A Nuffield Farming Scholarships Trust

Report

# The Young Nuffield (Bob Matson) Award

# New and emerging technologies: what's standing in the way?

Katy Lee

September 2013

NUFFIELD UK

# A Nuffield (UK) Farming Scholarships Trust Report

*"Leading positive change in agriculture. Inspiring passion and potential in people".*

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| Title | New and emerging technologies in agriculture: what's standing in the way? |
| Scholar | Katy Lee |
| Sponsor | The Young Nuffield (Bob Matson) Award |
| Objectives of Study Tour | • To uncover new truths about the political path to the adoption of new and emerging agricultural technologies<br>• To assess the politics of new and emerging technologies and how this translates into national legislation<br>• To examine public awareness and acceptance of new and emerging technologies<br>• To compare attitudes towards science and food safety |
| Countries Visited | USA<br>Argentina<br>Brazil<br>Colombia |
| Findings | • All over the world, scientists are identifying responses to modern day challenges to food and energy production<br>• Farmers are highly innovative and should have the choice of a wide range of safe and proven technologies to benefit agricultural production and the protection of natural resources<br>• Lack of expertise and accountability in the political community can hamper the transfer of technology to farmers<br>• Government foresight is needed to develop effective policy frameworks that match rapidly emerging and increasingly complex agricultural technologies<br>• A farmer-centred approach on agricultural technology policy will bring real benefits for society |

# Contents

## Disclaimer

The views expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, nor of my sponsor, nor of any other

# 1. Introduction

This was the first time I had had to sit down and really question my personal views about farming and food production. In September 2012 I left my dear colleagues at the EU office of the UK National Farmers' Unions and took up my Nuffield Farming Scholarship investigation. Six years of representing the views of others had ended and suddenly I was the one people wanted to influence as I put my questions to them.

Aside from conferences and informal chats, I organised 64 formal interviews: 26 in Portuguese, 25 in English, 12 in Spanish and 1 in French. It is fair to say that I couldn't have been pulled in more directions. I hope that the result in this paper is informative, balanced and blunder-free.

I was lucky because my investigation took place at an important time in the global debate on food production. With the World Farmers' Organisation I attended the Rio+20 United Nations Conference on Sustainable Development; I saw Californian citizens almost push through a historic requirement to label GM food; I participated in an audience with Brazil's President Dilma Rousseff on sustainability; and I saw Argentina seemingly lose patience (a number of times) with EU barriers to agricultural trade.

Many of my interviews were with farmers and politicians and I learnt that they can be similar no matter where you go. Turn up to a farmer with a list of questions and he might make it clear that he is wary of nosy-parkers. If you persevere, you will learn that he is doing more work for society and the environment in a week than you will do in your whole life. Meet a politician and he will be quick to talk,


**Nuffield Farming Scholar Katy Lee, CNA Headquarters, Brasilia**

thinking in headlines, a super-human multi-tasker and at the mercy of the public whim.

I will be forever grateful to the Nuffield Farming Scholarships Trust for giving me this opportunity. I thank John Stones and Mike Vacher for their guidance and support.

**Rose Akaki, Uganda Farmers' Federation and Zeinab Al Momany, Specific Union for Women Farmers, Jordan, delegation of the World Farmers' Organisation at the Rio+20 United Nations Conference on Sustainable Development**

I wholeheartedly thank my interviewees, especially Jessica Denning of "Right to Know",

Dr. Cathleen Enright of BIO, Ken Caldeira, Euler Ribeiro, Gustavo Idigoras, Ildo Romancini, Martin Lema of Argentina's Ministry of Agriculture and Mark Lynas for agreeing to be quoted and letting me make examples of them.

I am indebted to Celeres, Brazil's internationally renowned leader in agribusiness intelligence. Thanks to Celeres I was able to speak to farmers in remote parts of Brazil's fertile cropland that I would never have known existed. Celeres also gave me the chance to meet young women of my age who, like me, are working in agriculture. They were among the kindest, cleverest people I have met and I was moved by their dedication to the farming industry.

Lastly I thank the UK National Farmers' Unions and the farmers I had the good fortune to meet during the first six years of my career. For the education, the extraordinary examples of professionalism and for instilling in me a passion for farming.

## 2. Why I chose my topic

New and emerging technologies promise to advance the plight of agricultural producers facing increasing pressures such as climate change, land scarcity, animal feed availability, price stresses and soaring input costs.

Existing "tools in the toolbox" such as plant breeding and other gene technologies have been embraced by farmers across the world to varying degrees. Genetically modified crops, for example, were planted on 170 million hectares worldwide in 2012 (their 17th year of cultivation). The European Union, with its 27 Member States, planted just 129,071 of these hectares[1].

