zealand's Physicians and Scientists for the Responsible Application of Science and Technology, at http://www.psrg.org.nz; Greenpeace at http://www.greenpeace.org; Australia's Gene Ethics Network at http://www.geneethics.org, and the UK Soil Association which is opposed to UK farmers' embrace of GM crops on the same scale as the North Americans. See their September 2002 reports on GM in North America in Soil Association, *Seeds of Doubts*, *supra*, note 13. Furthermore in their struggle against the overwhelming presence of conventional and GM crops, about a thousand organic farmers in Canada recently filed a law suit against Monsanto and Aventis in a court in Canada's prairie province of Saskatchewan. They were seeking damages from the two corporations, who had sold genetically modified canola seeds to several farmers in the region. Canada is the world's largest exporter of canola, and much of it is grown in Saskatchewan which is Canada's agricultural epicenter. The *gravamen* of their claim was that their livelihood had been threatened because they could no longer grow canola due to the difficulty of guaranteeing that their produce was 100 percent GM-free as required by organic certifiers. This was because 60 percent of the canola grown in the province was genetically modified. The farmers also hoped that their suit would foreclose the introduction of transgenic wheat, the field trials of which Monsanto was conducting. See *World Environment News*, "Canadian organic farmers sue Monsanto on GM crops", available at http://www.planetark.org/avantgo/dailynewsstory.cfm?newsid=13999 (last accessed 30 October 2002)

[72] Michael F Jacobson, executive director of the Center for Science in the Public Interest stated the rationale for federal government support for organic labels, in his recent interview with the *New York Times* as follows: "There were lots of suspicions that people out there were charging twice as much for conventionally grown food simply by putting it under a sign that said organic. That could have been hurting consumers if there was some deception in the market. It was also hurting organic industry, because people simply hadn't had the confidence that the food they were buying was really organic. The way of conveying to a consumer that a food is grown organically is to put a label on the food. The label needs to mean something, and the law will ensure that it does." See Sherri Day, "The 'Organic' Label: Who Wins at the Banks?" *The New York Times* (20 October 2002), available at http://www.nytimes.com/2002/10/20/business/yourmoney/20FIVE.html?ex=1036161895&ei=3a750bc1fdbc58bf (last accessed 22 October 2002). The State of California had been prompted to define organic practices due to the furor generated among consumers and producers when some farmers were passing off non-organic as organic products to cash in on the success of organic products. See California Food and Agricultural Code; Section 46000-4605, available at http://www.leginfo.ca.gov/cgi-bin/displaycode?section=fac&group=45001-46000&file=46000-46015 (last accessed 20 October 2002). This among others subsequently prompted the US Department of Agriculture in 1990 to push for

October 2002, the US Department of Agriculture's "National Organic Programme" (NOP), which is made pursuant to the Organic Foods Production Act of 1990,[73] becomes operational under the auspices of the "Agricultural Marketing Service" (AMS), an arm of the US Department of Agriculture. The National Organic Programme is meant to facilitate domestic and international marketing of fresh and processed organic food by establishing national standards for the production and handling of organically produced products.[74]

The National Organic Programme Rules provide for a national-level accreditation programme[75] to be administered by AMS for state officials and individuals who want to be accredited as certifying agents. Certifying agents will be responsible for certifying organic products and initiate compliance actions in accordance with the standard rules.[76] Furthermore, the National Organic Programme Rules also require and stipulate the conditions for the labelling of products as organic and containing organic ingredients while also regulating importation of organic agricultural products from countries with the equivalent of organic programme rules.[77]

Moreover, Section 205.301 of the National Organic Programme Rules established four categories of organic content: 100 percent organic, 95 percent organic, 70 to 95 percent organic, and less than 70 percent organic.[78] In accordance with the new National Organic Programme Rules, a processed product will only be certified and labelled as "100 percent organic" if the ingredients are wholly or 100 percent organic.[79] The second category is the labelling of a processed product as "organic" if at least 95 percent organic of the organic ingredients are produced using production and handling practices pursuant to subpart C.[80] Up to 5 percent of the ingredients may be non-agricultural substances.[81] The non-organic

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Congress' enactment of Organic Food Production Act. See Mort Mather, "What is organic food? *Mother Earth News*, *supra*, note 30.

73 See Title 7 Subchapter M of the United States Code as amended by (7 USC 6501 *et seq*) supra note 24 above

74 See Department of Agriculture, Agricultural Marketing Service (7CFR Part 205 [Docket Number: TMD-00-02-FR] RIN: 0581-AA40) National Organic Program, available at http://www.ams.usda.gov/nop/nop2000/Final%20Rule/nopfinal.pdf (last accessed 19 October 2002).

75 Section 205.2 Subpart A of NOP Rules defines "Accreditation" as "a determination made by the Secretary that authorises a private, foreign, or State entity to conduct certification activities as a certifying agent under this part." *Supra*, note 74.

76 Section 205.2 Subpart A of NOP Rules defines "Certified operation" as "a crop or livestock production, wild-crop harvesting or handling operation, or portion of such operation that is certified by an accredited certifying agent as utilizing a system of organic production or handling as described by the Act and the regulations in this part." *Supra*, note 74.

77 See the National Organic Program Rules, *supra*, note 74.

78 See Subpart D of the USDA National Organic Programme Rules, *supra*, note 74.

79 *Ibid*.

80 *Ibid*.

81 *Ibid*.

ingredients components must not be produced using excluded methods, sewage sludge, or ionizing radiation. [82] The third category is a processed product which has between 70-95 percent organic ingredients. This can be labelled only as "made with organic ingredients."[83] Furthermore, organic and conventionally grown ingredients must be kept separate, and the organic ingredients must be stored in containers that do not compromise the organic nature of the food.[84] Moreover, neither organic nor conventional ingredients in organic products can be treated with ionizing radiation or synthetic solvents, or arise from excluded processes, *i.e.* genetic engineering.[85]

With effect from 21 October 2002, organic products such as fruits, vegetables, meats and milk and others labelled organic must carry a Department of Agriculture seal.[86] Meats and dairy products can be labelled organic only if the animals were not given antibiotics or growth hormones.[87] Though organic food labelling is voluntary,[88] Michael F Jacobson, the executive director of the Center for Science in the Public Interest said he would not expect farmers to opt out of certification and forgo organic seal since "…[i]t's like a ticket to print money…you can get a significant premium…you want to use organic whenever you can."[89]

From the foregoing rules, it is beyond doubt that the National Organic Programme, especially with its labelling requirement, clearly intends to distinguish between organic products, semi-organic products and non-organic products. In this respect, the USDA National Organic Programme rules are truly revolutionary, being a significant shift in the United States agricultural biotechnology policy.

The significance of the new labelling policy lies in its full implications for the US Food and Drug Administration's anti-GM food labelling policy,[90] since labelling of organic products will have the practical effect of

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82 *Ibid*.

83 This category of agricultural products has multiple ingredients which by weight or fluid volume (excluding water and salt) are between 70 and 95 percent organic agricultural ingredients. The organic ingredients must be produced in accordance with subpart C and subpart G. To qualify for this category of organic labelling, the non-organic agricultural ingredients must be produced and handled without use of the first three prohibited practices specified in paragraph (f) of section 205.301, but may be produced or handled using practices prohibited in paragraphs (f) (4) through (7). See the National Organic Program Rules, *supra*, note 74.

84 *Ibid*.

85 *Ibid*.

86 *Ibid*.

87 *Ibid*.

88 *Ibid*.

89 See Sherri Day, "The 'Organic' Label: Who Wins at the Bank?" *The New York Times*, *supra*, note 69.

90 The FDA operates Voluntary Labelling Guidelines; and is known to be against GM food labelling despite its admission that the vast majority of over 50,000 comments it received on its food policy favoured labelling of foods derived from biotechnology. See Kristin

isolating and identifying genetically modified food in the market place.[91] In effect, labelling of organic food is no more than an indirect or subtle labelling of genetically modified food itself. Herein lies the great irony, because the United States' Food and Drug Administration (FDA) is officially opposed to labelling of genetically modified food and was opposed to the State of Oregon's referendum on GM food labelling, on grounds that the process could potentially disrupt national food supply chain.[92]

If organic food certification and labelling eventually reveal GM and non-organic food in food stalls across the United States, then it depicts the following two significant issues in recent US food policy trends. The first issue is the role of consumer's interest, and its growing influence on US food policy. It is widely believed that the National Organic Programme is acquiescent to demands for consumer protection following the furor generated by the passing off of non-organic as organic food.[93] This shows increasing policy deference to consumer's demands to the right to know and make informed choice between organic and conventional food.

However, the US stance starkly contrasts to the EU, where the degree of official appreciation for consumer safety concerns is arguably, relatively higher in its comprehensive approach to labelling of both the organic and non-organic food.[94] It is important to note however that the USDA intends

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Dawkins, "Labelling and Traceability Of Bioengineered Foods" *Economic Perspectives, An Electronic Journal of the US Department of State*, vol. 7, No 2 (May, 2002) at 26-30.

91 It is logical for the consumer to conclude that non-organic food on market and supermarket shelves are either genetically modified or are grown with pesticides and antibiotics. This distinction is easily facilitated by organic food labelling.

92 The US Food and Drug Administration (FDA) has expressed its opposition to the governor of Oregon's referendum on the labelling of products that contain genetically modified organisms (GMO). Oregon went to polls on 2 November 2002 but voted against labelling of genetically modified foods. If the regulatory measures had sailed through, the State would have become the first to require such labelling. The Bush Administration believes such labels would scare consumers, and therefore should not be mandated. The practical consequences of US Department of Agriculture's certification and labelling rules could undermine the US Food and Drug Administration's anti-labelling stand. See *Organic Issues* "Oregon vs. the FDA" (14 October 2002), available at organic@iatp.org, on file with the author. See also Elizabeth Weise, "Label fight heats up in Oregon: 'Genetically engineered' is sticking point" *USA Today* (10 October 2002) at 2; and James Mayer and Michelle Cole, "Labelling altered food contents, health care fail to get support" *The Oregonian* (6 November 2002) at http://www.oregonlive.com/oregonian/news/Oregonian/index.ssf?/xml/story.ssf/html_standard.xsl?/base/front_page/1036587356185771.xml (last assessed on 8 November 2002).

93 See Mort Mather, "What is organic food? *Mother Earth News*, *supra*, note 30.

94 The EU organic labelling rules of 1991 also predated the US 2002 National Organic Program. On 17 October 2002, the EU refused to lift its moratorium on genetically modified crops, while introducing stricter regulatory and labelling provisions for new GMOs. See Michael Mann, "EU ban stays on new GM crops" *Financial Times* (18 October 2002) at 3. From 28 November 2002, EU countries are to require all food and feed products linked in any way to transgenic crops to be clearly labelled as "genetically modified". Prior to November, 2002, only foods containing measurable amounts of

organic labelling as a mere marketing tool and not as "a statement about food safety, nutrition or quality."[95] Though believed to have a relatively higher nutritional and safety qualities than conventional food,[96] it has been contended in a number of literature that there is no conclusive scientific evidence that organic food is superior in nutritional and safety qualities to non-organic or conventional food.[97] Such literature has however been countered as being "methodologically flawed."[98]

Though the definition of "organic production" in the USDA's Organic

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genetically engineered DNA required labelling. But from November 2002 onwards, labelling would extend to end-products such as sugars and oils even when GM ingredients cannot be detected in them because they are physically and chemically identical to products derived from non-GM crops (substantial equivalence). Such end products would also cover meat fed with transgenic feeds. 15 European Union Agriculture Ministers finally agreed on the minimum threshold level of 0.9 percent for labelling of all food and (for the first time) feed containing GMOs materials. The Ministers also agreed on the threshold accidental traces of unauthorised GMOs already assessed as risk-free at 0.5 percent in food and feed for a three year transitional period. The draft law would proceed for further reading in the European Parliament. See Jeremy Smith, "EU Ministers agree new thresholds on GM food, feed" *Reuters* (28 November 2002), available at http://www.reuters.com/newsArticle/ (last accessed 29 November 2002).

95 See mritchie@iatp.org, *Organic Issues*, "USDA: Organic foods may be more contamination-prone", an e-mail newsletter posted on 25 October 2002, available at organic@iatp.org, on file with the author.

96 See Ulrich Hamm *et al*, *Analysis Of The European Market For Organic Food: Organic Marketing Initiatives And Rural Development: Volume One* (Wales Aberystwyth: School of Management and Business University of Wales Aberystwyth 2002) at 4. While acknowledging that organic farmers were not immuned to diseases such as BSE, the authors opined that they produced "safer products by working to strict production guidelines where…use of pesticides is forbidden, antibiotics cannot be used as prophylactic medicine for animals, and farm sufficiency in animal feed is maximized."

97 See generally Woese K, Lange D, Boess C, Werner Boel K, "A comparison of organically and conventionally grown foods: results of a review of relevant literature" (1997) *Journal of the Science of Food and Agriculture*, 74 at 281-293; Worthington V, "Effect of agricultural methods on nutritional quality: a comparison of organic with conventional crops" (1998) *Alternative Therapies Health Med* 4 (1), at 58-59; Diver S, "Nutritional Quality of Organically Grown Food" (2000) Appropriate Technology Transfer for Rural Areas (ATTRA) report, Arkansas, US; Brandt K, Molgaard JP "Organic agriculture: does it enhance or reduce the nutritional value of plants foods?" (2001) *Journal of the Science of Food and Agriculture* 81 at 924-931; and Williams CM, Pennington TH, Bridges O, Bridges JW, "Food quality and health. Shades of Green, a Review of UK Farming Systems" (2000) Royal Agricultural Society of England, at 73-90. However, while upholding the superior nutritional and safety qualities of organic over conventional food, Shane Heaton contended that "…when methodologically flawed studies are screened out and a complete assessment of nutritional quality is made, collectively, the available evidence supports the hypothesis that organically produced food is superior in terms of safety, nutritional content and nutritional value to that produced non-organically". She branded contrary literature in this area as "methodologically flawed". See Shane Heaton, "Assessing Organic food quality: Is it better for you?" in Powell *et al* (ed), *UK Organic Research 2002: Proceedings of the COR*, available at http://www.organic.aber.ac.uk/library/Assessment%20organic%20food%20quality.pdf (last accessed 30 October 2002).

98 See Shane Heaton, "Assessing Organic food quality: Is it better for you?" *supra*, note 94.

Foods Production Act 1990[99] implicates the USDA's tacit recognition of the ecological and biodiversity preservation relevance of organic farming, the USDA does not officially endorse organic food as safer or more nutritious than conventional food in spite of its labelling policy. This official stance is underscored by the US under secretary for food safety, Elsa Murano, who, at a recent World Food Prize Symposium,[100] warned consumers to be wary of organically grown food. According to her:

> We must remember that bacteria and parasites are also all natural…Foods that have fewer or no preservatives can pose a challenge to consumers if they don't know what all-natural implies and how these foods should be handled and prepared…As a microbiologist, I know that preservatives are used in foods for a reason… to preserve food against the growth of microorganisms… Perhaps, there's not the evidence to show that one (method of growing food) is safer than the other… When we don't have those preservatives, you have to be aware of the fact that that's going to cost you something. That's what I think is the challenge for the food industry, especially those folks who produce organic foods and all-natural foods and so forth, to make sure they produce them and process them in such a way that it will not reduce the safety of those products…"[101]

The above statement also belies any hope of official endorsement of the acclaimed superiority of organic farming or food through the USDA National Organic Programme rules. In fact, as a major promoter and supporter of conventional farming and genetically modified crops,[102] a contrary stance by the USDA would be nothing short of a dramatic policy reversal that would sure reverberate beyond the US with potentially negative effect of legitimising or hardening the European Union's GM foods' precautionary policy resolve.[103] In a related development that depicts

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99 See Section 205.2 Title 7 Subchapter M of the United States Code as amended by (7 USC 6501 *et seq*), *supra*, note 24 above.

100 The World Food symposium held at Des Moines, Iowa, on 24 October 2002, drew hundreds of researchers and government officials from around the globe. See mritchie@iatp.org, *Organic Issues*, "USDA: Organic foods may be more contamination-prone", *supra*, note 95.

101 *Supra*, note 95.

