

# Soya: the ubiquitous bean

**A look at the environmental and social aspects of soya production.**

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Food Facts No

**s.a.f.e**

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Sustainable Agriculture,  
Food and Environment.

Public concern about the quality of the food we eat in the UK is demonstrated by increased fears about unsafe food (a recent poll<sup>1</sup> showed a majority now believe food safety is deteriorating) along with a growing interest in healthier eating and rising sales of organically-produced foods.

There is also concern about the environment and farming practices, and how our food production and distribution systems may be contributing to problems such as transport pollution, global warming and loss of wildlife.

This report is one of a series intended to provide information about the negative and positive impacts of food production methods on our environment and society.

SAFE Food Facts are sign-posting documents, indicating the current scope of the issues and sources of further information. SAFE Alliance members and observer organisations are additional sources of such information and their contact details can be found inside the back cover.

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The views expressed do not necessarily represent those of every member of the SAFE Alliance.

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# Soya: the ubiquitous bean

**Soya is in hundreds of foods that we eat from apple pies to Yorkshire puddings. It is in savoury foods and sweet, chocolates and bread, petfood and farm animal feed.**

**Recent public concern has focused on the potential threat to the environment and human health from genetically modified (GM) soya. GM soya and its derivatives (oils, emulsifiers, flavouring agents) are in our food, yet we may not know if we are eating these ingredients, nor if we are eating eggs, milk or meat from farm animals fed on GM soya.**

**Genetically modified or not, soya's impact on the environment is enormous. In Brazil alone, an area of 13 million hectares (equivalent to England and Scotland combined) is devoted to growing soya, much of it for export. Soya plantations have replaced thousands of square miles of peasant farmland, and the crop is heavily sprayed with pesticides.**

**The UK imports an average of 7000 tonnes of soya every day. This report reveals the problems which result from our dependence on this one widespread and largely invisible ingredient.**

<b>Index</b>	
Soya with everything.....	1
The commodity crop .....	2
The environmental impact.....	3
Food for chickens, pigs and cows .....	4
Genetically modified soya.....	5
Organic and non-GM soya .....	8
Soya for babies .....	10
Appendix.....	11
Contacts.....	12
References .....	13

## Soya with everything

If you had cereal and toast for breakfast, a biscuit for elevenses, and instant soup and a chocolate bar at lunch, you may well have eaten soya in every mouthful today. Soya flour is added to bread, soya oil is in margarine, soya lecithin is in chocolate and breakfast cereal, soya protein is in soup and so is soya flavour enhancer.

Soya is a nutritious food. The beans have a high protein content of about 40% (equivalent to chicken) with a good range of essential amino acids. Although in the West soya based foods have only been eaten since the 1960s, in China soya beans have been cultivated and eaten for over 4,000 years.

Soya 's high protein content make it very useful to the food industry in a wide range of foods. In the UK soya and soya-based ingredients are used in around 60% of processed foods. The soya bean can be processed to produce soya flour, protein concentrate, protein isolate and soybean oil. It is also used to make a number of vegetarian/vegan consumer products such as soya milk, tofu, and textured vegetable protein (TVP) for use in meat-free dishes.

**Soya flour** is used in doughnuts, cereal, bread, and sausage products. It is used in the baking industry to whiten bread to improve its appearance. **Soybean** concentrate is made by processing soya flour to obtain a product with a protein content of around 70% — this is used by the food industry to bind foods together and to add protein, particularly to cheap foods with a low protein content. Soya is also used to make **lecithin**, an emulsifier (E322) one of the most widely used food additives. And soya protein can be used to make the flavour enhancers **hydrolysed vegetable protein** and **monosodium glutamate**.<sup>2</sup>

As the soya bean is naturally high in oil, it is pressed to make **soya oil**, another widely used food ingredient. Soya oil is used in many margarines and spreads and is used widely for frying take-away foods.

## Animal feed

Soya is an important ingredient in animal feed. In the UK, soya makes up around one sixth of total feed use.<sup>3</sup> In 1997/8 the UK imported over a million tonnes of **soya cake** for animal feed — see the table overleaf. Soya is the main source of protein used in compound feeds for pig and chicken production.

## Industrial uses

Before the second world war, soya oils were used in a host of industrial uses from lamp oil to plastics. After the second world war petroleum based products took over. But since the mid-1980s huge soya oil surpluses led US interests to develop new soya-based products including soaps and bio-degradable detergents. Soya-based printing inks are becoming more widely used.

## Soya — the commodity crop

All soya-based foods and products come from the soya bean, a type of legume. The plant is usually found in temperate or tropical regions, although it needs a warm summer (and short days) to grow successfully. Like other legumes, soya plants help to fix nitrogen in the soil and so can be grown in rotation with other crops such as cereals and vegetables.

World production of soya was 143 million tonnes in 1997,<sup>4</sup> following a remarkable rise from just 32 million tonnes in three decades (see graph below). The US produces around half of the world's total soya harvest. In 1998, US soybean plantings reached 29.5 million hectares.

Soya is traded as an international commodity crop, along with coffee, oil and cotton. It competes with other products in a variety of different markets for oils, seedcake, marine and animal fats, industrial oils and cereals. Technological advances have meant that it is frequently possible to substitute one product for another depending on market price.