A complex web of obstacles hampers the choice of agricultural producers to adopt new and emerging technologies. These barriers can be anything from economic, infrastructural, regulatory to historical.

I worked at the heart of the European Union (EU) policy making machine representing UK farmers from 2006-2012 and it is the political barriers that interest me most. I believe that the EU is fraught with internal political wrangling on agricultural technology and this has an impact on the way we produce our food.

During my time in Brussels I worked on EU votes such as the offspring of cloned animals in the food chain and the freedom of Member States to ban or restrict the cultivation of Genetically Modified Organisms (GMOs) on their territory.

Often the result was politicised and anti-choice votes that led to the frustrations of some European farmers who wanted to have the tools enjoyed by their competitors in South and North America available to them.

As I am neither a farmer nor a scientist, the aim of my Nuffield Farming Scholarship investigation was not to judge the new and emerging technologies themselves, but rather to uncover new truths about the political path to adoption once they are approved.

Many of my interviewees highlighted to me that genetic engineering cannot be considered a "new" technology because it has been adopted since 1996. However, I strongly believe that GMO policy provides a useful optic through which we can examine and predict how other new technologies will be dealt with. It also gives an indication about the levels of so-called "anticipatory governance" employed on agricultural technologies. Other examples I use in this paper are livestock cloning in meat and milk production, and geo-engineering.

Before embarking on my travels, I interviewed protagonists in the UK debate: Mark Lynas who has said that genetic engineering in Europe is one of "the greatest science communication failures of the last half-century", farmers who have conducted field trials, and the crop research facility Rothamsted, which used common sense to convince campaigners not to destroy a GMO wheat trial in May 2012.

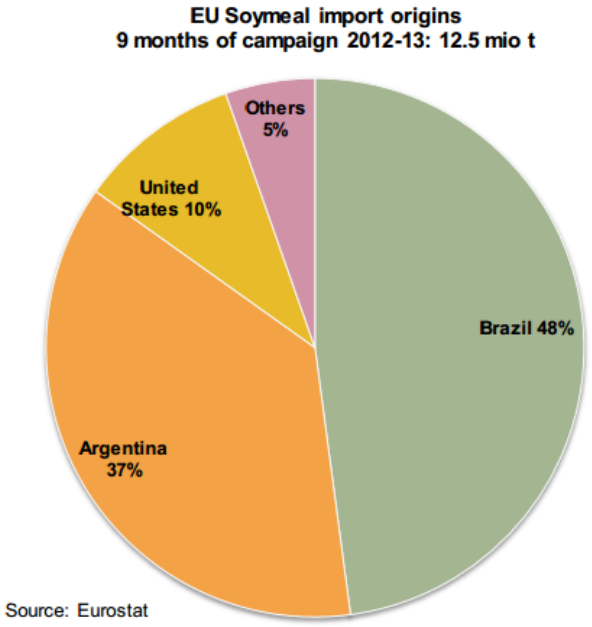
I chose to visit Argentina, Brazil and the USA because they are three countries that have adopted technologies such as genetic engineering and cloning which are under a *de facto* ban in the EU. There is a clear distinction between the tools their farmers have access to and the ones we have in Europe.

[1] ISAAA report 2012

**My Nuffield year: At home in Europe**

- 2012: Political turmoil sees the failure of an EU proposal to allow Member States to individually ban GMO cultivation. Health and Consumer Protection Commissioner John Dalli, had previously criticised EU government politicisation of biotechnology, publically reproaching Member States for failing to engage in a fact-led debate
- 2012: Around 30 million tonnes of grain were imported from third countries, including 13 million tons of soybeans, 22 million tons of soymeal, 2,5 million tons of maize and 2 million tons of oilseed rape
- September '12, Gilles-Eric Séralini et al. published a 2-year feeding study of rats that showed negative health effects of genetically modified maize. The study was quoted throughout the world but criticised by the European Food Safety Authority for being "inadequately designed, analysed and reported"
- January '13: Environmental activist Mark Lynas made a pivotal speech at Oxford Farming Conference apologising for having fought against GMO crops
- April '13: EU Standing Committee on Food Chain and Animal Health approves more stringent requirements on companies submitting applications for the authorisation of new GMOs
- June '13: Political agreement reached on new Common Agricultural Policy
- June '13: UK Minister Owen Paterson says Britain should embrace the benefits of GM crops
- July '13: Monsanto pulled all pending GMO approvals out of Europe owing to the lack of commercial prospects

Added to this, Argentina, Brazil and the USA are major agricultural exporting powers and contribute to global food, feed and energy security. For example in the area of animal feed, the EU is highly dependent on imported vegetable protein increasingly produced with genetic engineering technology. In terms of soymeal alone, which is used as a protein rich ingredient in animal feed, these countries are the main providers for EU imports.