102 The USDA supports land grant universities' agribiotechnology research, and has numerous agricultural research programmes in such areas as plant, microbial, and insect genetic resources, genomics and genetic improvement. See http://www.nps.ars.usda.gov (last accessed on 27 November 2002).

103 See generally *supra*, note 94. For instance, on 17 October 2002, the EU voted to continue with its *defacto* moratorium on new GM crops. A new EU directive came into force, giving guidelines to member states on how to handle requests by biotechnology companies to market GM foodstuffs. The EU governments can use the directive in deciding whether to lift the ban and allow companies to market new genetically engineered foods. Much to the displeasure of the United States, the EU felt that "there was no need to lift the moratorium

the readiness of the UK officials to endorse the merits of organic food (in sharp contrast to the US), the UK Foods Standards Agency was recently criticised by the Environmental Minister for its refusal to endorse the benefits of organic food.[104]

Viewed from this perspective therefore, the USDA's National Organic Programme and its organic labelling rule is arguably more of deference to increasing consumer demands for protection from fake organic food through the labelling process (which facilitates an informed choice between organic and conventional foods) than the officials' willingness to endorse or promote organic farming and food over and above non-organic, conventional, or GM food.

In the EU however, there is a conscious, corporate, promotional policy for organic farming and food.[105] According to Ulrich Hamm who investigated the promotion of organic food in nineteen European countries, most governments were promoting organic farming partly because of "the growing number of food scandals over the last few years",[106] the realisation that it is a "significant contributor to sustainable agricultural development",[107] and its potential "to reduce surplus production from conventional agriculture."[108]

According to Brian Halweil, eighty percent of organic growth in the EU area was "spurred by the 1993 establishment of a common EU definition for

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until the labelling and traceability rules are in force". See Michael Mann and Edward Alden, "EU ban stays on new GM crops" *Financial Times* (18 October 2002) at 3. The EU's continual GM crops imports ban from the US and Canada, which is predicated on public health and environmental concerns, has been in place since 1998 despite the World Trade Organisation's ruling on its impropriety. The US trade representative, Robert Zoellick had described the EU approach as founded on "fears and lack of scientific basis or knowledge." See "US Anger Growing Over EU, China GMO Policy." *Bridges Weekly Trade News Digest* Volume 6 Number 4 (2 February 2002) available at http://www.ictsd.org/weekly/02-02-05/wtoinbrief.htm#2 (last accessed 28 October 2002) See also "US dismisses potential EU relaxation of GM ban" *Agence France Presse* (28 October 2002), available at http://www.afp.com (last accessed 29 October 2002). It is estimated that due to GM crops rejection in Europe, almost the entire US$300 million annual US maize exports to the EU and the US$300 million annual Canadian rape (canola) exports to the EU had disappeared, while the US share of the world soya market has diminished considerably. See Soil Association, *Seeds Of Doubts*, *supra*, note 13.

104 The UK Environmental Minister, Michael Meacher, had written to FSA chair Prof Sir John Krebs, asking why the agency neglected to endorse the benefits of organic food. The UK organic certifier, the Soil Association, also expressed its displeasure at the agency's ambivalent stance on organic food, by calling off further talks with the agency until it was satisfied that the agency was ready to approach "the issue of organic food and farming with an open mind." See http://www.ehn-online.com/cgi-bin/newsI/EpFZkIkjlgGMIf.html. (last accessed 28 October 2002)

105 See Ulrich Hamm, Friederike Gronefeld and Darren Halpin, *Analysis of the European Market for Organic Food: Organic Marketing Initiatives And Rural Development:* Volume One *supra*, note 96 above.

106 *Ibid*.

107 *Ibid*.

108 *Ibid*.

'organic' and subsequent EU-wide policies"[109] of financially supporting farmers who desired to convert to organic farming.[110] For instance, in the UK the government has invested in organic farming development and promotion through research and financial assistance for farmers who wanted to convert to organic farming.[111] According to the Soil Association's reports, the UK government spent over 20 million pounds on the organic sector in the year 2001 and has a further 140 million pounds budget from 2001 onwards for farmers who would like to convert to organic farming in England alone.[112]

The second issue of note in recent US food policy trends is the ostensible clash of policy ideals between the United States Department of Agriculture (USDA) which is responsible for organic food certification and labelling regulations, and the FDA, which opposes GM food labelling.[113] One is inclined to ask if there is a kind of policy rivalry between the two federal agencies.[114] It is significant to note however, that while the USDA's

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[109] See Brian Halweil, "Organic Gold Rush", *supra*, note 11 at 24.

[110] Brian Halweil cited the sudden surge in organic interest in Germany in the wake of the "mad cow disease". According to him, the new agricultural minister resolved to up "organic production from 2.6 percent of farmland…to 20 percent by 2010." He contrasted institutional support for organic farming in the EU to the US where institutional interest bordered on indifference. He supported his assessment of US lackadaisical organic policy by South Dakota State University Professor Thomas Dobbs's assertion that "U.S policy is best described as one that is gradually evolving to be less *unfriendly* to organic production." See "Organic Gold Rush" *Watch World Institute*, *supra*, note 11 at 24.

[111] See Soil Association, *Seeds of Doubt*, *supra*, note 13 at 60.

[112] *Ibid*.

[113] The Preamble to labelling and market information in Subpart D of the USDA's National Organic Programme clearly acknowledges FDA's statutory duty to label food, the circumstances under which such labelling could be done, and that the new NOP labelling requirement will not supersede or prejudice FDA's statutory labelling rights. The preamble provides thus: "…provisions on organic food labelling are not intended to supersede other labelling requirements specified in other Federal labelling regulations. The Food and Drug Administration (FDA) regulates the placement of information on food product packages in 21 CFR and parts 1 and 101. USDA's Food Safety and Inspection Service's (FSIS), Federal Meat Inspection Act, Poultry Products Inspection Act and Egg Products Inspection Act, have implementing regulations in 9 CFR part 317 which must be followed in the labelling of meat, poultry and egg products. The Federal Trade Commission (FTC) regulations under the Fair Packaging and Labelling Act (FLPA) 16 CFR part 500 and the Alcohol Tobacco and Firearms (ATF) regulations under the Federal Alcohol Administration Act (FAA) 27 CFR parts 4, 5, and 7, also must be followed, as applicable to the nature of the product. The labelling requirements specified in this subpart must be implemented in a manner so that they do not conflict with the labelling requirements of these and other Federal labelling requirements." See The National Organic Programme, Labelling—Preamble, available at http://www.ams.usda.gov/nop/NOP/standards/LabelPre.html (last accessed 20 October 2002).

[114] In the US, responsibility for ensuring agricultural and environmental safety is vested in the USDA and Environmental Protection Agency (EPA) respectively, while the FDA is charged with the responsibility for food safety. See Bruce M Chassy, "Food Safety Evaluation of Crops Produced through Biotechnology" (2002) *Journal of American College of Nutrition*, Vol 21, No 3, 166S-173S at 166S. The overlap of duties, and jurisdictional confusion between the USDA and the FDA might be inevitable. For instance,

organic food labelling and the FDA's anti-GM food labelling policies might have practical contradictions, such effects are more of unintended consequences than of deliberate policy objectives which are borne of competition or rivalry, in view of USDA's pro-GM food stance.[115]

As the new organic rules become operational however, it is bound to give a fillip to organic farming and food in the United States markets with the concomitant flurry by local and international organic farmers to meet National Organic Programme standards and supply the US and home markets.[116] Under the circumstances, popularity of organic food is guaranteed to soar while the net effect on conventional and GM food sales could be really debilitating, inevitably casting shadows on the prospects of agricultural biotechnology.[117]

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the FDA recently announced that it has the legal backing to regulate transgenic animals as "drugs" despite strong consumer opposition. While using growth hormone-enhanced Atlantic salmon as a model, Donald Prater, an FDA Center for Veterinary Medicine (CVM) official, at the September 2002 Grocery Manufacturers of America meeting had argued that the FDA believed that the transgenic fish contained a "new animal drug" as defined in the Food, Drug & Cosmetic Act. Section 201 [321] (g) (1) (C) of the Act defines a "drug" to include "articles…intended to affect the structure or any function of the body of man or other animals." He asserted that the section covered and would regard genetically modified structure in man or animal with the resultant proteins as "drug". The section is yet to be interpreted by the court to validate the FDA's claims to regulatory jurisdiction on transgenic animals which the USDA could equally lay claim to. See Laura Gilcrest, "FDA says it has legal backing to regulate transgenic animals as 'drugs'", an e-mail newsletter of 22 October 2002, available at mritchie@iatp.org, on file with the author.

[115] For instance, "Zambian Vice President Enock Kavindele told Reuters in Lusaka that his country had declined a $50 million line of credit from the U.S. Department of Agriculture because of provisions that it would have to purchase GMO commodities": see "Eat GM or starve, America tells Africa" *Reuters* (26 July 2002), available at http://www.reuters.com/Article/ (last accessed 31 October 2002).

[116] For instance, Fetzer Vineyards, which already runs about 2,000 acres of organic vineyards in Northern California, has decided to become 100 percent organic in eight years in the wake of the new organic rules in the US. See "Fetzer to grow totally organic by 2010" *San Francisco Business Times* (28 October 2002), available at http://c.bizjournals.com/ct/rc/3460/sanfranscisco.bizjournals.com/sanfransico/stories/2002/10/28daily62.html (last accessed 1 November 2002). It is said that farmers from developing countries (especially neighbouring Mexico) could benefit immensely by exporting organic food to the US market. See Sherri Day, "The 'Organic' Label: Who Wins at the Banks?" *The New York Times* (20 October 2002), *supra*, note 72.

Already, the NOP stringent organic rules are said to be threatening Danish Dairy exports to the US. One of the USDA requirements is that cows treated with antibiotics should be excluded from organic production. But antibiotics are regularly administered to sick cows in Denmark. Denmark's organic food export to the US is about $31.45 million a year. Non-compliance with the NOP rules will deprive Danish Dairy of the USDA organic seal and premium organic prices. See Organic, "New U.S organic rules threaten Danish dairy exports", e-mail newsletter of 21 October 2002, available at mritchie@iatp.org, on file with the author.

[117] The 2002 Organic Consumer Trends Report (OCTR), jointly produced by The Natural Marketing Institute (NMI) and SPINS, indicates that the importance of organic would continue to grow due to the US Department of Agriculture's October regulation for organic food and beverage certification and labelling. The Report shows that 39% of the U.S population—over 40 million households—uses organic products. See Just-food.com,

### B. *Organic Food Regulation in the EU*

The legal basis for pan-European agricultural policy is rooted in Articles 32 to 38, title II of the EC Treaty.[118] In the EU, organic plant production is regulated by Council Regulation 2092/91/EEC (as amended)[119] while organic animal husbandry is regulated by Council Regulation 1804/99.[120] Prior to the Council Regulation on organic production in 1991, demands for organic products were on the rise while different certification and labelling rules existed in EU member countries.[121] The Regulation also provides for conditions for importation of organic produce from third countries[122] and the issuance of inspection certificates for such imports.[123] Regulation 2092/91 covers both processed and unprocessed agricultural products (crops and livestock) that are intended for human consumption.[124]

On organic livestock production, 15 (12) of the Regulation provides that livestock must "be fed on grass, fodder and feeding stuffs produced in accordance with the rules of organic farming."[125] However, the regulation allows for provisional authorisation of "a limited number of non-organically produced feeding stuffs to be used in restricted quantities"[126] where farmers have difficulty in securing supplies of organically produced feeding

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"USA: survey shows 39% of US consumers choose organic", available at http://just-food.com/news_detail.asp?art=52439&app=1&1 (last accessed 27 November 2002).

118 The European Community operates a "Common Agricultural Policy" (CAP). The policy comprises a set of rules and mechanisms which regulate the production, trade and processing of agricultural products in the European Union. See EUROPA, "Agriculture: Introduction", available at http://www.europa.eu.int/scadplus/leg/en/lvb/104000.htm (last accessed 2 November 2002).

119 Council Regulation 2092/91/EEC on organic production (OJ 1991 LI98/1 of 24 June 1991). This was amended by Regulation 1804/1999/EC to include rules on livestock production. The effective date of the amendment was 24 August 2000. See generally Barry Artwood, *Food Law*, 2nd ed (London: Butterworth, 2000) at 119-120.

120 See Barry Artwood, *supra*, note 119.

121 See the preamble to Council Regulation Directive 2092/91 of 24 June 1991, *supra*, note 23.

122 The detailed rules for implementing the provisions on the certificate of inspection for imports from third countries under Article 11 of Council Regulation (EEC) No 2092/91 on organic production of agricultural products and indications referring to agricultural products and foodstuffs were in Commission Regulation (EC) No 1788/2001 of 7 September 2001. See Official Journal L 243, 13 September 2001 at 0003-0014, available at http://www.europa.eu.int/smartapi/cgi/sga_doc?smartapi!prod!CELEXnumdoc&lg=EN&numdoc=32001R1788&model=guichett (last accessed 23 October 2002). See also Barry Artwood (2000), *supra*, note 119.

123 See Commission Regulation 345/92/EEC, Barry Artwood (2000), *supra*, note 115.

124 Processed and unprocessed agricultural products that are meant for feeding stuffs, compound feeding stuffs or feeding materials for animals are separately regulated. Directive 79/373/EEC regulates feeding stuffs, while Directive 96/25/EEC regulates feed materials. See generally Barry Artwood, *supra*, note 119 at 240-241.

125 See the 1999 amendment to regulation 2092/91EC by regulation 1804/1999EC. *Supra*, notes 23 and 119.

126 See 15 (13), *ibid*.

stuffs.[127] In the same vein, to facilitate the provision of "basic nutritional requirements,"[128] the regulation allows for the use of "certain minerals, trace elements and vitamins under well defined conditions."[129]

Furthermore, the regulation advocates for preventive measures in animal health management.[130] These include "appropriate selection of breeds and strains, a balanced high-quality diet and a favourable environment, in particular as regards rearing density, livestock housing and husbandry practices."[131] Though the regulation prohibits "the preventive use of chemically synthesised allopathic medicinal products"[132] in organic livestock farming, it could be used very restrictively and minimally when animals are sick or injured.[133] The restrictive and minimal threshold use is meant "to guarantee the integrity of organic production for consumers…"[134] These limited exceptions show the limits of pure organic livestock farming in the predominantly intensive, industry-driven, modern agriculture. This perhaps explains why, despite its refusal to lift its moratorium on GM exports from North America, EU still allows its farmers to import huge quantities of modified soy meal for animal feed.[135]

According to Greg Burns, in the absence of other economical source of protein, "producers of European meat, milk and eggs depend on it (modified soy meal), and labelling is not required for now because genetic engineering in the feed is undetectable in the finished product."[136] This raises doubts about the feasibility of achieving large-scale organic livestock production without the use of animal drugs or antibiotics and GM feeding stuffs. In Denmark's organic livestock production for instance, animals that have been treated with antibiotics are allowed to be taken back into organic production system.[137] According to Anne-Mette Arve, head of Danish Dairy Board's Economic and Political Department in her recent interview with Reuters, "…most farmers try to limit the use of antibiotics but if an animal is really sick they have to treat it……"[138]

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127 See 15 (3), *ibid*.
128 See 15 (14), *ibid*.
129 See 15 (14), *ibid*.
130 See 15 (15), *ibid*.
131 See 15 (15), *ibid*.
132 See 15 (16), *ibid*.
133 See 15 (17), *ibid*. Note however that preference must be given to "phytotherapetic or homeopathic medicinal products" before resorting to "chemically synthesised allopathic medicinal products", in the treatment of sick or injured animals.
134 See 15 (17), *ibid*.
135 See Greg Burns, "Europe shows little taste for U.S. biotech crops" *Chicago Tribune* (30 October 2002). Note however the new the minimum threshold level of 9.0 percent requirement for GM animal feed labelling. See Jeremy Smith, "EU Ministers agree new thresholds on GM food, feed", *supra*, note 94.
136 See Greg Burns, *supra*, note 135.
137 See 15 (17) Council Regulation 2092/91/EEC on organic production, *supra*, note 23.
138 See "New US organic rules threaten Danish dairy exports" *Organic*, *supra*, note 116. Recently, a drug-resistant "super bug", *Staphylococcus aureus bacteria* was discovered in

The pertinent question therefore is whether it is possible to have organic farming in its strictest sense[139] that is able to meet the challenge of catering to the world's burgeoning population?[140] Though it is not a completely apposite answer to the above question, Brian Halweil opined that the common reservation about organic farming's ability to "produce nearly as much food as conventional farming" is a mere myth.[141] He cited land grant Universities and Rodale research and trials which showed that organic systems were more profitable (even in the absence of premium prices) and

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the foot ulcer of a Pennsylvania patient. The bug was resistant to *vancomycin*, "one of the last lines of antibiotics." This has fuelled the growing concerns that indiscriminate antibiotics use in livestock production could increase antimicrobial or bacterial resistance in humans to conventional drugs. See Helen Pearson, "Bacteria defy last-resort antibiotic" *Nature* (26 July 2002), available at http://www.nature.com/nsu/020722-11.html (last accessed 15 November 2002); Shankar, N., Baghdayan *et al*, "Modulation of virulence within a pathogenicity island in vancomycin-resistant *Enterococcus faecalis*" *Nature*, 417, 750, (2002); CDC: Staphylococcus aureus resistant to vancomycin-United States, 2002, *Morbidity and Mortality Weekly Report*, 51, 567, (2002); CDC: Vancomycin-resistant Staphylococcus aureus- Pennsylvania, 2002, *Morbidity and Mortality Weekly Report*, 51, 902, (2002). This has prompted the introduction of a regulatory Bill into the US Congress by Senator Edward M. Kennedy. The Bill was entitled "Preservation of Antibiotics for Human Treatment Act 2002". Experts (including members of the American Medical Association) believed that the effectiveness of antibiotics in combating viral or bacterial infection in humans could be compromised if the use of antibiotics in livestock production was not regulated. See Michael D Maves, "The Preservation of Antibiotics for Human Treatment Act of 2002", a letter written to the Honourable Senator Edward Kennedy and posted on 27 June 2002 on the "antibiotics", an e-mail newsletter service at antibiotics@iatp.org, on file with the author.