The United States is the world's biggest soya bean producer, producing 50% of the world's supply. The annual soya harvest in the USA is worth around \$14 billion and ranks second (after maize) in cash value for US crops.

Soya is also produced in developing countries, principally in Latin America: Brazil and Argentina being the major producers. The amount of soya produced in these countries has grown enormously from the 1960s when large-scale soya farming began. Soya is also being grown over a wider and wider area

in Latin America: between 1970 and 1990 the amount of land taken up by soya production grew by an average of 9% every year. In many cases this growth has been aided by publicly-funded institutions, such as the World Bank's grant to Bolivia of \$12 million to cut down rainforests and to expand soya production.<sup>7</sup>

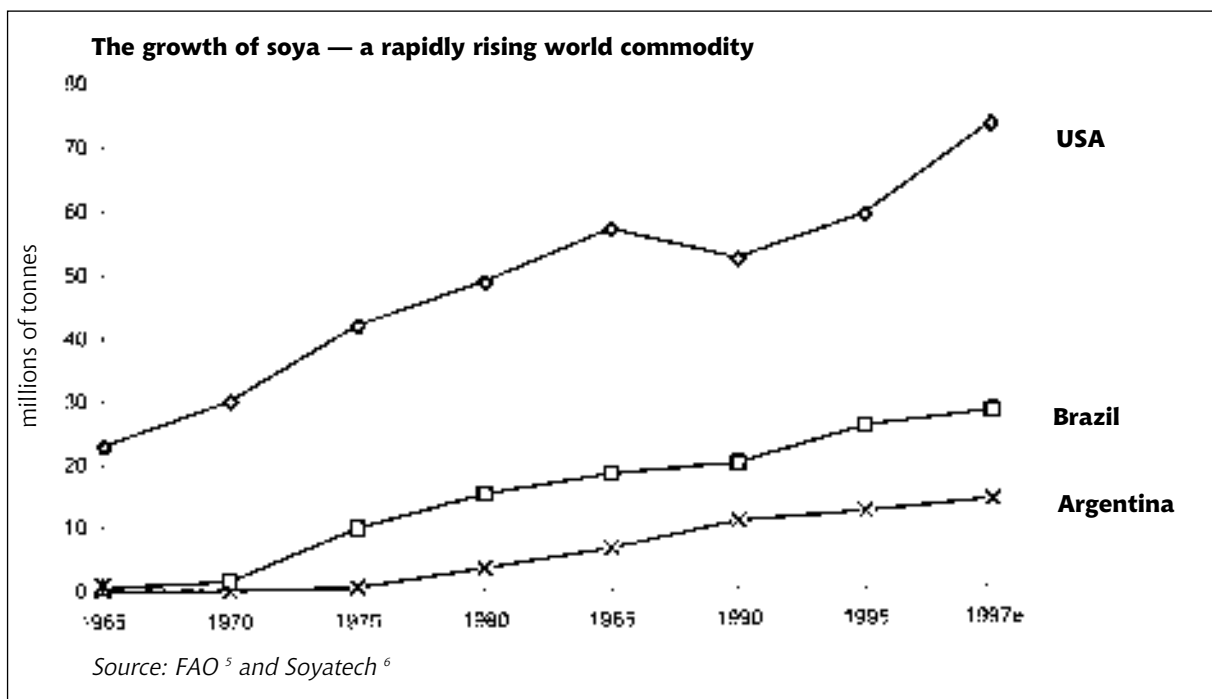
Soya bean production in Latin America and the rest of the developing world is predicted to continue growing rapidly, mainly to feed the rising numbers of livestock in these countries, where meat consumption is rising. For example, China's consumption of red meat is expected to double over fifteen years from its present 42 million tonnes. As a result, the demand for oilseed protein feed in the developing world is predicted to grow at a rate of 5% annually.

This huge rise in production will have to be met by expanding the amount of land under soya (and other oilseed production) as well as by the development of higher yielding varieties. The environmental and social consequences of this expansion are discussed below.

### Soya storage silos in the USA



Photo: U.S. Soy



## Green food? The environmental impact of soya

Derived from a bean and beloved of vegetarians, free of cholesterol, rich in protein, soya would appear to be a modern day dream food. But environmental concerns about soya range from the impact of soya production, deforestation, loss of small farms, and pesticide use, to the new concerns about the impact of genetically engineered soya on biodiversity and pesticide use.

### Food miles

In 1998 the UK imported over 2 million tonnes of soya products (see table, below). Of this, over half (1.3 million tonnes) was imported for animal feed, much of it from the United States and Brazil. Soya is being shipped over 5 thousand miles to provide over half of our imports of high protein seedcake feed used for intensively reared livestock in the UK. The relatively cheap costs of transport make it more economical for farmers to feed their livestock imported feeds rather than growing their own, or relying on less intensive farming methods.