The common themes I dealt with in each country were:

- Adoption of new and emerging technologies
- The politics of new and emerging technologies and how this translates into national legislation
- Public awareness and acceptance of new and emerging technologies
- Attitudes towards science and food safety

# 3. USA

I began my USA journey in California, in the run up to a momentous public ballot on GMO labelling on November 6, 2012. I was welcomed by the anti-GMO campaign group "Right to Know" in Sacramento, as well as farm cooperatives in charge of a community food delivery scheme.

From there I met biotechnology and geo-engineering scientists from the universities of Berkeley, Davis and Stanford, as well as seed company Monsanto and California's government crop institute.

The second half of my USA investigation took me over to the East, to Washington D.C. and Maryland. There I met soybean farmers, farm lobby groups and the US Department of Agriculture.

**Public vote on GMO labelling**

- The Californian public was given a referendum on GMO labelling on November 6th, 2012
- The final result was "No" to labelling at 53.7% versus "Yes" at 46.3%
- Campaign spending: $45 million (No) and $9 million (Yes)
- For the "Yes" to labelling camp, it was an important opportunity to provide transparent information about the origin of food
- For the "No" camp, this was a flawed ballot that could unnecessarily demonize most foods on the supermarket shelves
- There is a long-standing debate on GMO labelling in the USA. In a campaign speech in 2007, Barack Obama promised to bring in compulsory labelling of GMOs
- In June 2013 Connecticut became the first state to agree a law requiring GM food to be labelled, though caveats apply

## 3a. California: GMO labelling in the USA

The USA grows the biggest area of GM crops in the world, some 69.5 million hectares[2]. US soils are also home to the greatest *variety* of GM crops. A total of eight are cultivated: soy, maize, cotton, rapeseed, sugar beet, alfalfa, papaya and squash.

Unlike in Europe, US law does not specifically require the labelling of food that has been produced using genetic engineering technology. The reason for this, given by the US Food and Drug Administration (FDA) which oversees safety assessments of the products, is that they are no different in terms of composition. The US FDA has said that labelling policies would therefore "be inherently misleading".

### 3a.i. Pro-Proposition 37: California's NGO community

In terms of GMO-derived products, a high percentage of the world's 3 trillion meals produced since 1996 have been consumed in the USA. However, as I found out from following the GMO labelling vote, there is public resistance in the USA to crops being grown using the technology.

I arrived in California's state capital Sacramento two weeks before the referendum on GMO labelling. According to the official voter information guide, "Proposition 37" would let the public decide whether they wanted labelling "on raw or processed food offered for sale to consumers if made from plants or animals with genetic material in specific ways[3]".

[2] ISAAA report 2012
[3] http://voterguide.sos.ca.gov/propositions/37/

Days after my arrival in Sacramento, Los Angeles City Council unanimously passed a resolution endorsing the Proposition, so spirits were high among the pro-labelling campaigners I spoke to. On board with the "yessers" to labelling were Danny DeVito, celebrity doctor Dr. Oz, high-end supermarket Whole Foods, Consumer Federation of America, Pesticide Action Network, and organic food product manufacturers, among others[4].


**Whole Foods supermarket in San Francisco encouraging Californian voters**

For them a "yes" would have meant a rule change so that Californian shoppers, like those in the EU, would see when they are buying foods derived from genetic engineering technology.

I was kindly hosted for one week by Jessica Denning, a GMO-awareness and pro-labelling campaigner. It is safe to say that Jessica is dedicated to healthy and sustainable living. As a food shopper, she makes use of every available choice to make sure that her consumption fits with her vision of agricultural production. Physically, she is easily 20 years younger than her 70 and puts this down to a vegan non-GMO organic diet, avoiding all corn and wheat. As well as my generous host, Jessica was also my guide through the Proposition 37 debate, my insight into California's "local food" community, and even my jogging partner.


**Jessica Denning of the Right to Know campaign – 70 years old!**

Jessica has a large local following and was living and breathing the debate on Proposition 37. In the cool October temperatures I shadowed her and other campaigners doing a "honk and wave" protest at a major traffic intersection at rush hour. Holding signs saying "Vote yes on Proposition 37" "Right to Know" and "Know what's in the food you feed your family", the aim was to raise awareness and community spirit for the cause.