In the same vain, the US Food Drug Administration's Center for Veterinary Medicine has proposed to regulate antibiotics use in livestock. Towards this end, the FDA has crafted a "Draft Guidance" on 6 September 2002 for public comments. If the guideline sails through, FDA would in future require information about resistance risk when companies apply for approval of animal drug. Such information would be critical to FDA's approval. Livestock producers and animal drugs makers are understandably worried about the proposed guideline since it could make approvals harder to get. See antibiotics, "Groups debate US plan on antibiotics for animals", an e-mail newsletter service posted on the web on 7 October 2002 by antibiotics@iatp.org, on file with the author; Joe Vansickle, Critics Resist FDA's Drug Plan" *National Hog Farmer* (15 November 2002). See "Draft Guidance # 152" at http://www.fda.gov/cvm (last accessed 15 November 2002). See also David Wallinga, "Antimicrobial Use in Animal Feed: an Ecological and Public Health Problem" *Minnesota Medicine*, *supra*, note 48.

[139] Organic farming primarily excludes genetic engineering techniques, herbicides, pesticides and antibiotics. The International Federation of Organic Movements (IFOAM) and the UK Soil Association had both "agreed in 1994 that there was no place for GM technology in organic agriculture." See Soil Association, *Seeds of Doubts*, *supra*, note 13 at 8. There could however be limited use of pesticides or herbicides or animal drugs in dire circumstances such as envisaged by the EU Regulation 15 (17), *supra*, note 23.

[140] See John Mason, "Hunger reduction slows to dismal level" *Financial Times*, *supra*, note 12; Bourlaug Norman E, "Ending World Hunger. The Promise Of Biotechnology And The Threat Of Antiscience Zealotry", *supra*, note 11.

[141] See "Organic Gold Rush", *supra*, note 11 at 30.

sometimes "out-produced the conventional fields."[142]

Even if Halweil's assertion was correct, could the world suddenly rid itself of chemicals, pesticides, or antibiotics even if it was prepared to alienate genetic engineering from the farmlands? Given its minuscule percentage of the global cultivated acreage,[143] how could a wholly organic world cope with farmlands riddled with microbes, pests, vermin and droughts and still ensure food security in the short term? If the present momentum in organic growth is maintained however, it could possibly eclipse conventional farming in some distant future, but this is extremely doubtful in view of individual, industry and institutional vested interests in conventional farming[144] and the fact that even organic rules in the US and EU permit a limited use of animal drugs and chemicals in dire circumstances.[145]

Besides, unless of course there is cogent scientific evidence that overwhelms the immediate benefits of the use of animal drugs, herbicide and pesticide on the farmlands,[146] should not conventional farmers have as

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[142] *Ibid*. He however noted a caveat to the effect that "though organic farm can yield as much corn as the conventional operation in any given year, over a four year period, the conventional farm will bring you more corn." This he attributed to inevitable decrease in "acreage devoted to any given crop" and "a different mix of (crop) production over the long term" since organic system is averse to monoculture over a span of four or more years.

[143] See Audrey M Litterick, Christine A Watson, David Atkinson, "Crop protection in organic agriculture: a simple matter?" *supra*, note 51; Anthony Trewavas, "Much food, many problems: A new agriculture, combining genetic modification technology with sustainable farming is our best hope for the future", *supra*, note 19.

[144] For instance a recent field study that a widely used herbicide, a*trazine*, is making male frogs grow female gonads in the US Midwest has generated controversies amongst scientists. According to the Nature magazine report, "US farmers use about 27,000 tonnes of atrazine each year to protect maize and other crops from weeds." Many European countries have banned the chemical due to concerns about its "ability to disrupt sex hormones." The accuracy of this finding which was published by Tyrone Hayes *et al* as "Herbicides: Feminization of male frogs in the wild" *Nature* 419, 895 (31 October 2002) is being hotly contested in the scientific community. While James Hanken, a herpetologist from Harvard University said he had no doubt about the findings and that the "conclusions are sound and results valid", James Carr of Texas Tech University "says that he does not see the same effects as Hayes." Carr's work is said to be sponsored by Syngenta, the manufacturers of atrazine. See Kendall Powell, "Herbicide makes wild frogs hermaphrodite" *Nature* 419, 895 (31 October 2002).

[145] See 15 (17) Council Regulation 2092/91/EEC on organic production, *supra*, note 23; *Organic New* "US organic rules threaten Danish dairy exports" *supra*, note 116.

[146] The general consensus appears to be that the presence of pesticides in vegetables is not detrimental to health if their levels do not exceed safety limits. Codex Alimentarius Commission, which regulates international food standards and safety, has recommended the maximum safety limits (MRLs) of legally permissible pesticides that can be taken daily over a lifetime without serious risk to health. The first international Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant DNA Plants as well as the Principles for the Risk Analysis of Foods Derived from Modern Biotechnology have been drafted and slated for adoption in 2003 by the Codex Alimentarius Commission. See Stephanie Nebehay, "World Guideline for Pre-Market GM Testing Agreed" Reuters

much right to support their method as organic farmers? Unfortunately, there is no unanimity of views on this. Scientific opinions are as varied as the number and disciplines of scientists out there.[147]

*A fortiori*, preserving the right of either party to choose is as crucial to truly democratic food governance as guaranteeing of consumer's right to choose between organic and non-organic food. The current food law in the US and the EU seem to hold the balance, though the latter is slanted more in favour of non-GM food, relative to the European Union's GM food precautionary policy.[148] The jurisprudential basis for this proposition will be highlighted later in this paper.[149]

## III. Agricultural Genetic Engineering and GM Food: A Safety Net or "A Flight into the Unknown"?[150]

The Cartagena Protocol[151] defines "Modern biotechnology" as the application of:

> (a) In vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (b) Fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection.[152]

The above definition mainly encapsulates gene shuffling, otherwise known as genetic engineering. It is a technique whereby individual genes can be

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Online (7 June 2001), available at http://special.nothernlight.com/gmfoods/premarket_testing.htm#doc (last accessed 30 October 2002).

147 *Supra*, note 144. Similarly, two major seed companies recently refused access to the investigating scientists to assess whether genetically modified sunflowers can turn their wild counterparts into "super weeds". A team led by Allison Snow, a plant ecologist at Ohio State University in Columbus, had uncovered preliminary evidence that a transgene that confers insect resistance can increase the number of seeds produced by wild sunflowers. This could allow plants to proliferate as weeds. See Rex Dalton and San Diego, "Superweed study falters as seed firms deny access to transgene" *Nature* 419, 655 (2002)

148 See Robert L Paarlberg, *The Politics of Precaution: Genetically Modified Crops in Developing Countries* (Baltimore: The John Hopkins University Press, 2001) at 19-24. The author noted that apart from the US, GM biohazard threats were deemed sufficiently cogent to warrant "separate legislation and separate regulatory consideration" in most of the industrialised world.

149 See generally part V (A) of this paper on the GM food labelling debate and the consumer's right to know and choose between GM and non-GM food.

150 Denis Pepin, a French middle-aged urban planner, quoted in Greg Burns, "Europe shows little taste for U.S biotech crops" *Chicago Tribune* (30 October 2002) at 5.

151 *Supra*, note 3.

152 See Article 3 (i) of the Protocol, *supra*, note 3. See also Article 3 (g) on "Living modified organism" quoted in note 3, *supra*.

copied and transferred to another living organism to alter its genetic make up and thus incorporate or delete specific characteristics into or from the organism. The technology is also referred to as gene splicing, recombinant DNA (rDNA) technology, or genetic modification.[153]

Genetically Modified Food (GM Food) is defined as "a food, or food ingredient, derived from a plant or animal, including fish, produced through the process of genetic engineering…"[154] Canola,[155] carnation,[156] chicory,[157] maize,[158] melon,[159]papaya,[160] potato,[161] rice,[162] soybean,[163] squash,[164] sugar

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[153] See Donald J MacKenzie, "International Comparison of Regulatory Frameworks for Food Products of Biotechnology", prepared for The Canadian Biotechnology Advisory Committee Project Steering Committee on Regulation of Genetically Modified Foods. (CBAC December 2000) at 8, available at http://www.cbac-cccb.ca (last accessed 2 November 2002). For further readings, see George Wei, *An Introduction To Genetic Engineering, Life Sciences and The Law* (2002) *supra*, note 4; Michael J Reiss and Roger Straughan, *Improving Nature? The Science and Ethics of genetic engineering* (2001) *supra*, note 4; Kristin Dawkins, *Gene Wars: The Politics of Biotechnology* (New York, Seven Stories Press 1997); Sigrid Sterckx (ed), *Biotechnology, Patents and Morality* (Aldershot: Ashgate Press, 2000); Philippe Georges Ducor, *Patenting the Recombinant Products of Biotechnology* (London: Kluwer Law International, 1998); Sheldon Krimsky, and Roger P Wrubel, *Agricultural Biotechnology and the Environment: Science, Policy and Social Issues* (Champaign: University of Illinois Press, 1996).

[154] See Donald J MacKenzie, "International Comparison of Regulatory Frameworks for Food Products of Biotechnology" *supra*, note 153 at 8.

[155] *Argentine Canola* has been engineered to express seven different traits: (i) tolerance to Imidazoline herbicide, specifically imazethapyr; (ii) tolerance to Phosphinothricin (PPT) herbicide, specifically glufosinate ammonium; (iii) tolerance to Glyphosate herbicide; (iv) tolerance to Oxynil herbicide, including bromoxynil; (v) modification of seed fatty acid content, specifically high laurate levels and myristic acid production; (vi) modification of seed fatty acid content, specifically high oleic acid, low linolenic acid content; (vii) modification of pollination control system: male sterility and fertility restoration. See *Essential Biosafety, The latest scientific and regulatory information for genetically modified and other novel crops and foods*. *Agbios*, CD-ROM, 2nd ed, (Ontario, 2002) available at www.agbios.com.

[156] Carnation has been genetically altered to increase shelf-life due to reduced ethylene accumulation through introduction of truncated aminocyclopropane cyclase (ACC) synthase gene; Sulfonylurea herbicide tolerance, specifically triasulfuron and metsulfuron-methyl. See *Essential Biosafety*, *ibid*.

[157] Chicory has been genetically altered to achieve male sterility; Sulfonylurea herbicide tolerance, specifically glufosinate ammonium, *ibid*.

[158] Maize has been genetically altered to achieve sterility in male and to be tolerant to Glyphosate herbicide, Imidazoline herbicide, Phosphinothricin herbicide, Cyclohexanone herbicide, and be resistant to European corn borer and corn root worm, *ibid*.

[159] Melon has been genetically altered to achieve delayed ripening by introduction of a gene that results in degradation of a precursor of the plant hormone, ethylene, *ibid*.

[160] Papaya has been genetically altered to resist "viral infection, papaya ringspot virus (PRSV)", *ibid*.

[161] Potato has been genetically altered to develop resistance to "Colorado potato beetle (*Leptinotarsa decemlineata*, Say)", *ibid*.

[162] Rice has been genetically altered to be tolerant to "Imidazolinone herbicide", *ibid*. It has also been genetically altered to produce beta carotene, the precursor of vitamin A (golden rice). See Kitta MacPherson, "Getting out of the lab and into the world: The effort to bring genetically engineered crop to developing countries takes a tangled path" *The Star Ledger*

beet,[165] tobacco,[166] tomato,[167] and wheat[168] are GM food plants which have passed regulatory approval,[169] while GM cotton has also been approved for commercial cultivation.[170] The crops have been genetically modified to develop traits such as a longer shelf life, resistance to insect pests, diseases, and tolerance to herbicides which would allow farmers to eliminate weeds without harming the crops.[171] Scientists also have the intention to engineer food crops to express pharmaceutical properties.[172] For example, scientists

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(7 January 2002) http://www.nj.com/specialprojects/index.ssf?/specialprojects/rice4.html (last accessed 18 April 2002).

163 Soybean has been genetically altered to tolerate "Glyphosate herbicide, Phosphinothricin herbicide." Its "seed fatty acid content, specifically high oleic acid expression" has also been modified. *Supra*, note 155.

164 Squash has been altered genetically to resist "viral infection, water melon mosaic virus (WMV) 2, zucchini yellow mosaic virus (ZYMV), and cucumber mosaic virus (CMV)", *supra*, note 149.

165 Sugar Beet has been genetically modified to tolerate "Phosphnothricin (PPT)" and "Glyphosate herbicides", *ibid*.

166 Tobacco has been genetically modified to tolerate "Oxynil herbicide", *ibid*.

167 Tomato has been genetically altered to achieve "delayed ripening by introduction of a gene that results in degradation of a precursor of the plant hormone, ethylene", delayed softening through suppression of polygalacturonase (PG) enzyme activity, to achieve "resistance to lepidopteran pests including, but not limited to, cotton bollworm, pink bollworm, tobacco budworm", *ibid*.

168 Wheat has been genetically modified to tolerate "Imidazolinone herbicide, specifically Cyanamid AC299 263 (imazamox, active ingredient)", *ibid*.

169 The following countries have regulatory approvals for commercial cultivation of the crop indicated against their names: Argentine Canola, Canada (1995); Japan (1997, 1998); United States (1995), Australia, (2002) See *Essential Biosafety*, *supra*, note 143 for the different types of Argentine Canola, and year of approval by the aforementioned countries. For Carnation (Delayed ripening), Australia (1995); European Union (1998); for Carnation flower colour, Australia (1995); European Union (1997, 1998). For other crops mentioned above, see *Essential Biosafety*, *supra*, note 155, for countries and year of regulation.

170 Quite a few of these are commercially cultivated, although not yet rice or wheat, the main staples. Cotton has been genetically modified to resist "lepidopteran pests" and to tolerate "oxynil herbicide", Sulfonylurea herbicide" specifically triasulfuron-methyl." *Ibid*.

171 The main (almost total) modifications have been the insertion of genes which make plants herbicide tolerant, the insertion of genes to permit the manufacture of toxins which are primarily toxic towards Lepidoptera. Very little else has been commercialized (as yet). Ibid. See also Eric S Grace, *Biotechnology Unzipped: Promises and Realities*, *supra*, note 6 at 97-132.