#### 1998 UK soya imports

	metric tonnes
soya cake.....	1,385,945
soya flour.....	63,043
soya beans (other than for sowing).....	1,039,632
soya beans for sowing.....	78
non food uses .....	17,456

Source: DTI<sup>8</sup>

### Land use

Brazil is one of the countries where huge volumes of soya are grown largely for export to Europe. Since the 1960s soya cultivation has expanded from 200,000 hectares to 13 million hectares.<sup>9,10</sup> Soya production on this large scale has led to environmental and social problems. Large mechanised soya estates have caused soil erosion on the Cerrados plateau, Brazil's main soya producing region.<sup>11</sup> The Cerrados plateau is an ecologically fragile savannah area home to many endangered species. The growth of large farms producing soya has led to the loss of small farms and a rise in rural unemployment which in turn have been important factors in the deforestation of the Amazon region.

### Case study

The main form of agriculture in the Brazilian state of Parana up until the late 1960s was small farms growing coffee. Then a mechanised system of soybean cultivation using larger farms and fewer workers was widely introduced. Between 1970 and 1980, over 100,000 farms of less than 50 hectares were lost in Parana. Farms larger than 1,000 hectares increased in number by 450, taking over more than a million hectares of land. During this period the area where soybeans were grown rose from 172,000 to 2.3 million hectares. With less demand for labour due to the mechanised nature of the soya farms, many labourers, sharecroppers and tenant farmers lost their only source of income. As a result, net migration from the rural areas of Parana reached 2.5 million during the 1970's compared with a net gain of 170,000 in the previous decade. Many of these people migrated to the Amazonian state of Rondonia where they started clearing the forest.

Source: UNRISD<sup>12</sup>

Brazil has gained foreign exchange from the soya trade but, according to one commentator, the country 'has proved considerably more efficient at feeding European cattle than maintaining the livelihoods of poor Brazilians'.

### Ghost hectares and food security in the developing world

By relying on huge volumes of imported feedstuffs such as soya for intensive livestock production, the UK is effectively farming 'ghost hectares' in other countries. In 1995 Britain farmed over 400,000 ghost hectares of soya in other countries, over half of this in Brazil.<sup>14</sup> In the mid-1980s feedstuffs grown for the export market used over 9 million hectares of land in developing countries — much of it in countries like Brazil with large numbers of rural landless poor.

## **Soya — food for chickens, pigs and cows**

Over half of the UK's soya use every year is for animal feed. The UK's cows, chickens and pigs in intensive farming systems are fed large amounts of soya as a protein feed. As a result the animals grow larger and faster than they would on a diet of grass or fodder crops. Soya is therefore a central part of the UK's intensive meat and dairy production system.

However, this type of farming leads in turn to the production of large amounts of animal wastes — creating a large waste disposal problem. One estimate puts the total UK pollution load from livestock excreta as being equivalent to that of 150 million people, and there are typically around 1000 pollution incidents from livestock slurry reported annually to the Environment Agency.<sup>15</sup>

Intensive animal production also leads to raised levels of methane, a major 'greenhouse gas' implicated in climate change. Ironically, in Europe more animals and more meat is produced than is needed. This surplus meat is often stored (at taxpayers' expense) or exported to developing countries at subsidised prices, undercutting the market for locally produced meat.

### **Alternative protein feeds**

The two case studies below illustrate the possibilities of producing more of the UK's animal feed in the UK. Although this may not address all the environmental problems of the UK's intensive livestock industry, more locally-grown animal feed such as beans or lupins would reduce the long-distance transport of animal feed and the UK's ghost hectares in countries like Brazil.

#### **Case 1: Feed means beans**

Field beans are a good source of protein for cattle and can be produced in the UK. A Cleveland farmer Andy Welford set out to grow field beans as a high protein animal feed for his own cattle. Despite some problems with harvesting and drying the beans, his first year gave him a respectable profit when he sold the beans to a local feed company. Mr Welford noted that his income from subsidy was greater than that from the sale of the beans. The feed company made him up a special 28% protein feed containing 40% field beans. This was mixed with the farm's own rolled wheat and barley to give a 16% protein feed at around £110 per tonne. Mr Welford reported that the cows fed on this feed milked well with high levels of milk proteins.<sup>16</sup>

#### **Case 2: Home-grown soya**

A UK company, Robin Appel Ltd, has pioneered the development of a new soya bean variety suitable for growing in southern areas of the UK. The variety, called Northern Soya, is the product of a conventional plant breeding programme, not genetic engineering. Some 500-600 acres of Northern Soya were planted in the UK in 1999 (see photo on page 9), and the area

is expected to grow by 10% a year. The soya planted so far is being grown for seed to enable more widespread commercial farming to take place, although 75 tonnes were sold on to animal feed manufacturers last season. Interest in UK-produced Northern soya is being driven by the need for traceability by animal feed suppliers and their customers, supermarkets and major meat producers. This is mostly as a result of fears following the BSE epidemic, but concerns about the public acceptability of genetically modified (GM) soya are also fuelling demand for GM-free, UK-grown animal feed.<sup>17</sup>

### **Soya and pesticides**

Soya crops and maize crops are the two largest users of pesticides, accounting for the highest percentage of world-wide herbicide sales.<sup>18</sup> Conventional soya production requires the use of at least two applications of herbicide, one before the crop is planted and one during plant growth.

In the United States there are over 29 different herbicides in common use on the soya crop. In 1996 US soya farmers used around 27,496 tonnes of herbicide on their crop.<sup>19</sup> The most widely used herbicides are imazethapyr, glyphosate, pendimethalin and trifluralin.<sup>20</sup> One of these, glyphosate, is becoming more widely used because of increased plantings of genetically engineered soya (see below) which has been modified to tolerate being sprayed with this herbicide.

Although its manufacturers have claimed that use of genetically engineered herbicide-tolerant soya will reduce herbicide use, this is disputed by many (see Splicing the bean, opposite).

Brazil is the world's second largest producer of soya and it spent an estimated US\$1.4 billion in 1994 on pesticides.<sup>21</sup> With large tracts of land given over to the intensive production of crops such as soya and sugar cane, Brazil is caught in a chemical treadmill with ever increasing expenditure on herbicides. As intensive farming practices have led to soil erosion and deteriorating soil structure, Brazil's larger farmers have adopted minimum tillage practices, which in turn bring an even greater dependence on herbicide applications to control weeds.

In other Latin American countries such as Argentina, where soya is the largest agricultural crop, there is also heavy use of herbicides. In 1995 more than half of Argentina's total agrochemical use was for soya beans.<sup>22</sup>

Both the natural environment and the local population pay the price for this heavy use of chemicals on crops such as soya grown largely for export. Although there is a lack of information about the true extent of ill-health from agrochemicals, one study in Brazil looked at 556 cases of pesticide poisonings between March 1990 and March 1993, and found 46 cases of respiratory problems, one third resulting from work accidents

## Splicing the bean: genetically modified soya

Monsanto is the world's main manufacturer of glyphosate, the herbicide used on over 35% of US soya farms. In 2000 their US patent runs out, which may reduce their profits from this chemical as other agrochemical companies can start to produce it. Monsanto developed a genetically engineered soya bean to help extend their product's life.<sup>23</sup> Monsanto's Roundup Ready soya beans are genetically modified to tolerate being sprayed with Monsanto's glyphosate. Roundup Ready soya (RRS) has had genes inserted from a petunia plant, a cauliflower mosaic virus and a bacterium (*Agrobacterium sp*).

The idea is that a field of RRS beans can be sprayed with glyphosate to eliminate weeds. Other soya crops would be killed or damaged if sprayed with glyphosate. The main selling point to farmers has been reduced costs: glyphosate is cheaper than the more specific herbicides which have to be sprayed on non-GM soya.

Industry figures for 1998 show that 50% of the US soybean area — over 14.6 million hectares — was planted with Monsanto's Roundup Ready soya.

### Roundup Ready soya being grown in the USA<sup>24</sup>

1996 — 500,000 hectares  
1997 — 3 million hectares  
1998 — 14.6 million hectares

The main plantings of GM soya have taken place in the US, but 1997 saw an estimated 85,000-105,000 hectares of RRS grown in Argentina, and the first sowings in Brazil are due to take place in the 1999/2000 season, despite opposition from environmentalists and consumers.

## Environmental concerns about genetically modified soya

One of the major concerns about GM soya is the extent to which the inserted 'foreign' genes could be transferred to native related species and cause genetic pollution — passing on the introduced traits (in this case resistance to glyphosate) to other plants including weeds. Soya pollen can be carried by bees to other soya plants and to related wild or weed plants. Soya can cross with other members of the *Glycine* family which are found in Australasia, including Japan, where Monsanto is currently conducting field trials with RRS.

Most testing for the safety of GM crops was based on the premise that the likelihood of gene transfer between GM plants and normal plants was the same as that between non-GM plants. However recent research shows that GM plants are 20 times more effective at passing on their genes to other plants than non-GM plants with the same characteristics.<sup>25</sup> The

implication is that GM crops could be highly effective at spreading their genes into wild populations.

There is also the possibility that, due to its resistance to herbicide, the RRS could itself become a troublesome weed. Monsanto has argued that soya's susceptibility to frost will prevent this from happening. However this ignores the problem of persistence in the Far East and parts of Latin America where frost may not occur.

## Glyphosate

Monsanto has argued that there will be two major environmental benefits as more farmers plant RRS: reduced use of herbicide by farmers and the environmentally benign characteristics of glyphosate. However both these claims appear flawed.<sup>26</sup>

On the issue of less herbicide use, Monsanto has calculated that the average weight of herbicide active ingredient (ai) used in 1993-1994 in some areas of the US was 1.13 ai kg per hectare and that a similar area of RRS will receive 0.74 ai kg per hectare — a reduction of about one third.<sup>27</sup> However, newer active ingredients have the same effect at lower doses than older products and correspondingly higher efficacy and efficiency — and therefore a lower weight of herbicide is not the same as using less herbicide.

In addition industry reports show that most farmers are giving two annual crop sprayings to give season-long weed control.<sup>28</sup> Sales of glyphosate have increased by over 70% across the US since Roundup Ready soya was introduced.

Nor is glyphosate environmentally benign. All herbicides have environmental impacts, given that they are designed to kill unwanted plants. Glyphosate has been shown to inhibit anaerobic nitrogen fixation in soil<sup>29</sup> and to be toxic to a range of soil micro-organisms which influence soil fertility.<sup>30</sup> Although glyphosate generally has low toxicity to mammals and birds, its effectiveness against a wide range of plants has led to the destruction of habitats and food sources for some birds and amphibians. Low doses of glyphosate have also been shown to effect semen quality in rabbits.<sup>31</sup> (See also GM soya and human health, overleaf.)