172 See Anne Simon Moffat, "Exploring Transgenic Plants as a New Vaccine Source" *Science*, vol 268 (5 May 1995) at 658-659. The author discussed the prospects of transgenic plants embodying vaccines that could be eaten. He argued that it should be cheaper, easier to store and administered than conventional drugs. He further noted that this would be of immense value to developing countries. In the US for instance, there has been field trials of genetically engineered pharmaceutical corn. This is not approved for human consumption, and the recent reported contamination of such corn with ordinary corn fields in Iowa necessitated the destruction of 155 acres of Iowa corn on the order of the US Department of Agriculture in September 2002. This has invoked the furor of environmentalist and biotech activists. See Justin Gillis, "Biotech Firm Mishandled Corn in Iowa" *Washington Post* (14 November 2002) at E01. In the US and Canada, the biotech industry is reportedly taking voluntary precaution by "adopting a broad moratorium on planting certain types of crops in major food-producing regions." According to the executive director for food and

at Cornell University in the United States have created bananas that contain a vaccine for hepatitis B.[173] Commercial cultivation of GM crops made its debut in the US in 1996.[174] Four countries—Argentina, Canada, China and USA—account for 99 per cent of the global GM acreage.[175]

In the livestock sector, scientists have sought to improve the health, quality and productiveness of farm animals.[176] For dairy farmers, one of the first genetically modified products was the "bovine somatotropin" (BST) or bovine growth hormone (BGH).[177] It occurs naturally in the pituitary gland of cattle and is responsible for promoting growth in calves and regulation of milk production.[178] This product has been evaluated by the World Health Organisation, and approved by the US Food and Drug Administration as an

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agriculture at the Biotechnology Industry Organisation, Michael J Phillips, the new precautionary policy was taken to prevent a repeat of the genetically engineered StarLink corn debacle in 2000, where the corn, which was approved for animal feed only, found its way into the food chain. See Justin Gillis, "Biotech Industry Adopts Precaution" *Washington Post* (22 October 2002) at E01. The subsequent StarLink-contaminated products recall "cost Aventis an estimated $1 billion and the U.S government at least $13 million". See Soil Association, *Seeds of Doubt*; (2002), *supra*, note 13 at 32-34.

[173] See "Feeding the Five Billion: New Agricultural Techniques Can Keep Hunger At Bay" *The Economist*, *supra*, note 5.

[174] See Soil Association, *Seeds of Doubts*, *supra*, note 13.

[175] *Ibid*. After the US, China is said to the next country where GM crops have been enthusiastically embraced. In 1999 for example, while the US invested approximately US$2 to US$3 billion on GM technology, China had spent US$112 million. Though a modest figure, it ranked first in the developing world and was far ahead of the combined figure of US$15 million for India and Brazil. A new survey also showed that Chinese were working on more plant biotechnology products than anyone outside North America. See Huang J *et al*, "Plant Biotechnology in China" (2002) Science, 295 at 674-677; Tom Clarke, "China leads GM revolution: Government funding puts Chinese plant biotechnology second only to US" Nature online, (25 January 2002), available at http://wwww.nature.com/nsu/020121/020121-13.html (last accessed 15 November 2002).

[176] Apart from seeking to improve the quality of dairy, eggs, beef *etc*, farm animals and other mammals have been the subject of intense scientific research for medical purposes. An example is "Tracy" the sheep, to whom copies of the human gene that makes AAT-*antitrypsin* (a critical protein, the deficiency of which causes emphysema, a fatal, incurable human lung disease) were successfully transferred by researchers at PPL Therapeutics in Edinburgh. Emphysema can also be caused by cigarette smoking, DNA genetic mutations, or exposure to other airborne irritants. The disease could only be cured by the infusion of approximately 200 grams of AAT per year. Tracy was able to produce approximately 35 grams of AAT in each litre of her milk. This was a considerable feat compared to the more expensive method of squeezing the proteins out of extremely large amount of human blood. See R James, "Human therapeutic proteins generated in animals" (1993) *The Genetic Engineer and Biotechnologist*, 13 at 189-197. See also Michael J Reiss *et al*, *Improving Nature? The Science and ethics of genetic engineering*, *supra*, note 4 at 165-193. Other medical experiments involving mammals are the "Harvard Onco mouse", (*Ex Parte Allen*), *supra*, note 4; transgenic pigs, whose internal organs were coated with human proteins to make them suitable for transplanting into humans *etc*. See Michael J Reiss, *Improving Nature? The science and ethics of genetic engineering*, *ibid*.

[177] See Eric S Grace, *Biotechnology Unzipped: The Promises and Realities*, (1997), *supra*, note 6 at 100.

[178] See Eric S Grace, *ibid*.

animal drug.[179] According to Eric S Grace, the hormone was engineered by bacteria, using relevant cows' genes as templates.[180] The engineered hormone is capable of boosting a cow's yield by up to 30 percent.[181]

The application of genetic engineering to agriculture has been variously hailed as the surest means of achieving food security, through expected yields in crops and livestock production.[182] According to the World Health Organisation, crop protection was the primary reason GM plants were developed, with a view to increasing yields.[183] Jikun Huang *et al*[184] argued that depression had trailed the global food production in the wake of the green revolution boon of the 1960s and 1970s,[185] while the expected "demographic pressure" in this century could precipitate a global food deficit.[186] They maintained that "conventional breeding, as well as emerging technologies based on molecular biology, genetic engineering and natural resource management will continue to improve productivity in the coming decades."[187]

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[179] See "Summary of Evaluations Performed by the Joint FAO/WHO Expert Committee on Food Additives". It is classified as a veterinary drug (milk production aid): see http://jecfa.ilsi.org/evaluation.cfm?chemical=BOVINE%20SOMATOTROPIN (last accessed 16 November 2002). The FDA approval was given in 1993 by the Center for Veterinary Medicine. See "BST Increases Feed Intake and Milk Production", *supra*, note 7.

[180] Eric S Grace, *ibid*.

[181] Eric S Grace, *ibid*.

[182] See Bourlaug Norman E, "Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry", *supra*, note 11; "Feeding the five billion: New agricultural techniques can keep hunger at bay" *The Economist*, *supra*, note 5; Anthony Trewavas, "Malthus foiled again and again" (2002) Nature 418 at 668-670; Philip H Abelson, "The Third Technological Revolution" (27 March 1998) *Science*, vol 279 at 2019; Jimmy Carter, "Biotechnology Can Defeat Famine" *New Perspectives Quarterly*, vol 14, (November 1997) at 32-33.

[183] See the World Health Organisation's "20 Questions on Genetically Modified (GM) Foods", available at http://www.who.int/en/ (last accessed 15 November 2002).

[184] Jikun Huang, Carl Pray and Scott Rozelle, "Enhancing the crops to feed the poor" (8 August 2002) *Nature*, vol 418, available at www.nature.com/nature (last accessed 15 November 2002).

[185] See Jikun Huang *et al*, *ibid*.

[186] See Jikun Huang *et al*, *ibid*. According to the authors, "…the world population will reach 8 billion by 2025. In order to meet the corresponding demands for food, they posited that "food and feed production must continue to rise annually by 1.2%....." While countering the Christian Aid report that genetic manipulation was not needed because enough food could be grown without it, Anthony Trewavas contended that food supply could not be guaranteed. He cited the devastating US corn diseases in 1971 and the Irish mass starvation of the 1840s. He argued further that the world population would have increased by 2.3 billion in 2025 and that an average annual increase in food production of 1.3% would be needed. See "Much food, many problems", *supra*, note 19.

[187] See Jikun Huang, *supra*, note 184. See also GJ Persley and JJ Doyle, "Biotechnology for developing-country agriculture: problems and opportunities" *In Shed agenda: perspectives on overcoming hunger, poverty, and environmental degradation*, International Food Policy Research Institute (IFPRI), (Washington, 2001) at 239-243; Qaim AF Krattiger and JJ Braun Von, *Agricultural biotechnology in developing countries: towards optimizing the benefits for the poor* (Boston, MA: Kluwer Academic Publishers, 2000); Bourlaug Norman, "Ending World Hunger. The Promise Of Biotechnology and The Threat Of

They also maintained that there is virtually no difference between GM food and non-GM food, and that the former is as safe as the latter.[188] According to Dr Peter Raven of Missouri Botanical garden, "[h]undreds of millions of people are eating GM food, and as far as I know no one has gotten sick and no one has posed a plausible theory of why they would get sick."[189] However, the hypothesis that GM technology and food are the panacea to world hunger, in the expected higher yield and consequent surplus and cheaper food has been disputed by some scientists.[190]

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Antiscience Zealotry", *supra*, note 11; "High-yield rice for West Africa", *BBC News* (28 March 2002), available at http://news.bbc.co.uk/hi/english/world/africa/newsid_1899000/1899097.stm (last accessed 17 November 2002)

According to Anthony Trewavas, "A new agriculture, combining genetic modification technology with sustainable farming is our best hope for the future." While maintaining the indispensability of GM technology in future agriculture, he said further that "the future will demand agriculture to be both flexible and diverse in technology, but efficient in land use. Farmers will have to be highly skilled at using technologies that must sustain farming for thousands of years." See "Much food, many problems", *supra*, note 19.

188 The FDA's safety assessment criterion of GM food or product with GM content is the principle of "substantial equivalence". It was endorsed by the Food and Agricultural Organisation and World Health Organisation Consultation in 1996. It means treating GM food or GM food components which are substantially equivalent to existing or conventional food components as the same. Lauterburg opined that the doctrine "is not a substitute for a safety assessment but a part of the assessment process." In applying the concept to GM food safety assessment, it must be shown that the GM food is as safe as its conventional counterpart "through a consideration of both the intended and unintended effects of the products." See Dominique Lauterburg, *Food Law: Policy & Ethics* (2001), *supra*, note 2 at 162-163.

189 Quoted by Sharon Tisher in "Report from Harvard Conference on Biotechnology" held in September 2-3 1999 by Harvard University, *Maine Organic Farmers and Gardens Association*, (MOFGA) available at http://mofga.org/tm129902.html (last accessed 30 October 2002), on file with the author.

190 Top UK aid agencies recently told the British Prime Minister, Tony Blair, that genetically modified foods would not solve world hunger, but might actually increase it. See Geoffrey Lean, "GM food will not ease hunger" *The Independent* (10 November 2002) available at http://www.news.independent.co.uk/uk/environment/story.jsp?story=350544 (last accessed 27 November 2002).

In his testimony before the Senate Subcommittee in Washington, Brian Halweil, while acknowledging that biotechnology played some role in "the alleviation of malnutrition", contended that "the dominant causes of poverty and hunger around the world are not technological in nature, but rooted in basic socioeconomic realities……" He said further that global biotechnology was concentrating "the vast majority of its investments into a limited range of products for which there are large secured markets within the capital-intensive production systems of the First World—products which are of little relevance to the needs of the world's hungry." He compared "the $4 million that has been spent on developing Beta-carotene enhanced rice for use in Vitamin A deficient populations with the $500 million spent on developing Roundup-Ready soybeans, the dominant herbicide resistant variety." He advised further that the technology was inimical to abundant plant biodiversity in developing countries due to "the risk of cross-pollination between genetically engineered crops and wild relatives……" See Brian Halweil, "Testimony from Senate Subcommittee on International Economic Policy, Export and Trade Promotion at the Hearing on "The Role of Biotechnology in Combating Poverty and Hunger in Developing Nations" (12 July 2000) available at http://www.worldwatch.org/biotech/bhtest.html (last accessed 30 November 2002). See also Five Year

Similarly, the environmental merits of GM technology and the safety of GM food have been queried.[191] Critics contend that herbicide and pesticide

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Freeze, "Feeding or fooling the world? Can GM really feed the hungry?" (October 2002) www.fiveyearfreeze.org (last accessed 17 November 2002). The report contested the biotech industry claims that GM technology in agriculture was the key to resolving world hunger.

[191] Public and environmental health concerns have been raised by scientists as diverse in their fields as medical doctors, ecologists, environmental scientists, biologists, environmental activists, and NGOs with similar interests, who perceive GM crops as threats to the integrity of the world's plants genetic resources. For instance, the British Medical Association has been consistently opposed to commercial cultivation and field trials of GM plants. The body is at present pressuring the Scottish Executives to renege on its support for GM field trial in Scotland. According to them, "...further research is required into the health and environmental effects of GMOs before they can be permitted to be freely cultivated…This may be executed in such a way as not to expose the population to possibly irreversible environmental risk, which may, in turn, have as yet unquantified public health implications." See David Scott, "Crop trials must stop, say doctors" *The Scotsman* (19 November 2002) available at http://www.thescotsman.co.uk/index.cfm?id=128469002 (last accessed 21 November 2002). See also Vandana Shiva, *Protect or Plunder: Understanding Intellectual Property Rights* (2001), *supra*, note 15.

They also fear that GM crops could and are now actually undermining non-GM crops due to documented evidence of contamination. The contamination usually occurred through pollen transfer from GM to non-GM crops, during harvesting, transfer and storage of crops. See Katie Eastman and Jeremy Sweet, *Genetically modified organisms (GMOs): The significance of gene flow through pollen transfer* (Copenhagen: European Environmental Protection Agency, 2002) available at http://europa.eu.int (last accessed 18 November 2002). See generally Soil Association, Seeds of Doubt (Bristol, 2002), *supra*, note 13 at 32-34. See also Mike Toner, "Alarms over Biopharming cast doubt on gene altering" *The Atlanta Journal and Constitution* (November 17, 2002) at 7. The author reported the recent contamination of non-GM corn by genetically modified cornhusks in a Nebraska elevator, and expressed doubts on the government's ability to protect the nation's food from crops genetically engineered to produce drugs and chemicals. Still on the safety of GM farm products, the BST or BGH offers another case study in the controversies surrounding the advent of genetic engineering in agriculture. The veterinary drug (BST or BGH) which is designed for boosting milk production has come under fire. Objections range from the ethical propriety of putting the animals under such considerable strain for pure economic reasons. See Michael J Reiss and Roger Straughan, *Improving Nature? The Science and ethics of genetic engineering* (2001), *supra*, note 4 at 165-193. See also Eric S Grace, *Biotechnology Unzipped: Promises and Realities*, *supra*, note 6 at 96-108.

Another objection to the milk-boosting technology synthetic hormone sold by Monsanto under the brand name of "Posilac" centered on its alleged health risks for man and cattle, despite the FDA approval and Monsanto's assurances that the synthetic hormone poses no health risk to cattle or man. Some scientists and farmers still remain sceptical of the technology. For instance, Dr Samuel Epstein, a scientist at the University of Illinois, who has advised the Congress on several occasions on cancer-causing agents in the environment, and who has three medical degrees and has written eight books, said of BGH: "…there are highly suggestive if not persuasive lines of evidence showing that consumption of this milk poses risks of breast cancer and colon cancer."

In the same vein, Charles Knight, a Florida Dairy farmer who had used Monsanto's Posilac described the corresponding health problems amongst his herds as follows: "About the same time we began having a lot of foot problems with our cows because they got so crippled they couldn't walk". This was by no means peculiar to Charles Knight's cows. According to Monsanto research, hundreds of other cows on other farms were suffering from hoof problems and *mastitis*, a painful infection of the cow's udders. If left untreated

tolerant crops are encouraging the use rather than decreasing the use of chemicals on the farmlands.[192] They allege that these chemicals are potentially harmful to humans, microorganisms, and other living things whose existence are critical to sustainable farming and the survival of the fragile biodiversity.[193]

On the economic front, critics, environmental activists, farmers NGOs, *etc*, are ever suspicious of a clandestine corporate control agenda of the world's food production through the instrumentality of intellectual property rights protection regime.[194] The drought-stricken southern African countries

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with antibiotics, the infection could get into the cow's milk. Even Posilac label warned that "…use of Posilac is associated with increased frequency of the use of medication in cows for *mastitis*……"

Also, while commenting on the propriety of FDA's approval of BGH, Dr William von Meyer, a research scientist, who has spent 30 years studying chemical products and testing their effects on humans, said: "A human drug requires two years of carcinogenic testing and extensive birth defect testing. BGH was tested for 90 days on 30 rats at any dose before it was approved". However, Dr Robert Collier, Chief Monsanto BGH scientist, countered that BGH "…is the most studied molecule certainly in the history of domestic animal science" and that "The public can be confident that milk and meat from BGH-treated cows is safe to consume". Nonetheless, a United Nations Committee has insisted that BGH needed more studying, and that it was too early to permit a worldwide sale of BGH. See BGH BULLETIN available at http://www.foxbghsuit.com/ (last accessed 10 November 2002). See also M Hallberg (ed), *Bovine Somatotropin and Emerging Issues* (Boulder, Colo: Westview Press, 1992). The author highlighted the downside of the technology and how it could be properly managed to minimize risks to man and animal health. See also Daniel Bellow, "Vermont, the Pure-Food State" *The Nation*, vol 268, (March 8, 1999) at 18. The author discussed the tussle between the Vermont State government in the US and Monsanto over the use of Posilac to increase milk production in cows. The reluctance of the state of Vermont government to adopt Posilac was attributed to the research that linked the drug to breast and prostrate cancer.