## The problem of resistance

The widespread sowing of RRS and the attendant use of glyphosate over several seasons is likely to lead to the problem of resistant weed populations. Even the agrochemical industry acknowledge that this is likely:

*'The recent and widespread appearance of herbicide resistant weeds is substantially challenging conventional weed management strategies, and the use of engineered HRCs (herbicide resistant crops) will only exacerbate the problem.'*<sup>32</sup>

Some weeds have already developed resistance to glyphosate, such as annual ryegrass in Australia and

knotgrass and field bindweed in the UK. Inevitably the rise of glyphosate resistant weeds will not only affect those farmers sowing RRS but all farmers in the area. If widespread weed resistance does become a reality then farmers will be ever more firmly locked into a cycle of using higher and higher doses of glyphosate and other herbicides with attendant effects of wildlife and eco-systems.

## Soya — genetically modified animal feed

Although consumer concerns are leading the food industry to turn to GM-free soya, the livestock industry and the Ministry of Agriculture, Fisheries and Food (MAFF) do not appear concerned that chickens, pigs and cows are eating GM soya. Last year the UK animal feed industry and UK livestock farmers used 2 million tonnes of soya meal for animal feeds. Of this a large proportion came from the US<sup>33</sup> and other countries such as Canada and Argentina which are growing GM soya. There is a strong probability that soya-based animal feeds will contain some GM soya.

Despite a recent briefing to the animal feeds industry in which MAFF said that *'it is unlikely that viable GMOs would survive the processing of most soya .... used in animal feed'*, the current processing of soya for animal feed is not specifically designed to destroy DNA.<sup>34</sup> There is also some evidence in experimental animals to show that modified DNA

fragments can survive digestion and invade cells throughout the body and even bind with the DNA of the animal's white blood cells.<sup>35</sup>

It appears that large numbers of UK livestock have been eating some GM soya for at least two years without MAFF carrying out tests to show that DNA from this GM soya is in fact destroyed during processing and digestion. The precautionary principle, and the experience of the recent BSE epidemic, suggest that new feed ingredients should be fully tested to show they pose no risks before they are released into the food chain.

## GM soya and human health

GM soya contains genetic material from organisms which may not have previously formed part of the human diet, and this must raise concerns about the long term effects of consuming novel proteins in terms of their toxic or allergenic potential. The other main health concern is whether the greater use of the herbicide glyphosate, which Monsanto's GM soya is designed to withstand, will effect human health.

Monsanto's GM soya contains a gene from an *agrobacterium* species which codes for an enzyme; 5-enolpyruvylshikimate-3-phosphate. The herbicide glyphosate usually kills plants by inhibiting this enzyme which is important for the healthy functioning of the plant. The new form of this enzyme which had been engineered into soya is not susceptible to glyphosate and thus allows the GM soya to tolerate

### Just chicken feed?

Soya makes up an important part of chicken feed in the UK, providing the main source of protein for broiler chickens (reared for meat) and layers (reared for their eggs). Both intensively-reared and free-range birds eat soya (see Table 2 in the Appendix). Only organic chickens are given feeds which are guaranteed to be free of GM soya.

**The Food and Drink Federation**, which represents a wide range of food manufacturers making chicken-based products, said that they had *'no safety concerns about the use of genetically engineered soya in chicken feeds'*.<sup>36</sup> They did not want to comment on whether consumers had the right to know if they were consuming chicken which had been fed on genetically engineered soya.

**Birds Eye Walls**, who sell a large number of frozen chicken products, did not know if the chickens they used were fed on GM soya or not. They stated that they were not looking into this at the moment.<sup>37</sup>

**The British Egg Federation**, which represents most of Britain's battery and free-range egg producers, explained that their member were not concerned about this issue.<sup>38</sup>

**The British Poultry Meat Federation** said that although it was likely that most chickens were eating some GM soya, in general their members were not concerned about this and

it was unlikely that their members were trying to source GM-free soya feed for their birds.<sup>39</sup>

### And the supermarkets...

**Sainsbury's** stated that because there is currently no segregation of the soya crop it is likely that their own brand chickens are currently eating some GM soya. However, because they are now committed to phasing out genetically modified ingredients from their products, they are working towards setting up alternative sources of non-GM soya to be used to feed their own-brand poultry.

**Waitrose** could not confirm that their own brand chicken and eggs were currently fed on GM-free soya. However, as they have been working on this for some time they hoped to have systems in place by the end of April which would mean that their own brand chickens (broilers and egg-layers) received a GM-free diet.

**Tesco's** customer care department said that they could not confirm that their own brand chickens' feed did not contain GM soya, but they felt that the chances of this 'were very slim'.

**Safeways** could provide no information.

Source: SAFE survey, March 1999



spraying with this herbicide. There are concerns over whether the new enzyme could be allergenic in soya products which contain the protein.