[192] See Soil Association, *Seeds of Doubt* (2002), *supra*, note 13.

[193] See IC Munro and RL Hall, in JF MacDonald (ed), *Agricultural Biotechnology, Food Safety, and Nutritional Quality for the Consumer* (Ithaca, NY: National Agricultural Biotechnological Council, 1991) at 64-73; Soil Association, *Seeds of Doubts*, (2002), *supra*, note 13. See also Eric S Grace, *Biotechnology Unzipped: Promises and Realities*, (1997), *supra*, note 6. See also Madeleine Nash, "Grains Of Hope" *Time* (31 July 2000) available at http://www.time/archive/preview/0,10987,1101000731-50576,00.html (last accessed 20 October 2002).

[194] According to the United Nations Human Rights Commission's food envoy, Jean Ziegler, "there is absolutely no justification to produce genetically modified food except the profit motive and the domination of the multinational corporations." See *Reuters*, "U.N food envoy questions safety of gene crops" (15 October 2002) available at http://www.reuters.com/news (last accessed 5 November 2002). There is a perception that the farmer's right to save seeds for replanting is under a considerable threat by the corporatisation and commercialisation of seeds. They argue that encroaching on the farmer's right to seeds is a major threat to world's food security. See Vandana Shiva, *Protect Or Plunder: Understanding Intellectual Property Rights*, (2001), *supra*, note 15. According to the Soil Association's report, "Du Pont and Monsanto are the largest seed companies in the world with combined sales excess of $3.5 billion in 2000": see *Seeds of Doubt*, (2002), *supra*, note 13 at 39. See also Kristin Dawkins, *Gene Wars: The Politics of Biotechnology* (New York: Seven Stories Press, 1997). The author affirmed the presence of a definitive corporate agenda for the control of genetic engineering food plants. She

had initially rejected the GM food aid from the United States. With the exception of Zambia, they later reneged on their refusal, on condition that the donated corn should be monitored to prevent farmers from planting them.[195]

The main grounds for refusing the food aid were public health safety concerns, environmental concerns (fear of contamination with local species should the corn be rerouted for planting) and the fear of losing their wholly non-GM export markets (mainly to the European Union).[196] According to the Zambian president, "There is no justification for feeding people poison."[197] Undoubtedly, this was an emphatic and definitive exercise of the

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warned of the inevitable backlash in genetic diversity depletion and the consequent exposure of millions to hunger. See also Cary Fowler and Pat Mooney, *Shattering: Food, Politics, and the Loss of Genetic Diversity* (Tucson: University of Arizona Press, 1990); *The Economist*, "The Knowledge Monopolies: Patent Wars", *The Economist* (18 April 2000) at 85-89; Michael Perelman, *Steal This Idea*, (2002) at 127-128, *supra*, note 15; and Jeffrey Kluger, "The Suicide Seeds" *Time*, vol. 153 (1 February 1999) at 44. A commentary on Monsanto's patented "terminator technology", which made it impossible for farmers to save seeds bought under license from Monsanto. The harvested seeds would not germinate if replanted. This was widely seen as a self-help mechanism for the enforcement of Monsanto's patents in seeds sold to farmers, and has been strongly opposed by various interest groups who are calling for its ban. See ETC Group, "Ban Terminator Before It's Too Late", an e-mail newsletter posted on the web on 5 April 2002, available at www.etcgroup.org, on file with the author. See also B Visser *et al*, "The impact of 'terminator' technology", *Biotechnology and Development Monitor* 48 (2001) at 9-12. Where the terminator gene is not used, Monsanto usually resorts to court to enforce any suspected breach of its intellectual property rights in its seeds. See *Percy Schmeiser and Schmeiser Enterprises Ltd* v *Monsanto Canada Inc. and Monsanto Company* [2002] FCA 309. The Canadian Court of Appeal upheld the decision of Mr. Justice MacKay of the trial Division of 29 March 2001 as reported in *Monsanto Canada Inc* v *Schmeiser* [2001], 202 FTR 78, 12 CPR (4th) 204, [2001] FCJ No 436 (QL). The Court of Appeal found the appellant liable for infringing Monsanto's patent number 1,313,830 in 1998 by planting for harvest a crop of glyphosate resistant canola having a gene or cell that is the subject of the patent.

195 Specifically, Zimbabwe asked to be allowed to mill the corn to ensure that they could not be replanted. See generally, David Gollust, "Africa Raises Questions on 'Biotech' Food" *BBC News* (2002), *supra*, note 1; James Lamount and Daniel Dombey, "Brussels refuses to back U.S. over GM food for Africa" *Financial Times* (2002), *supra*, note 1; Jon Jeter, "Famine Sweeps Southern Africa: Millions Suffering in Crisis Created by Nature, Exacerbated by Man" *The Washington Post*, (2002), *supra*, note 1; James Lamont, "Zambia turns away GM food aid for its starving" *Financial Times* (2002), *supra*, note 1; and David Gollust, "Zimbabwe eases GM stance" *BBC News* (2002), *supra*, note 1.

196 The United States has criticised the European Union for discouraging African countries from adopting the GM technology. Specifically, there was a rift between the US and the UK officials over GM food in Johannesburg, at the UN's August 2002 Conference on sustainable development. Tony Blair's chief scientific adviser had denounced the United States' attempts to force the technology into Africa as a "massive human experiment". See Mark Townsend, "Blair Urges Crackdown on Third World Profiteering" *The Observer* (1 September 2002), available at http://www.observer.co.uk/uk-news/story/0,6903,784262,00.htm (last accessed 31 October 2002).

197 According to a BBC report, Zambia was so adamant in its GM food aid refusal that it declined a US$50 million line of credit from the US Department of Agriculture because of provisions that it would have to purchase GMO commodities. See "Zambia 'ignored

consumer's choice at the institutional level.[198] It started with the knowledge of GM food existence, and culminated in a decisive decision. But was the decision justified in the face of imminent starvation? US officials have described Zambia's basis for GM rejection as baseless, while the World Health Organisation declared that all GM foods have been assessed for safety, and "are not *likely*[199] to present risks for human health."[200]

The UN food envoy with the United Nations Human Rights Commission, Jean Ziegler, however, viewed GM food differently from the WHO. According to him, "all nutritionists, the highly qualified biologists and these NGOs say there is a risk for the human body over the long term…They say we have not reached a security level. I believe them."[201] However, the World Health Organisation and the Food and Agricultural Organisation have resolved to evaluate the safety and nutritional aspects of food derived from genetically modified plants, micro-organisms and animals.[202] According to WHO, such an assessment would consider health benefits as well as possible negative health implications.[203]

The Southern African food aid saga has rekindled the debates on the safety of GM food. What is the propriety of their rejection? Is GM really safe? Is it good for the environment? Should GM food be labelled? Is there a legal or ethical basis for consumer's right to know? These questions

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science' over GM" *BBC News* (31 October 2002), available at http://www.bbc_Africa/bbc_africa.html (last accessed 31 October 2002).

198 Zambia might not legally qualify as a consumer since the rejected GM corn was a gift from the United States. But critics argued that the gift was no more than an advertisement gimmick to secure GM seed market for the biotechnology companies in Zambia. See Thabo Thakalekoala, "Away with Genetically Modified Organisms" *The Survivor*, *supra*, note 1.

199 Emphasis added. There is no definitive assurance from the WHO, FAO or the biotechnology industry that GM food is completely free of risks to human health. Are people justifiably afraid then? The recent string of food disasters and contamination in the UK, largely attributed to modern intensive farming, has contributed to GM scare particularly in Europe. Besides, there is ample evidence of well-intentioned technologies that went horribly bad. The asbestos which gave rise to medical disabilities is one of such. Furthermore, people have queried assurances issued by biotechnology industry or individuals or groups with vested interested in the science. This is justifiably so. After all, the tobacco industry continued to push aggressively its advertisement propaganda and to deny that the product had anything to do with cancer until finally proven wrong, and the imperative for the industry's regulation was deemed expedient. See also Byron Kaufman, "It's too soon yet to say that GM foods are safe" *The Canberra Times* (30 October 2002), available at http://canberra.yourguide.com.au/detail.asp?Class=your%say&subclass=genera (last accessed 10 November 2002).

200 See The Lancet, "How Safe is GM Food", vol 360 (26 October 2002) at 1261, available at www.thelancet.com (last accessed 14 November 2002); Cantani A. and Micers M. "Genetically modified foods and children potential health risks" *European Review for Medical and Pharmacological Sciences* 5 (1), (2001) at 25-29

201 See "U.N food envoy questions safety of gene crops", *Reuters*, *supra*, note 194.

202 See *The Times of India*, "World Health Organisation to Examine Safety of GM Foods", *The Times of India* (25 January 2002) at 8

203 See The Lancet, "How Safe is GM Food", *supra*, note 200.

transcend mere rhetoric and are bereft of definitive answers as policy makers continually grapple with GM food governance. The following section will examine GM food regulation in Singapore vis-à-vis the EU, US and other jurisdictions where Singapore's food is imported from. The role of the consumer in shaping GM policies as well as the underlying ethical and legal issues will be discussed.

## IV. FOOD PRODUCTION IN SINGAPORE

Singapore's agricultural sector which boasted of some 20,000 farms on 14,000 hectares of land in the 1960s was predominantly traditional in nature.[204] The traditional farming of the 1960s gave way to intensive commercial farming in 1970s.[205] By 1980s however, a drastic reduction in agricultural land precipitated mechanised farming and the development of "high-tech modern farms".[206]

The increasingly dwindling agricultural land however put a cap on food self-sufficiency levels by 1990s.[207] This necessitated reliance on food imports from the EU, USA, Australia, New Zealand, Brazil, China and a number of ASEAN countries.[208]

### A. *Regulating GM Food in Singapore: A Comparative Analysis*

The Genetic Modification Advisory Committee (GMAC) was set up in April 1999 by the Agri-Food & Veterinary Authority (AVA) and the Agency for Science, Technology and Research (A* Star).[209] The primary role of GMAC is to oversee and advise on the research and development, production, use, and release of GMOs in Singapore.[210] GMAC is charged

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[204] See the website of the Agri-Food & Veterinary Authority of Singapore at http://www.ava.gov.sg/JAVASCRIPT/m1-option1.html (last accessed 20 November 2002).

[205] During this time, Singapore was self-sufficient in poultry production. According to the website of Agri-Food & Veterinary Authority of Singapore, self-sufficiency in poultry was 80%, eggs production, 100%, and pork production, 104%. See the website of the Agri-Food & Veterinary Authority of Singapore, *supra*, note 204.

[206] The Primary Production Department (PPD) which was responsible for regulating the local farming and fishing industry was formed in 1959. (On 1 April 2000, PPD was reconstituted as a statutory board with the name of Agri-Food Veterinary Authority (AVA)). It was closely involved in training, advising and equipping the farming community to adjust to the diminishing agricultural land and helped to ensure the supply of affordable and safe food. *Supra*, note 204.

[207] *Ibid*.

[208] These ASEAN countries are Malaysia, Indonesia, and Thailand. According to the AVA, Singapore's food supply was diversified to ensure "resilience" in food supply; and stability in food prices. *Ibid*.

[209] *Supra*, note 199. Singapore's AVA is the equivalent of the United States' FDA, or USDA as far as regulating and monitoring of GMOs related products are concerned.

[210] See Singapore Guidelines On The Release Of Agriculture-Related Genetically Modified Organisms (GMOs) (July 1999) available at http://www.gmac.gov.sg/download/Agriculture_Guidelines.doc (last accessed 22 November 2002).

with the responsibility for developing biosafety guidelines on GMOs and ensuring the guidelines' hamonisation and compliance with international standards.[211] It also has the authority to recall any genetically modified organisms approved for release based on its assessment of new information.[212] GMAC also advises the AVA, which has the power to *inter alia* "implement an integrated food safety system that regulates the safety of food supply in Singapore."[213]

Singapore has a favourable policy towards biotechnology development.[214] The AVA had seen agrotechnology as a veritable means of maximising output from Singapore's limited agricultural land.[215] To this end, it is investing in and offering Singapore as an investment hub for "product development, commercialisation of laboratories, production of agri-biotechnological materials, and provision of tropical agrotechnology services for the agriculture industries in the region."[216]

Singapore's pro-agrobiotechnology policy squares with that of the United States, and is in contrast to the E.U which still has a *de facto*

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[211] *Supra*, note 210.

[212] *Supra*, note 210.

[213] See Section 12 (b) of the Agric-Food & Veterinary Authority Act Cap 5, 16 of 2000 (as revised in 2001). The functions of the AVA are stated in section 11 (1) (a)-(g) of the Act. Other powers of the AVA include Section 12 (a): "to prescribe, regulate or implement measures and standards on any matter related to or connected with agri-food and veterinary sectors, and liaise or collaborate with any other organisation for the purpose of determining the standards to be prescribed"; 12 (c) "regulate the importation, production, processing, storage and distribution of food products related to or connected with agri-food and veterinary sectors." See generally section 12 (d) - (f) of the Act for more of the AVA's powers: *supra*, note 204.

[214] See http://www.biomed-singapore.com and http://www.a-star.gov.sg/astar/upload/mid1/type14/cat63/444_312 (last accessed 22 November 2002) for further details on government's grooming of the biotechnology sector as a strong alternative manufacturing sector. It is an economic strategy to diversify Singapore's manufacturing sector which is dominated by electronics. The government has invested millions of dollars and has continually supported the budding biotech industry with a view to making Singapore a global biotechnology hub. See George Wei, *An Introduction to Genetic Engineering, Life Sciences and the Law*, *supra*, note 4 at 276- 277.

[215] In order to achieve this objective, the AVA embarked on a three-pronged agrotechnology programme. These are:
"The development of Agrotechnology Parks in Singapore to house modern intensive farms."
"The development of agrotechnology and agri-biotechnology (the latter defined as "the knowledge in agriculture and molecular biology applied to large-scale intensive farming")."
"The promotion of investments in agri-industry." *Supra*, note 204.

[216] *Supra*, note 199. For instance, the AVA, in collaboration with GEA-NUS Pharmaceutical Processing Research Laboratory, recently co-partnered a project with the Tropical Marine Science Institute in Singapore. The researchers were working on a special nutritional supplement with the aim of tapping into the S$275 million global larva feed market for hatcheries. The Tropical Marine Science Institute which was launched on 4 October 2002 has a S$12.8 million facility for research in varied areas ranging from combating pollution, coastline development to long term-health of Singapore waters. See Chang Ai-Lien, "Lab's feed for small fry set to net big bucks" *The Strait Times* (4 October 2002) at H2.

moratorium on GM field trial and mandatory GM food labelling,[217] or Australia and New Zealand where mandatory GM food labelling exists.[218] Though Singapore differs from the United States (where farmers plant almost 70 per cent of all GM seeds),[219] the EU, Australia and New Zealand in terms of agricultural output, the basis for equating Singapore's pro-GM agricultural policy to that of the US is founded on both her heavy investments in the agrobiotechnology sector[220] and her collaborative GM-crops related research outreach beyond her shores.[221] Examples include GM field trials in China and New Zealand with researchers and scientists from both sides,[222] while there is good prospect for similar collaboration with other ASEAN countries where field trials of laboratory researches could be tested.[223]

Furthermore, unlike the EU, Australia and New Zealand, there is no requirement for GM food labelling in Singapore.[224] The Singapore's Sale

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[217] See D Butler, "Europe gets tough on labeling genetically modified foodstuffs", (November 7, 2002) *Nature* 418, (6894) at 114; A.G Halsberger, "Monitoring and Labeling for genetically modified products" (2000) *Science* 287 (5452) at 431-432

[218] See Michael Mann, "EU ban stays on new GM crops" *Financial Times* (18 October 2002) at 6. In the UK, for example, there is an ongoing public debate on whether commercial production of approved GM crops should be undertaken. The British Medical Association, The Soil Association, Greenpeace and other NGOs are opposed to such moves. For instance, senior doctors in Scotland recently demanded an immediate halt to genetically modified crop trials in a move to pressurise the Scottish Executive to reconsider its controversial backing for the programme. Premising its opposition on public health and environmental safety concerns, the British Medical Association warned that "insufficient care is being taken to protect the public health and that there has been a lack of public consultation about crop trials despite the steady increase in the number of them." On the possible harm to human health, the body said that "there has not been a robust and thorough search into potentially harmful effects of GM foodstuffs on human health. On the basis of the precautionary principle, farm scale trials should not be allowed to continue." See David Scott, "Crop Trials must stop, say doctors" *The Scotsman*, *supra*, note 191.

[219] See David Fin, "Big Players poised to exploit biotech advances" *Financial Times* (14 October 2002) at iii.

[220] See generally George Wei, *An Introduction to Genetic Engineering, Life Sciences and the Law*, (20002), *supra*, note 4.

[221] The comparison is neither based on the degree of investments in agrobiotechnology nor GM food production output (the US is the undisputed world leader in both) but on institutional policy commitment to biotechnology research and applications.

[222] See Sakarindr Bhumiratana, "Report On Biosafety Policy Options And Capacity Building Related To Genetically Modified Organisms In The Food Processing Industry Of Asean" (June 2002), available at http://www.aseansec.ore.i (last accessed 30 October 2002).

[223] At the Institute of Molecular Agro-biology in Singapore, there are intensive research activities on development of plants varieties for resistance to disease, to produce pharmaceutical products and to obtain higher yields. Neighbouring countries are the most likely candidates for testing such transgenic varieties. See Sakarindr Bhumiratana, "Report on Biosafety Policy Options and Capacity Building Related to Genetically Modified Organisms in the Food Processing Industry of Asean", *supra*, note 222.

[224] The GMAC however has a Sub-Committee for food labelling which is looking into the labelling issue. See http://www.gmac.gov.sg/subcommittee-labelling.html (last accessed 22 November 2002). According to the chief executive of agri-food veterinary authority, Ngiam Tong Tau, "the labelling issue is under consideration", while the Commissioner of

Of Food Act[225] only required that packaged food should indicate "the trade name, true measure or volume, the quantity, strength, purity, composition, and proportion of the contents, and the name and address of the importer, manufacture or packer....."[226] There is no allusion to genetically modified food disclosure on packaged food. In Singapore, there has been no formal approval for any GM food product, while only one non-food GM product has been approved for commercial release.[227] Since soy is a major foodstuff for most South-East Asian countries, and most of the countries from which Singapore imports her food are into commercial cultivation of certain GM crops, it is almost certain that products derived from GM are sold in Singapore.[228]

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Public Health, Daniel Wang, said that Singapore was waiting for the Codex Alimentarius Commission's international standard which it would follow: see http://www.gmac.gov.sg/hot_news/20001125.html (last accessed 22 November 2002). In Australia and New Zealand, the mandatory labelling of GM foods was initiated by the Food Standards Australia New Zealand and began in October 2001: see http://www.foodsstandards.gov.au/foodstandardscode/ (last accessed 24 November 2002). Labelling is however not required for GM foods prepared at the point of sale, food with up to 1 per cent inadvertent GM contamination, and foods with up to 0.1 per cent GM flavourings with no novel DNA or protein in the final product which include refined oils, sugars, and starches: see Michelle Brooker, "Quiet start to GM labelling" *Northern Light* (12 October 2001), available at http://special.northernlight.com/gmfoods/quiet_start.htm#doc (last accessed 22 November 2002). In Singapore, labelling is rarely an issue, relative to other big agricultural countries where laboratories are constantly picketed and vandalised and where proposed field trials often sparked public opposition: *supra*, notes 191 and 218 for the ongoing opposition in the UK. Similarly in New Zealand, the accidental planting of genetically modified sweet corn and the alleged cover up became a big political issue which the Jurassic Park star, Sam Neill, described as more serious than the nuclear-free debate. It was so serious that it threatened the Labour government's re-election bid in the 2002 parliamentary elections: see Virginia Marsh, "GM plants scandal crops Labour's poll lead" *Financial Times* (18 July 2002) at 8. Similarly, on 16 November 2002, a consortium of anti-GM activists—"Auckland GE Free Coalition and GE Free NZ"—in food and environment held a GE free March in Auckland. According to Jon Carapiet, the spokesperson for the group, "GE is a powerful experiment on us all. It is scientists and doctors who are warning us of the threat… not just to our food supply and basic rights, but to humanity itself from the insane push to clone human beings. The only way to protect our families, our land and future is to control GE, to keep it contained, and—unless a use is based on ethics—not to use it at all." See Aotearoa, *Independent Media Centre* (17 November 2002) at 12. Both Australia and New Zealand have joint food regulatory procedures established pursuant to the Australia and New Zealand Food Act of 1991, available at http://www.indymedia.org.nz/front.php3?article_id=1893&group=wecast (last accessed 19 November 2002). See also Mildred Leinweber *et al*, "Scientists Brace For Animal Activism: Legal and illegal animal rights actions continue" *The Scientist*, vol 16, issue 23, 53 (25 November 2002).

225 Chap 283 1973 (as amended by 7 of 2002).

226 See section 16, Sale of Food Act, *supra*, note 225.

227 This is the genetically modified blue carnation (cut flowers), which is, however, not approved for cultivation. See Sakarindr Bhumiratana, (June 2002), *supra*, note 222.

228 The author of this paper toured three big groceries and cold stores in Singapore at the time of writing (October to November 2002). There was no special labelling to distinguish GM from non-GM food. When the author asked one of the staffers in one of the foremost grocery stores, she could not say whether they had GM stock or not. It is not unlikely however for labelled GM food from Australia, New Zealand and EU to appear in groceries

According to the information on its website, Singapore's Genetic Modification Advisory Committee confirm the possibility of GM presence in processed foods imported from Australia, Canada, USA and the EU.[229] This is not to suggest that the Agri-Food and Veterinary Authority does not take food safety seriously. In fact, food safety procedures in Singapore are as rigorous as that of the United States and other industrialised countries.[230]

For the purposes of regulating genetically modified products, the GMAC has published a guideline.[231] All agriculture-related GMOs meant for release in Singapore must comply with existing national and international regulations.[232] In addition, such GMOs sought to be released must be approved for release by the GMAC[233] and be registered with the GMAC at its secretariat prior to release.[234] The proponent of the GMOs has the responsibility to comply with all the conditions of release, to constantly monitor the release, and disclose all material information on the GMOs to the GMAC.[235]

GMAC's role complements that of Singapore's Agri-Veterinary Authority as much as the United States FDA, EPA or USDA complements each other in GMOs regulation,[236] while its role is very similar to Australia's Gene Technology Regulator.[237] However, in terms of food

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and food stalls in Singapore, since these countries from where Singapore imports some of her food have mandatory labelling laws. This highlights Singapore's vulnerability to food policies beyond her shores.

229 The Committee however assured that the foods were safe for consumption because they had met the rigorous safety standards in countries of origin. See their website, *supra*, note 204.

230 In Singapore, the producer of imported GM food must comply with international standards tests on quality, allergenicity, toxicity, composition, and nutritional standards. Additionally, more stringent tests will be required under the new GMAC guidelines. Besides, all imported GMOs-based food must be proven to be safe by the competent national international national regulatory bodies of the exporting countries before they are allowed into Singapore. See GMAC's website, *supra*, note 204.

231 See Singapore Guidelines On The Release Of Agriculture-Related Genetically Modified Organisms (GMOs) (July 1999), *supra*, note 210.

232 See paragraph 5.1 of the Guidelines, *ibid*.

233 See generally paragraph 6 of the Guidelines, *ibid*.

234 See generally paragraph 7 of the Guidelines, *ibid*.

235 See generally paragraph 10 of the Guidelines, *ibid*.

236 See Ellen Matten, "Food Labelling In Codex Alimentarius" *Economic Perspectives, An Electronic Journal of US Department of* State, vol 7, no 2 (May 2002) at 29-30.

237 Section 26 of the Gene Technology Act No 16 2000 (as amended) established the office of the Gene Technology Regulator. He is in charge of granting GMOs licenses, developing draft policy principles and policy guidelines, developing codes of practice, issuing of technical and procedural guidelines on GMOs and GM products, providing information and advice to the public about GMOs regulation, providing advice to *inter alia* the Ministerial Council about his own operations, undertaking or commissioning research into risk assessment and the biosafety of GMOs, promoting the harmonization of risk assessments relating to GMOs and GM by regulatory agencies, monitoring international practice in relation to the regulation of GMOs and maintaining links with international organizations that deal with the regulation of gene technology and with agencies that regulate GMOs in countries outside Australia. See section 27 of the Gene Technology Act.

safety regulation, the Agri-Veterinary Authority of Singapore, European Food Safety Authority, United States FDA, and the Australia New Zealand Food Authority are on the same turf.[238]

In GM food safety assessment, the relevant authorities in Australia, New Zealand, Singapore, and the US (with the exception of the EU)[239] apply the principle of "substantial equivalence".[240] The principle was endorsed by a joint FAO/WHO consultation in 1996 as well as by most countries.[241] The concept connotes treating GM food or GM food components which are substantially equivalent to existing or conventional food or food components as the same, and as good as the existing or conventional food.[242]

## V. The GM Food Labelling Debate and the Consumer's Right to Know

Food labelling regulations have been in existence in most countries long

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[238] The Australia New Zealand Food Authority (ANZFA) was established by the Australia New Zealand Act of 1991. The Act established the mechanism for joint regulatory measures between the two countries. The ANZFA is an independent bi-national organization that has the role of protecting the health and safety of the Australian and New Zealand people in collaboration with other agencies for the development and maintenance of a joint Australia New Zealand foods standards code. See generally http://www.foodstandards.gov.au (last accessed 22 November 2002).

[239] Though Europe did not quite remove the concept of substantial equivalence, it never relied on it completely. From 2001, the European Union additionally opted for more stringent scientific risk assessment covering environmental risk as well as human and animal health and safety. The European Food Safety Authority is responsible for food safety assessment. See Ellen Matten, "Food Labeling In Codex Alimentarius" *Economic Perspectives, An Electronic Journal of the US Department of State*. *Supra*, note 236.

[240] See Dominique Lauterburg, *Food Law: Policy & Ethics*, *supra*, note 2. In Singapore, "substantial equivalence" is defined by paragraph 3.1 of the Singapore Guidelines On The Release Of Agriculture-Related Genetically Modified Organisms (GMOs) to "embod(y) the concept that if a new food or food component is found to be substantially equivalent to an existing food or food component, it can be treated in the same manner with respect to safety (*i.e.* the food or food component can be concluded to be as safe as the conventional food or food component." See the GMAC Guidelines, *supra*, note 210.

[241] See Dominique Lauterburg, *Food Law: Policy & Ethics*, *supra*, note 2. According to The Royal Society Report on GM food and human health, "substantial equivalence is based on the principle that if a novel GM food can be shown to be essentially equivalent in composition to an existing food then it can be considered as safe as its conventional equivalent…It also recognises that foodstuffs represent highly complex mixtures of many different compounds and that the detailed composition and nutritional values of many crops will depend, among other things, on growth conditions, climate, and time of harvesting…It also recognises that toxicological testing of whole foods has limitations due to bulkiness (the difficulties in ingesting sufficient quantities of the whole food in the diet) compared with food additives or medicines… ." See The Royal Society, "Genetically modified plants for food use and human health— an update" (February, 2002) at 4-5, available at www.royalsoc.ac.uk (last accessed 23 November 2002).

[242] See paragraphs 5 & 6 of the GMAC Guidelines, *supra*, note 210.

before the commercial cultivation and release of GM food.[243] The Codex Alimentarius Commission has long been responsible for managing multiple labelling regimes to prevent barriers to trade in food.[244] Traditionally, food labelling regulations have dealt with identifying the country of origin, disclosing nutritional contents, or preventing misleading food labelling.[245] The advent of GM in the food chain has prompted calls for labelling of such food to enable consumer to make an informed choice between GM and non-GM food.[246] Demands for GM labelling were partly fueled by a string of recent food tragedies especially in Europe, where food safety concerns, and suspicions of high-tech, intensive agriculture has peaked in the wake of the mad cow disease.[247]

There are those who are opposed to GM food labelling. They fear that the consumer may misconstrue it as a caveat or warning signal that GM food is not safe.[248] Industries also believe that mandatory food labelling could add to the cost of production and sales.[249] KA Goldman opined that

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[243] In Singapore, there is the Sale of Food Act, *supra*, note 225. This legislation has obviously been in existence before commercial release of GM food. It makes no allusion to GM food labelling. It requires food manufacturer to, *inter alia*, include on the labels certain information about nutritional contents of food, or the presence of compounds that could result in allergic reaction. A related legislation is the Consumer Protection (Trade Descriptions And Safety Requirements) Act Chap 53, No 18 of 1975 (as amended). In Canada, related food labelling legislations are the Food and Drugs Act and the Consumer Packaging and Labelling Act. Both of them make no reference to GM food labelling as in Singapore. In the United States, there is the Fair Packaging and Labelling Act. It was passed in 1966 and served essentially the same function as the Singapore and Canada legislations, in that there is no reference to GM food labelling. It requires, *inter alia*, that all consumer products in interstate commerce be honestly and informatively labelled.

[244] The Codex Alimentarius Commission was created in 1963 by the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO) with a view to developing "food standards, guidelines, and related texts such as codes of practice under the joint FAO/WHO Food Standards Programme." The programme aims to ensure fair trade practices in the food trade and promote harmonization of international food safety and standards. See its website at http://www.codexalimentarius.net/ (last accessed 22 November 2002).

[245] See Ellen Martten, "Food Labeling in Codex Alimentarius" *Economic Perspectives, An Electronic Journal of the US Department of State*, *supra*, note 236.

[246] See D Jackson, "Labeling Products of biotechnology: towards communication and consent", *Journal of Agricultural & Environmental Ethics*, (2000) 12(3) at 319-330.

[247] See AG Halsberger, "Monitoring and labelling for genetically modified products" (2000) *Science* 287 (S452) at 431-432.

[248] See David Landes, "GM food Industry gears up campaign against labels: An initiative on genetically-engineered ingredients could result in significant losses for the biotechnology industry" *Financial Times* (13 November 2002). According to this report, a Coalition Against the Costly Labelling Law raised US$5 million for its campaign. It was also reported that CropLife International, a biotechnology company, donated US$3.7 million of the US$5 million campaign money against GM food labeling. The campaign was supported by a US$2.5 million advertisement blitz to change public opinion against Oregon Measure 27 Labelling Law.