It is impossible to predict exactly which food substances will cause allergies. Monsanto have argued that there is no risk attached to the use of this enzyme in GM soya as it does not share a common gene sequence with other known protein allergens.<sup>40</sup> However other specialists argue that allergenic proteins do not necessarily have common amino acid sequences, so a comparison would be worthless.<sup>41</sup>

The other concern is over the extent to which GM soya will have been exposed to greater amounts of glyphosate than non-GM soya and whether GM soya will therefore contain higher herbicide residues.

A study by the Pesticides Trust concluded that by definition the GM soya is likely to be exposed to greater amounts of the herbicide and is therefore more likely to contain higher glyphosate residues. There is evidence from the World Health Organisation to show glyphosate residues remain in flour and cereal products, following glyphosate use on cereals in the fields, and that residues in animal feed resulted in traces of glyphosate being found in meat, milk and eggs.<sup>42</sup>

## The right to choose what we eat.

Most consumers want to know what is in the food they are eating or giving to their children. In an attempt to deal with this issue, the European Commission has brought in EC Regulation (1139/98) on the 1st September 1998 which requires that all foods containing protein or DNA from Roundup Ready soya (or a type of GM maize) must declare this on the label. This will include food in restaurants and take-aways.

However, the regulation exempts foods derived from GM soya if the food does not contain protein or DNA from the GM ingredients. This means that the huge number of foods which contain soya oils or soya lecithin will not have to be labelled even if they come from GM soya. The Food Commission has listed over a thousand top brands which may contain soya ingredients but which don't have to be labelled to comply with the new legislation. Examples from their list include:

Confectionery such as **Kitkat, Flake and Galaxy** (which may contain soya-derived lecithin)

Loaves of bread, such as **Hovis and Sunblest** (which may use soya-derived additive E471)

Biscuits and snacks, such as **Kellogg's Nutri-grain** (which may contain soya-derived oils)

It is possible that these products do not contain GM soya derived ingredients, but under current legislation the consumer has no right to know.

The failure of the government to police the GM soya in our food was highlighted by newspaper reports in March 1999.<sup>43</sup> Tests by trading standards

officers in Worcestershire found a type of genetically engineered soya bean in foods which has not been approved for use in the UK but believed to be from another type of GM soya which is licensed for use in the USA but not in the UK.

## Public concern about GM foods

A recent Mori survey found 61% of the public do not want to eat GM food and 77% supported a ban on the commercial growing of GM crops. During the early months of 1999, public concern about GM food and its presence in the food chain increased. Despite government reassurances that GM food, including soya, was safe, a number of institutions declared that they were banning GM foods from their menus. The Local Government Association in February 1999 recommended that councils in England and Wales ban GM foods from their schools, care homes and meals-on-wheels services for five years.<sup>44</sup> The House of Commons restaurants had already been pursuing a policy of GM-free foods for several months.<sup>45</sup>

## Your veggie burger

When veggie burgers were launched in 1983 by Haldane Foods, demand was restricted to a vegetarian minority, but over the last seventeen years thanks partly to concerns over healthy eating and partly to the BSE epidemic, more and more people, particularly younger people, are avoiding meat or reducing their meat intake. This has led to a huge growth in sales of vegetarian convenience foods, including veggie burgers. A recent survey showed that 24% of consumers buy vegetarian burgers, sausages and grills.<sup>46</sup>

Most of these veggie burgers have a large soya content. The exceptions are the Quorn based burgers and grills made by Marlow Foods. Soya-based veggie burgers had annual sales of £18 million in 1996,<sup>47</sup> around 58% of the meat-free burger market. Veggie burgers and other meat-free convenience foods are now seen by the food industry as a dynamic and rapidly expanding area. For example, Birds Eye spent over £3 million on advertising to support the re-launch of its meat-free range of burgers and grills in 1997 for the mass market — not just vegetarians. But what exactly is in the average soya-based veggie burger and where does it come from ?

Most of the soya-based veggie burgers are made from Textured Vegetable Protein, (TVP). TVP is made from de-fatted soya flour and processed to give a sponge-like texture, and then flavoured to resemble meat. A much smaller percentage of veggie burgers are made from tofu (coagulated soya milk from soya beans, pressed into cakes.). Veggie burgers also tend to contain vegetable oil which is likely to be soya oil (as this is the most widely used vegetable oil).

## GM veggie brands?

We surveyed the leading makes of veggie burger to find out which brands are GM-free. Although the majority of the manufacturers claim that they do not use GM soya in their products, the consumer has no guarantee that the product does not contain GM soya derivatives and the manufacturers are under no obligation to make sure that the soya derivatives are GM-free.

**Birds Eye Walls** is the brand leader with annual sales of £7 million and 23% of the market in 1996. Birds Eye says that there is no GM soya or soya oil or lecithin in their veggie burgers. Some of Birds Eye's meat products contain GM soya, including Birds Eye Original beefburgers, beef quarter-pounders and Southern Fried Chicken Nuggets. Product packs are labelled to show that they contain GM soya ingredients.

**Cauldron Foods** is the leading brand of tofu based burgers and the leading supplier of tofu in the UK with 90% of the market. Their food products are currently approved by the Vegetarian society. At the moment there is no labelling on their products to say that they are GM-free, but the company states that their soya is from Canada and is guaranteed by their suppliers to be GM-free.