[249] See G Golder *et al*, "Economic impact study: potential costs of mandatory labelling of food products derived from biotechnology in Canada" *Steering Committee: Economic Impacts of Mandatory Food Labelling Study* (December 2000). The report investigates the potential

labelling of bioengineered food was totally unnecessary.[250] He argued that if chemical pesticides which were generally considered as less safe than plant-incorporated protectants were not required to be disclosed in labels, then bioengineered food should not be disclosed in labels.[251] Although Goldman's argument is perfectly logical, GM labelling discourse transcends safety considerations which underpin his argument. It is about choice—choosing between two alternatives—not about the safety or otherwise of genetically modified food. *A fortiori*, the consumer's right to know and to exercise his choice should be independent of the existing conflicting views on the safety or otherwise of GM food. This proposition is consistent with Dr Kinderlerer's views that "the consumer has a right to know. Even if the scientist believes that a label is stupid, unnecessary, and possibly even false, the decision of the consumer that the label is necessary must be overriding."[252] Paul F Lurquin underscored the imperative for consumer' right to know when he argued that "the public has a right to know and understand how its food is manipulated at its most basic level, that of DNA itself…the absence of scientific information is the main problem blurring the perception of plant biotechnology."[253]

In most countries where surveys of public opinion have been taken, most people, oftentimes bordering on the majority, preferred GM food labelling. According to Naomi Klein, "…roughly 70 per cent of foods sold in Canada contain GM ingredients, while more than 90 per cent of Canadian tell pollsters that they want labels, telling them if their food's genetic make-up has been tampered with."[254] Similarly, in Singapore, of the 5 people polled by *The Strait Times* in May 2001, 3 said yes to GM food labeling, 1 said no to GM food labelling, while the remaining 1 said that the government should decide.[255] The five were all professionals and very

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economic impact if Canada were to introduce mandatory labelling of food products containing ingredients from biotechnology and non-biotechnology. Canada does not currently require mandatory labelling of foods containing biotechnology ingredients except where the composition, nutritional value or safety of a product is significantly different from its conventional counterparts or where allergen risk exists. The findings were based on interviews with a limited number of Canadian industry participants at each level in the supply chain for grain and oil seed products. See also James Oehmke and Weatherspoon Maredia, "The Effects of Biotechnology Policy on Trade and Growth" (2001) *The Estey Journal of International Law and Trade Policy*, vol 2, no 2 at 10 available on-line at http://www.esteyjournal.com (last accessed 23 November 2002).

250 K .A Goldman, "Bioengineered food – safety and labeling" (2000) *Science* 290 (5491) at 457-459.

251 *Ibid*.

252 Quoted by Sharon Tisher in "Report from Harvard Conference on Biotechnology" held on 2-3 September 1999, *MOFGA*, *supra*, note 189.

253 See Paul F Lurquin, *High Tech Harvest: Understanding Genetically Modified Food Plants.* (Boulder, Co., Westview Perseus 2002) at 98.

254 Naomi Klein, "Soon all our foods will be polluted by genetic modification" *The Guardian* (21 June 2001) at 5.

255 Ms Louisa Zhang, a consultant nutritionist, and a member of the Singapore Nutrition and Dietetics Association, felt that GM food should be labelled for two reasons. First, there was

knowledgeable about food issues. One was a consultant nutritionist, the second was an associate professor of biochemistry, the third was a managing director of a soya bean producing company, the fourth was the general manager of a nature's farm which dealt in health food supplements while the fifth was the vice-president of corporate communications for Monsanto Asia, one of the world's foremost agribiotechnology companies.[256] In Australia and New Zealand, the Food Standards Australia

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not enough research by neutral bodies to back the claims that GM food was safe. She believed that most of the studies vouching for GM food safety were done by companies with vested interests. She cited tobacco companies' belated admission of nicotine's harmfulness as her reason for distrusting industry's safety assurance. Her second reason was that even if GM was safe for others, it did not mean that it would be safe for Asians. According to her, "our bodies are different, so what is alright for them may trigger off reactions in us. We cannot just transport whatever is the case in the US, or elsewhere, and put it into our Asian context."

The second person who said yes to GM labelling was an Associate Professorial Fellow at the National University of Singapore's department of biochemistry, Mr John Candlish. He felt that it would be unethical to feed people with GM without telling them. He cited the mad cow disease instance as a reason for advocating for GM food labelling. He stressed the need for a caveat about the possible side effects of GM food. He feared that bacteria could be transferred to human from GM food. He acknowledged the definitional problems that would confront attempted GM food labelling. According to him, "the problem is that when people say GM foods, what do they mean? Do they mean meat from animals that have been fed genetically modified foods, like maize? Or do they only mean intact food, like tomatoes, which have been modified genetically, and still have the genes that were inserted in them artificially? So all this takes a bit of intellectual sorting out."

The third person who said yes to GM food labelling was Mr. Francis Goh, managing director of Unicurd Food Company, a large scale producer of soya bean products. He said there was no concrete scientific proof that GM food posed any risks. He believed however that it could hurt vegetarians or Muslims if they should take GM foods that have DNA from animal sources. He believed that in order to avoid unnecessary fear among consumer, it was better to label GM food so that people could make their choices.

The only person who said no to GM food labelling was Mr. Chan Chong Leong, general manager of Nature's Farm, retailer of health-food supplements. He believed that it would be impossible to label everything. According to him, "if you define GM foods very broadly to mean everything that has been genetically modified, how can we label them? There comes a point when it becomes absurd. A lot of these things have been around for years, so why the hoo-hah now?"

The fifth person who wanted the authority to decide was Mr. Charlie Martin, vice-president of corporate communications for Monsanto Asia, a leading producer of genetically modified seeds. He believed that GM technology could help reduce the use of insecticides which pollute the Asian environment. He said his company was not saying everyone should grow GM crops, but that "genetic modification is one more technology farmers could use." He affirmed that there had not been any reported incident of ill health due to GM food consumption, and that he would leave the labelling issue for the government to decide. According to him, "when it comes to labelling, we think consumers have a right to know. Some countries may use labels while others may use websites to inform consumers. We leave it to the countries to decide." See "Should GM food be labeled?" *The Strait Times interactive* (25 May 2001), available at http://www.straittimes.asia1.com.sg/health/story/0,3324,46582,00.html (last accessed 23 November 2002).

[256] See *The Strait Times*, *supra*, note 255.

New Zealand[257] had, in late 2001, acceded to the demands of consumer to know and make a choice between GM and non-GM food by the introduction of mandatory GM food labelling.[258]

Though United States is the world's foremost producer of GM food, there is no official mandatory labelling rule for GM food;[259] while there have been increasing demands for GM food labelling.[260] This probably led to the introduction of two bills by the US Congress in 2000. The proposed bills are "Genetically Engineered Food Safety Act" and the "Genetically Engineered Food Right to Know Act."[261] If the two bills ever became laws, then the US would join the EU, Australia and New Zealand in GM food labelling. In early November 2002, the State of Oregon went to the polls to vote on whether or not GM food should be labelled.[262] The FDA was opposed to this referendum,[263] while the pro-labelling group eventually lost

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257 Formerly known as Australia New Zealand Food Authority. See Food Standards Australia New Zealand Act 1991, available on-line at http://scaleplus.law.gov.au/html/pasteact/0/31/top.htm (last accessed 24 November 2002).

258 The objectives of the Australia Food Standards Australia New Zealand are contained in section 10 of Australia New Zealand Food Act of 1991. They are: (i) the protection of public health and safety; (ii) the provision of adequate information relating to food to enable consumers to make informed choices; and (iii) the prevention of misleading or deceptive conduct. Towards this ends, on 28 July 2000, Health Ministers of the Australian States and Territories, the Australian Commonwealth and the New Zealand agreed to new labelling requirements of genetically modified food under Standard 18—Food Produced Using Gene Technology—in the Australian Food Standards Code. This Standard also appears in the joint Australia New Zealand Food Standard Code. It came into effect on 8 December 2001. For the Australian Food Standards Code, see Standard A-18: Food Produced Using Gene Technology, available at http://www.foodstandards.gov.au/foodstandardscode/ (last accessed 24 November 2002). For the joint Australia New Zealand Food Standard Code: Standard 1.5.2, Food Produced Using Gene Technology, see http://www.foodstandards.gov.au/foodsstandardscode/standard15/standard152.cfm (last accessed 24 November 2002). See generally http://www.foodstandards.gov.au/aboutus/ for more information about GM food governance in Australia and New Zealand.

259 GM food labeling in the US is mandatory. It is extremely doubtful if the industry could embrace voluntary GM food labelling in view of their opposition to it. In October 2002, organic food labelling rule came into force. See Sherri Day, "The 'Organic' Label: Who Wins at the Banks?" *The New York Times*, *supra*, note 72.

260 See Kristin Dawkins, "Labelling and Traceability Of Bioengineered Foods", *supra*, note 90. According to the author, the FDA acknowledged that the vast majority of the more than 50,000 people who commented on its labeling policy wanted mandatory disclosure of genetically modified foods in the United States.

261 HR 4813 Genetically Engineered Food Safety Act (Introduced In House), see http://thomas.loc.gov/cgi-bin/query/z?c107:H.R.4813 (last accessed 24 November 2002) The bill would amend the Federal Food, Drug, and Cosmetic Act to include genetically engineered food and related materials in the definition of "food additive". It would also authorise citizens' suits on food additives against alleged violator or the secretary for failure to act or perform a mandatory duty under the Act. The Bill was introduced to the Senate on 22 May 2002.

262 See Elizabeth Weise, "Label fight heats up in Oregon: 'Genetically engineered' is sticking point" *USA Today*, *supra*, note 92.

263 See Elizabeth Weise, *ibid*.

at the polls.[264]

In the EU, there already exists a mandatory GM food labelling rules.[265] The Europeans are reluctant to embrace the GM technology, citing public health and environmental safety concerns as their reasons.[266] In the UK, a GM food poll conducted between 18-22 April 2002 with 1,004 adults, aged 15 and above showed 76% backing the EU position on mandatory GM food labelling.[267]

The Codex Alimentarius Commission established the Codex Committee on Food Labelling in 1965 to ease international trade in food.[268] With respect to labelling of foods derived from modern biotechnology, the Codex Committee on Food Labelling is agreeable to the labelling of such foods when "there are significant changes in composition, nutritional value, or intended use and it is important to provide such information to consumers."[269] However, there is no such consensus among Codex countries on mandatory GM food labelling.[270] This is not surprising because the joint FAO/WHO's formulated and endorsed principle of substantial equivalence hardly sees any significant difference in composition or nutritional value of GM food and non-GM food.[271]

Consequently, countries such as Singapore that adopt substantial equivalence principle would see no urgent need for GM food labelling except when compelled to do so by strong public opinion, pressure from consumer groups or environmental activists. Singapore has made it known officially that it was watching the trends at the international level and might commence GM food labelling rule once the Codex Commission advised it.[272]

Robert Paarlberg classified GM technology governance into three categories of promotional, permissive and precautionary.[273] Countries with strong national interests or investments in agribiotechnology research and

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[264] See James Mayer and Michelle Cole, "Labelling altered food contents, health care fail to get support" *The Oregonian* (6 November 2002), *supra*, note 92.

[265] See EU labelling Directive 79/112 and Regulation 113/98 which requires the provision of certain information other than those in Directive 79/112, *supra*, note 23. See generally Dominique Lauterburg, *Food Law: Policy & Ethics*, (2001), *supra*, note 2.

[266] See Soil Association, *Seeds of Doubt*, *supra*, note 13.

[267] Only 6% supported the US position that labelling should not be mandatory, while 20% has no preference for either way. Moreover, 51% said that if they had the choice, they would avoid eating GM food, while 40% would not mind to eat GM food. 3% would prefer not to eat at all. Only 18% thought that the benefits of GM food outweighed the risks, while 39% thought otherwise. 24% thought that the benefits and the risks were equal. See Paul Brown, "Trade War As Public Resists GM Food" *The Guardian* (7 May 2002) at 9.

[268] See Ellen Matten, *supra*, note 236 at 26-29.

[269] See Ellen Matten, *ibid*, at 27-28.

[270] While Canada, US and Singapore have no mandatory labelling rules, Australia, New Zealand and the EU have such rules. *Supra*, note 224.

[271] See Dominique Lauterburg, *Food Law: Policy & Ethics*, *supra*, note 2.

[272] See Agri-Food Authority of Singapore's website, *supra*, note 204.

[273] See Robert L Paarlberg, *supra*, note 148.

applications would most likely adopt the promotional policy on GM food governance.[274] Singapore's and the United States' GM policy could be classified as promotional while the EU's policy approach could best be described as precautionary.[275] This classification is however not sacrosanct. It is possible for a nation with strong interest in the technology to still adopt a permissive or precautionary policy approach in deference to public opinion (especially on labelling) or trade issues.[276]

It should be noted however that GM food labelling policy does not necessarily connote official disapproval of the technology or an adoption of precautionary policy approach. It is about consumer empowerment facilitating the right to choose. Labelling would bestow a kind of transparency in food governance that could in turn, boost consumer confidence in the technology. The industry might stand to gain more from GM food labelling than it ever imagined.[277]

## VI. Consumer's Choice as Human Right and Ethical Imperative

### A. *Legal and Rights Perspectives*

The consumer's right to know and choose between GM and non-GM food raises legal and ethical questions too. By extrapolation, the term "consumer" would, in this context, cover national governments and farmers who would otherwise have nothing to do with genetically modified crops.[278]

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[274] See Robert L Paarlberg, *ibid*.

[275] For instance, the EU *de facto* moratorium on the new GM crop trial has continued since 1997. Also, unlike Australia and New Zealand, the EU no longer places much reliance on the FAO/WHO endorsed principle of "substantial equivalence" in the safety assessment of GM food. See Kristin Dawkins, "Labelling And Traceability Of Bioengineered Foods", *supra*, note 90.

[276] One of the reasons Brazil and certain African countries shy away from wholesale adoption of GM crops is the fear of export market especially in Europe that would not accept GM food and that fetches premium prices for non-GM food. See Robert Paarlberg, *supra*, note 148. See also Soil Association, *Seeds of Doubt*, (2002), *supra*, note 13.

[277] According to Paul B Thompson, people who are willing to take GMOs may believe that the right of consent should be protected, while their distrust of the food biotechnology company could ironically be based on the resistance of the industry to GM food labelling. See Paul B Thompson, "Agricultural Biotechnology, Ethics, Food Safety, Risk, And Consent" in Thomas H Murray and Mehlman (ed), *Encyclopedia Of Ethical, Legal, And Policy Issues In Biotechnology*, vol 1, *supra*, note 39.

[278] Organic farmers in the province of Saskatchewan, Canada, have recently filed a class action suit against Monsanto and Aventis in [Suit No 67 of AD 2002], in the Court of Queen's Bench, Judicial Centre of Saskatoon, and in the suit of *Larry Hoffman and Dale Beaudon* v *Monsanto Canada Inc and Aventis Crop Science Canada Holdings Inc*. The plaintiffs contended *inter alia* that Monsanto's Roundup Ready Canola and Aventis' genetically modified Liberty Link Canola were "prohibited substance" within the meaning of the Certification Standards of the Organic Certifiers. They claimed further that the GM crops have proliferated and grown in places where they were not intended and have contaminated non-GM crops mainly through cross-pollination process. The plaintiffs further alleged that so pervasive was the contamination that only few, if any, non-GM

The legal basis for institutional or governmental GM food-specific policy is a nation's sovereign right to decide what it wants for its people. The Zambian GM food aid rejection[279] and the European Union's *de facto* moratorium and insistence on GM food labelling[280] are good examples of institutional exercise of the right to choose. The president of the World Food Programme, speaking on BBC Radio regarding Zambia's GM corn rejection, said: "We believe governments have the rights to choose [not to have GM grain] … A sovereign issue that must be determined by the governments."[281] Similarly, the on-going protest by some farmers in Canada and the United States against GM wheat field trials for fear of crop contamination is no less an expression of the right to choose than the institutional control of GM food dissemination in a country.[282]

While a government could use its sovereignty as the legal basis for its GM food policy, the ordinary consumer could justify the exercise of his right to know and choose what he eats as his inalienable human right. Article 25 (1) of the 1948 Universal Declaration of Human Rights[283] provides *inter alia* that "every one has the right to a standard of living adequate for the health and well-being of himself and of his family, including food……"[284] Arguably, inherent in the right to food is the right to choose which food to eat. If choice is removed, then the right to food could be compromised.

For the individuals who might wish to know whether their groceries have been genetically modified with animal contents either because they are vegetarians or for religious reasons, they could justify their demands to know and make appropriate choice by virtue of Articles 1 (1) and 18 (1), (2) & (3) of the United Nations International Covenant On Civil And Political Rights.[285] The United Nations' awareness of the need to address the human

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farmers could warrant that their crops were GM-free. They wanted damages for; *inter alia*, farm pollution, negligence for trespass, or under strict liability and or nuisance. They also wanted an interlocutory or permanent injunction to restrain the defendants from continuing with their confined field trials of genetically modified wheat. See the plaintiffs' claim prepared by their solicitors, Larry Hoffman and Dale Beaudoin at http://www.saskorganic.com/Sod_Claim.pdf, on file with the author (last accessed 27 November 2002).