**Haldane Foods**, subsidiary of Archer Daniels Midland, says that the soya in their veggie burgers and other meatless products is not from GM soya beans. Haldane say that when their entire range is GM-free they will probably label their products as GM-free.

**United Biscuits Ross Young** are manufacturers of the Linda McCartney brand, one of the leading veggie burger companies accounting for around 10% of the market. In February 1999 the Linda McCartney brand found itself under pressure when it was revealed that their sausages and vegetarian mince contained GM soya. The company had previously assured consumers that it only used non-GM soya.

**Tivall's** products, which include veggie burgers, are a mixture of soya and wheat protein. Tivall also make veggie burgers for Sainsbury's own brand. The company states that the soya in their products is GM-free and that they have certification for this from their suppliers.

**Marlow Foods** are makers of Quorn products, the leading veggie brand on the market with 32% market share in 1997. The company uses unspecified vegetable oil, which could be derived from soya oil.

**McDonald's** Vegetable Deluxe burger bun contains soya flour, the pattie contains soya protein isolate and the sandwich sauce contains soya bean oil. The company says that both the soya flour and the soya protein isolate are tested as being GM-free by the suppliers. McDonald's cannot confirm whether the source of the soya bean oil is GM-free.

**Burger King** states that it is unable to guarantee that the soya used in any of its products is GM-free. Products that contain soya-based ingredients include the burger buns and the oil used to fry products.

## New markets — organic and non-GM soya

Given the environmental and human health concerns which exist about genetically engineered soya and the concerns about high herbicide usages on conventional soya two new markets are emerging, for organically-grown soya and for guaranteed non-GM soya.

### Organic soya

Organic soya, that is soya grown without the use of pesticides, artificial fertilisers and production methods that damage the environment, has been available for several years although its market share is still small. In the United States, the American Soybean Association estimates that current organic production levels are less than 1% of the soya harvest.<sup>48</sup> Although figures for the amount of acreage under organic soya are hard to come by, in Iowa, a large grain producing state, there were approximately 22,950 acres of organic soya in 1997.<sup>49</sup>

Organic soya commands a high premium. Growers in the US currently get between \$14-20 per bushel for

tofu grade beans, compared with \$8-15 per bushel for the non-organic equivalent.<sup>50</sup> In the United States one company, American Health and Nutrition, estimated it currently has between 300-500 growers under contract, producing around 50,000 tonnes per year for use in soya milk.<sup>51</sup> Other companies serve different parts of the soya market producing soya for tofu production, soya meal or oil. There are also organic soya producers in Canada.

A large part of the organic soya currently produced in the United States is exported to Japan. Industry sources confirm that the demand for organic soybeans is *'tremendous, particularly in Asia'*.<sup>52</sup> Increasing demand for organic meat, milk and eggs is also driving demand for organic foodstuffs. A growing number of US West Coast and international feed companies are setting up supply contracts with organic growers in the Midwest to fulfil orders. Demand for organic soybeans is outrunning the supply, and as a US grain supplier points out *'We really want these soybeans, we have contracts to fill... in the long term they'll be better off serving a human food market than a feed market'*.<sup>53</sup>

## Non-GM soya

Demand for non-GM soya has grown in all sections of the UK food industry, from animal feed suppliers to supermarkets. The UK's two largest suppliers of soya flour, Arcady Craigmillar and Spillers Premier Products, are both now supplying only GM-free soya flour to bakers. The non-GM soya for both companies comes from Canada. Although some Canadian soya farmers are using GM beans, the smaller scale of the Canadian soya bean industry and their greater experience in segregation has made it easier to keep track of non-GM soya. Canadian companies are benefitting from the increased interest in their GM-free products. One company, WG Thompson, a soya bean supplier, has noted 'a very significant rise' in exports to the UK of non-GM soya beans for soya flour.

UK companies are also benefiting from the growth in the market for non-GM soya and soya products. A UK company, Soya International, supplies GM free soya milk and health foods. They source their soya from Brazil, providing the GM-free soya seed beans to farmers in the Sao Paulo region who grow under contract for them. Soya International have seen demand for their products rise over the last twelve months, they currently supply several major supermarkets including Iceland Foods, Asda and Marks & Spencers.

## A final note on soya for babies

Over the last few years many parents concerned about allergies to dairy products have started to feed their babies with soya-based formula milk. Around 3% of infants in the UK are now fed on soya formula milk with sales worth nearly £9 million a year.<sup>54</sup>

However since 1994 groups such as the Food Commission have warned that soya baby milk may affect children's health. In 1996 the UK Department of Health stated that phytoestrogens found in soya infant formulas could affect the health of infants.

Phytoestrogens are compounds that occur naturally in some foods such as soya. The type of phytoestrogens found in soya, called isoflavones, mimic the effects of the female hormone oestrogen which controls fertility and reproductive health. Exposure to these oestrogen mimics in early infancy could effect future fertility and reproductive development. Soya isoflavones have also been shown to have other biological effects on infants including changes in the function of the central nervous system, the thyroid and behavioural patterns.<sup>55</sup>

A study of the effects of eating daily small amounts of soya on adult women showed disruption to the menstrual cycle which persisted for three months after the experiment ended.<sup>56</sup> Infants having several feeds of soya milk a day are being exposed to significantly higher doses of isoflavones for longer periods than the women in the study.<sup>57</sup> The levels of isoflavones found in babies fed with soya formula are comparable to levels that exert significant oestrogenic effects on experimental animals.