279 *Supra* note 1

280 See Dominique Lauterburg, *supra*, note 2.

281 See Judith Lewis, "WFP on BBC Radio 4's 'Today Programme'" (25 November 2002), cited in [biotech_activist] "WFP in U-turn, now endorses nations right to choose non-GM food aid", an e-mail newsletter of 26 November 2002. On file with the author.

282 See World Environment News, "Canadian organic farmers sue Monsanto on GM crops", *supra*, note 71.

283 The United Nations 1948 Universal of Human Rights, available at http://www.hrweb.org/legal/udhr.html (last accessed 25 November 2002).

284 *Ibid*.

285 Article 1 (1) of the International Covenant on Civil and Political Rights provides that "all people have the right of self-determination". By virtue of that right they freely determine their political status and freely purse their economic, social and cultural development. Article 18 (1) provides that "everyone shall have the right to freedom of thought,

rights implications of modern biotechnology led to the United Nations High Commission For Human Rights' Resolution 2002/71 in 2001 and the setting up of the "High Commissioner's Expert Group on Human Rights and Biotechnology."[286]

Besides the rights-based United Nations' provisions for consumer empowerment, the United Nations' 1999 approved guidelines for consumer protection is equally pertinent to the consumer's right to know and make informed choices in the food market.[287] One of the guidelines' objectives is "to facilitate production and distribution patterns responsive to the needs and desires of consumers."[288] The general principles of the guidelines include ensuring "access of consumers to adequate information to enable them to make informed choice according to individual wishes and needs"[289] and "consumer education, including education on the environmental, social and economic impacts of consumer choice."[290]

Additionally, most countries have constitutional and legal provisions guaranteeing the consumer's right of choice directly or indirectly. For instance, in Singapore, a consumer who does not take certain meat for religious reasons could found the basis of his legal right to know the genetic components of his groceries through labelling upon article 15 (1) of the Constitution of the Republic of Singapore,[291] which provides that "every person has the right to profess and practice his religion and to propagate it." Similarly, such a consumer in Canada could rely on section 2 (a) & (b) of The Constitution Acts, 1982,[292] which provides for fundamental "freedom of conscience and religion" and "freedom of thought, belief, opinion and expression, including freedom of the press and other media of

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conscience and religion. This right shall include freedom to have or adopt a religion or belief of his choice, and freedom, either individually or in community with others and in public or private, to manifest his religion or belief in worship, observance, practice and teaching." Article 18 (2) provides that "no one shall be subject to coercion which would impair his freedom to have or to adopt a religion or belief of his choice." Article 18 (3) provides that "freedom to manifest one's beliefs may be subject only to such limitations as are prescribed by law and are necessary to protect public safety, order, health, or morals or the fundamental rights and freedoms of others." See The United Nations International Covenant On Civil And Political Rights, available at http://www.hrweb.org/legal/cpr.html#Article%2017.2 (last accessed 25 November 2002).

286 Though GM food technology was not mentioned specifically, the Expert's Reports highlighted in its reports of 26 July 2002 *inter alia* the need to consider and protect human dignity where it could be compromised by modern biotechnology. See "High Commissioner's Expert Group on Human Rights and Biotechnology", Geneva, 24-25 January 2002, available at http://www.unhchr.ch/biotech/conclusions.htm (last accessed 25 November 2002).

287 See United Nations Guidelines on Consumer Protection (as expanded in 1999), available at http://www.unctad.org/en/docs/poditcclpm21.en.pdf (last accessed 25 November 2002).

288 See Paragraph 1 (b) of the guidelines, *ibid*.

289 See paragraph 2 (c) of the guidelines, *ibid*.

290 See paragraph 2 (d) of the guidelines, *ibid*.

291 SI 1963 No 1493 (GN Sp No S 1/63) (as amended).

292 The Constitution Acts 1867 to 1982 (consolidated on 1 April 1999).

communication" respectively.[293]

It would be interesting to see consumers around the world challenge the constitutionality of anti-GM labelling policy. The prospects for such litigations are real, given consumers' increasing awareness of the existence of genetically modified products in the food chain and the possibility of lawsuits for allergic reactions as in the recent Chicago class-action lawsuit against Aventis in the StarLink corn contamination saga.[294]

### B. *Ethical Perspectives*

Apart from the ethical issues raised by genes shuffling,[295] denying the consumer of the right to know and make informed choice also has ethical implications. Critics have consistently charged that it is unethical to keep the consumer in the dark and to deny him the right to make a choice between GM and non-GM food.[296] Two ethical theories, among others,

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[293] See The Constitution Acts, *ibid*.

[294] A federal court in Chicago recently approved a US$9 million settlement in a class-action lawsuit by consumers who complained of allergic reactions to genetically modified corn in supermarket products. The products had been contaminated by "Star Link corn" which was approved by the United States' Environmental Protection Agency for use in animal feed, but not for human consumption. See Mike Robinson, "Judge OKs Biotech Corn Settlement." Cited on the website of the American Farm Bureau Foundation for Agriculture, http://www.ageducate.org/biotech/biotech_news.html (last accessed 25 November 2002). In a related development, some farmers in the United States have recently sued Aventis Corporation the producer of StarLink Corn for alleged damages to economic interests due to the StarLink corn contamination saga. See *In re StarLink Corn Products Liability Litigation* 212 F. Supp. 2d 828 N.D. III. [2002]
Similarly, Biowatch, an environmental activist group, has recently sued the South Africa's Department of Agriculture at a Pretoria court for its failure to disclose certain information on genetically modified crops which included maize, wheat, soya, potatoes and tomatoes. The Department contended *inter alia* that the group had no *locus standi* to sue and no right to any information about the controversial genetically modified crops. See Melaine Gosling, "GM plants fight ends up in court" *The Mercury* (27 November 2002), available at http://www.themercury.co.za/index.php?fArticleId=20880 (last accessed 28 November 2002).

[295] Scientists have been accused of playing God, endangering the biodiversity and being driven solely by profits, while forcing their technology on an unwilling public. See Michael J Reiss and Roger Straughan, *Improving Nature? The Science and Ethics of Genetic Engineering*, *supra*, note 4.

[296] It has been suggested that it is the consumer, rather than the farmer that would determine the fate of genetically modified food. See William Lacy, "Agricultural Biotechnology, Socioeconomic Issues, and the Fourth Criterion" in Thomas H Murrah and Maxwell J Metilman (ed), *supra*, note 41 at 83-84. In a related development, African consumer leaders, at a recent meeting in Lusaka, Zambia, claimed that "consumers have the right to choose the food they want to eat and pursue such choices based on their own tastes and convictions, be they religious, cultural, environmental, animal welfare or ethical considerations, and that such decisions must be respected and that consumers must be facilitated to make such decisions through transparent and full disclosure of all relevant and factual information." See "African consumer leaders adopt a critical position with respect to GMOs", an e-mail newsletter of 27 November 2002 from

have been used to assess biotechnology governance. They are "contractualism" and "consequentialism", and would be especially relevant to the GM labelling policy debate.[297]

According to Robert Streiffer, contractualism is often used "to explore the question of what moral principles are for determining how large a benefit must be in order to justify a given level of risk when utilising biotechnology."[298] The theory basically requires explanation on moral grounds for our actions, especially as they affect others.[299] In the context of GM food labelling, contractualism would be relevant if GM food is perceived as representing some level of risks to consumer. In this circumstance, non-GM food labelling policy must justify its reasonableness in the face of the perceived risks, however minimal.[300]

If it would be unreasonable for the consumer to reject non-labelling policy, then contractualism supports the continuation of the policy, and it would be morally justified.[301] But if it would be reasonable for consumer to reject the non-labelling policy, as a result of some perceived risks, then it would be morally wrong to impose such policy.[302] Though GM food labelling is not necessarily and should not be a warning signal, the absence of definitive scientific consensus on its implication for human health should warrant some degree of caution. Consumer's demand for labelling would in this context be reasonable. Consequently, non-GM food labelling policy would be morally wrong.

The other ethical theory is "consequentialism". This is also founded on moral theory.[303] An individual is morally required to perform a particular action or do a certain specific thing only if it would result in greater good and benefit to the world than if he had chosen to perform one of the alternative actions.[304] How do we assess if GM food labelling policy would be more beneficial or lead to the greater good of the society than a non-GM food labelling policy and vice versa? Who is to determine and gauge the benefits? The easiest way to do this would be through a referendum, and let the people decide which would be more beneficial: a labelling or a non-labelling policy. This was attempted in the State of Oregon in November

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coordinator@geneticfoodalert.org.uk, available at biotech_activist@iatp.org. On file with the author.

297 See Robert Streiffer, "Ethical Theory: Consequentialism", Bioethics Institute Handbook, as part of reading materials supplied at the Bioethics Institute Conference held at the University of Wisconsin-Madison, June 1-7 2002 at 1-3, on file with the author. The author of this paper was a participant at this conference.

298 See Robert Streiffer, "Ethics in Modern Biology", course overview for 2001 at the Department of Philosophy, University of Wisconsin-Madison, available at http://www.biotech-info.net/bioethics_course.html (last accessed 26 November 2002),

299 *Supra*, note 297.

300 *Ibid*.

301 *Ibid*.

302 *Ibid*.

303 *Ibid*.

304 *Supra*, note 297.

2002, but the majority was opposed to GM food labelling.[305] The Oregon GM labelling votes were the first of its kind. Usually, imposing a non-labelling policy is accomplished by the relevant regulatory body such as the FDA in the United States, or the GMAC in Singapore.

Most people who are opposed to agribiotechnology have scored its governance low on democracy.[306] According to Robert Streiffer, "some of the objections voiced by the public are not so much about the particular governmental decisions that have been made regarding biotechnology as they are about the political process by which those decisions, right or wrong, were made."[307] Viewed from the foregoing perspective, it would be morally wrong and unethical to make a definitive non-labelling policy for GM food without consulting the people whom the decision was supposed to benefit.

## VII. The Limits of the Consumer's Choice

*"…When people are desperate, they will accept anything—a dictator, food, sterilisation-you name it."*[308]

The right of the consumer to know and choose could be constrained by events that are well beyond their control. These range from famine to trade issues. The Southern African GM food aid is an appropriate instance of where the consumer could not really exercise his choice.[309] With the exception of Zambia, five other countries had to choose between GM corns or allow their people to face starvation.[310] The pertinent question is: should they have followed Zambia's example? While some people believed that it was ethically wrong to thrust GM food on an unwilling, drought-stricken people,[311] others believed that accepting the food was morally appropriate since there appeared to be no alternative.[312]

Another factor that could limit the consumer's choice is the increasing incidence of contamination of non-GM by GM food.[313] Analysts have warned that it might get to a point where it would be difficult to get a completely GM-free food market with the on-going contamination rates

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[305] See Elizabeth Weisse, "Label fight heats up in Oregon, *USA Today*, *supra*, note 92.
[306] *Supra*, note 297.
[307] *Ibid*.
[308] Siswe Nbele, a Malawian dockworker as quoted in "Frankenfoods create furor on Dark Continent" *WorldNet Daily*, US (10 October 2002), available at http://www.worldnetdaily.com (last accessed 28 October 2002).
[309] See generally note 1 above.
[310] *Ibid*.
[311] *Ibid*.
[312] *Ibid*.
[313] See Soil Association, *Seed of Doubt*, *supra*, note 13.

both on the farms and in storage facilities.[314] Yet another factor that could limit the consumer's choice, especially at the institutional or governmental level, is trade issues. The continuing EU *de facto* moratorium on GM food and the mandatory labelling policy has been a sore point in the US/EU and Canada/EU trade relations.[315] North American farmers from Canada and the US have lost a substantial export market in the EU. This has threatened to crystallise into the biggest trade dispute that would surely dwarf the EU/US banana wars.[316]

In the same vein, Canada currently perceives an imminent trade row with the US as a potential obstacle to adopting GM food labelling policy.[317] According to a recent Department of Agriculture statement to the Parliament,

> The adoption of mandatory labelling system by Canada could have a significant impact on its trade relationship with its largest agricultural trading partner, the United States, which does not support mandatory labelling of biotechnology-derived foods…. Not only is the US Canada's largest agri-food export market, but Canadian agri-food industries and markets are highly integrated with those of the US… . A disjointed approach with the US on voluntary versus mandatory labelling could place both trade investments at risk.[318]

This has significant implications for Singapore that has just entered into a free bilateral trade agreement with the US.[319] Singapore is America's 11th largest trading partner, with two-way goods and services trade of US$38.8

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[314] *Ibid*. Naomi Klein, "Soon all our foods will be polluted by genetic modification" *The Guardian* (21 June 2001) at 5

[315] *Supra*, note 94.

[316] The long-standing banana dispute between the EU and US/Ecuador before the WTO Dispute Settlement Body came to an end after the EU adopted a regulation that increased the percentage of banana imports from Latin America to 17 percent. The dispute arose in consequence of the EU banana import regime which favoured African and Caribbean countries to the detriment of Latin America. The United States had retaliated by the imposition of some US$200 million worth of trade sanctions on EU exporters. See "Dispute Settlement Update: Bananas; US-EC Steel." Bridges Weekly Main Page Volume 5 Number 43 (20 December 2001) available at http://www.ictsd.org/weekly/01-12/story2.htm (last accessed 28 November 2002)

[317] See Barry Wilson, "Canada afraid to upset US with GM labels" *Western Producer* (21 November 2002), available at http://www.producer.com/articles/20021121/news/20021121news14.html (last accessed 28 November 2002).

[318] See Barry Wilson, "Canada afraid to upset US with GM labels" *Western Producer*, *supra*, note 317. Some trade analysts believed that a mandatory labelling regime in Canada would most likely be challenged by the US as a new trade barrier that contravenes NAFTA or WTO rules.

[319] Singapore signed a bilateral free trade agreement with the United States in November 2002. See http://ustr.gov/regions/asia-pacific/2002-12-13-singapore_facts.pdf (last accessed 28 November 2002) Singapore may not be able to freely exercise the GM labeling policy on food imports from the US, if and when she decides to implement it.

billion in 2001.[320] The United States being one of the countries from which Singapore imports her food; it might not be easy for Singapore to introduce labelling rules to GM food from the US without risking a trade row.[321] Except, of course, the US also introduces the GM food labelling policy.

## VII. CONCLUSION

The most controversial aspect of agribiotechnology today is the labelling of food derived from modern biotechnology. The industry is opposed to labelling. They justify their stance on grounds that there is no difference between bio-engineered food and conventional food, and that labelling would up the costs of food production. They are also quick to point to the near-impossibility of crop segregation from the farmlands, through storage to the market. On the other hand, the majority of the consumers polled from Singapore, Canada, Australia, EU and New Zealand felt that labelling was desirable. They cited conflicting scientific views on GM food safety as a reason for demanding GM food labelling. This is justifiably so in Europe which has witnessed a string of food disasters in recent decades.

After reviewing the agricultural history from its organic beginnings to the modern cutting-edge bioengineered agriculture as well as the merits and demerits of organic, conventional and genetic engineering systems, the sudden surge of interest in organic farming, the organic farming's inability to feed the world in the short term, and the conflicting scientific views on GM food safety, this paper argued that only the consumer could decide whether to patronise GM food or not. The best way to do this was through consumer empowerment by giving them the opportunity to know and choose between GM and non-GM food. The most convenient way to do this is through GM food labelling.

Labelling is not and should not be regarded as a warning signal that GM food was unsafe. But it should be seen rather as a legitimate right that is legally and ethically justifiable. This paper therefore argued for the legal recognition of the consumer's right to know and make informed food choice based on legal and ethical grounds. Anti-GM food labelling views are undoubtedly not without merits. But beyond the labelling fray are more fundamental issues of ethical and legal implications of GM food commercialisation. The consumer should have the right to know of the existence of GM food or GM components in the food they want to buy. Then they would be able to make a conscious choice between GM and non-GM food. The consumer's disempowerment in this respect is unethical and clearly derogates from their legal rights.

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[320] See USTR, "Trade Facts, Free Trade With Singapore, America's First Free Trade Agreement in Asia." Available at http://ustr.gov/regions/asia-pacific/2002-12-13-singapore_facts.pdf (last accessed 28 November 2002)

[321] The ongoing trade dispute between the EU and the US on GM labeling could easily occur between Singapore and the US.