Because the endocrinal systems in infants are still developing in the months after birth, exposure to endocrine disrupters should be avoided. A senior scientist at the US Food and Drug Administration's National Centre for Toxicological Research, Dr Daniel Sheehan, said that infants fed soya formula milks are taking part in a '*large, uncontrolled and basically unmonitored human infant experiment*'.<sup>58</sup>

Current government advice is that soya formula should not be fed to infants unless on the recommendation of a health professional. But as soya formula is widely available, usually on the same shelf as cow's milk formulas, there is nothing to prevent parents using soya milk formula, neither are there any warnings on the packs.

The government has asked the soy milk companies to reformulate their milks to remove the soy isoflavones. The companies are currently considering the matter. In the meantime, they have announced they are removing all GM soya from their products following public concern over the issue.<sup>59</sup>

## **Recommendations for consumers:**

Buy organic soya, as this will mean that the soya has been produced in a more environmentally friendly way, and that the soya has not been genetically engineered.

Read the ingredients labels on all processed foods to avoid genetically modified soya (see the Food Commission's guide *GM Free*).<sup>60</sup>

Avoid soya based formula milks for babies. Breast-feeding is best for infants. The American College of Paediatrics now recommends breast feeding for a minimum of one year. This means that an infant's exposure to phytoestrogens during a crucial developmental period is reduced.

If you eat chicken, pork or beef, start asking retailers and manufacturers such as Birds Eye whether the animal was fed on genetically engineered soya or not. Make it clear that you would prefer animals fed on GM-free feeds.

Buy meat that has been reared organically as this method uses little extra feed rations, and no GM food at all.

Buy more fresh, unprocessed food. It is healthier and less likely to contain soya-derived ingredients.

## **Recommendations for retailers**

Phase out products contain genetically modified soya. Support those soya producers growing non-GM soya.

Make sure that the meat, milk and egg products you stock are derived from animals fed on GM-free diets in order to give consumers a choice.

## **Recommendations for farmers**

Try feeding animals on non-soya home-grown protein feeds such as home-produced beans.

Take advantage of the higher premiums for organic producers and convert to organic farming.

Ask your feed suppliers to supply non-GM soya feeds. The greater the demand the cheaper these feeds will become.

## **Recommendations for government**

Respond to consumer and environmentalists' concerns about the potential for damage to the environment and human health from GM soya by opposing the licensing for sale of new varieties of GM soya.

Given the uncertainty about the long-term effects of genetically engineered soya on the environment and human health, act on the precautionary principle and withdraw Monsanto's licence to sell their Roundup Ready soya in the UK.

Implement a freeze on all further commercial development of GM food crops, including their use in the food supply, until better segregation, tracing and monitoring procedures are in place.

Increase support for organic agriculture in line with other European countries.

Use fiscal policy to encourage farmers to rely on home-grown feedstuffs for animal feeds.

## Appendix

**Table 1. Farm animal population in the UK, June 1998**

Cattle .....	11.5 million
Pigs .....	8.1 million
Poultry .....	152.9 million
Sheep .....	44.4 million

Source: MAFF<sup>61</sup>

**Table 2. Constituents of chicken feed**

	Broilers (reared for meat)	Layers (kept for eggs)
Soya .....	21%	18%
Soya oil .....	1%	4%
Wheat .....	66%	63%
Limestone .....	0%	10%
Fishmeal .....	4%	0%
Fats .....	5%	0%
Grassmeal .....	0%	3%

Source: BEIC/NFU<sup>62</sup>

**Table 3. Soya imports 1997**

millions of metric tonnes

	UK	European Union
soya cake .....	1.39	9.83
soya beans .....	1.04	13.68

Source: FAO<sup>63</sup>

**Table 4. Soya bean production 1997/8**

	Production million tonnes	Area million hectares
Argentina .....	13.9	6.3
Brazil .....	28.0	12.6
China .....	14.5	8.5
EU (Italy, Spain) .....	1.4	0.4
Paraguay .....	2.7	1.3
USA .....	73.2	28.3

Source: Soyatech<sup>64</sup>

## Useful contacts

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### Farming and Wildlife Advisory Group

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*Campaigning organisation covering a wide range of food production and nutrition issues, and publishers of The Food Magazine.*

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*An independent charity addressing the health and environmental problems of pesticides and working for a sustainable future.*

### The Royal Society for the Protection of Birds (RSPB)

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**March 1999 - the Greenpeace campaign against GM soya included the dumping of a truckload of beans at the entrance to Downing Street. The truck says 'Tony don't swallow Bill's seed'.**



Photos:  
Greenpeace/Cobbing

**Outside Downing Street the soya became a focus for pro-organic farming methods.**



**The truck driver was invited to accompany the local police.**







The Sustainable Agriculture, Food and Environment Alliance exists to unite farmer, environmental, consumer, animal welfare and developmental organisations. We seek forms of food production which are beneficial to the environment, sensitive to the need for global equity, and which produce safe and healthy food in a manner supportive of rural life and culture.

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