Jessica believes that Europeans are "savvy" about GMOs. She believes that Europe "nurtures consumer education and freedom to choose", not just because of mandatory labelling laws, but also because of press coverage about food in Europe. She told me

[4] http://www.carighttoknow.org/endorsements

that “Americans look at Europe wistfully as an example of open press”.

"Right to Know" campaigners in Sacramento, California

I found that arguments on both sides of the GMO labelling debate provoked an emotive or “fear” response in me. On the “yes” side of the debate this was on the perceived domination of multinational companies of the world’s seeds, with only profit for motive. For example, the Right to Know website claims that “companies like Monsanto are allowed to control and suppress research on genetically engineered foods[5]”. Similarly, on an anecdotal level, I heard people say that GMO derived products are untested, they have saturated American processed foods against public will and that GMO pollen has contaminated conventional seeds.

## 3b. Going east : D.C. and America’s political hub


US Department of Agriculture in Washington D.C.

### 3b.i. Anti-Proposition 37: Biotechnology lobby in D.C

Another woman I met who dedicates her work to food security and environmental sustainability was Dr. Cathleen Enright. Dr. Enright is Executive Vice President for Food and Agriculture at the Biotechnology Industry Organization (BIO), the world’s largest biotechnology trade association representing the likes of Monsanto, DuPont, BASF and researchers. I spoke to Dr. Enright in Washington D.C, many miles away from Jessica Denning in California, both in terms of geography and stance on Proposition 37.

For BIO, the goal of the labelling referendum was not to provide transparent information for consumers but, based on the statements of its major funders, “to eradicate biotech from America’s cropland and supermarket shelves”. I heard that 80% of food in the US is derived from GMOs in one way or another but most of it is in oil and sugar, undetectable and therefore complicating any requirement to label “all” GE foods. The labelling proposition was, in their opinion, sloppily written to mislead consumers and threatened to place a

5 http://www.carighttoknow.org/first_television_ads

kind of “skull and crossbones” unnecessarily on GMO-derived products.

Indeed, the Proposition 37 vote served to sharpen the public focus on the reputation of the biotech industries. At the time of my investigation, Dr. Enright stated in a press release “We recognize we haven’t done the best job communicating about GMOs—what they are, how they are developed, food safety information—the science, data and processes”. In June 2013 a website was launched called www.GMOAnswers.com of which Enright said “We want people to join us and ask their tough questions. Be sceptical”[6].

The “no” camp was certainly stronger when it came to campaign financing in California. Overall, biotech companies spent some USD 45 million on TV commercials and public outreach, compared to the USD 9 million on the other side of the debate. The “yes” camp saw this as a David and Goliath situation, yet from BIO’s point of view it seemed a huge frustration to spend this money defending a proven technology rather than on a more positive public campaign highlighting what they believe to be the benefits of their products.

The emotive or “fear” response I felt when reading literature from the “no” camp was that the world will struggle to be fed without the use of genetic engineering. Anecdotally, I also heard certain people from the pro-GMO lobby talk about a kind of “organic conspiracy theory”, whereby the organic food industry, ballooning in value, is deliberately sowing seeds of doubt in the public mind-set on the technology, in order increase sales of their own products which prohibit the use of GMOs.

### 3b.ii. Farmer views on GMO labelling

The American Farm Bureau Federation (AFBF) is the biggest farmers’ union in the USA, with six million members, fifty state Farm Bureau affiliates and one in Puerto Rico. I spoke to the offices both in California and in Washington D.C. to assess views on GMO labelling and general opinions on agricultural technology.

In California alone, the Farm Bureau represents more than 74 000 agricultural, associate and collegiate members in 56 counties. During my interview, I heard that the AFBF was one of the official opponents of Proposition 37 on GMO labelling. The AFBF felt that the Proposition would undermine the scientific safety assessments carried out by the US food safety authority, the FDA. They also objected on the grounds that it was state-only legislation, not set at federal level and that it would lead to “frivolous lawsuits”. Furthermore, the AFBF website at the time stated “farmers feel that labeling wrongly implies that biotech foods are unsafe and misleads many consumers”[7].

Reservations on Proposition 37 were echoed by a farmer I interviewed in Maryland who makes use of genetic engineering technology. A producer of corn, soy, wheat, barley and hay on more than 500 hectares, it is felt that there are clear benefits of biotechnology on

[6] http://www.bio.org/media/press-release/plant-biotechnology-companies-begin-new-conversation-about-gmos-and-how-our-food

[7] http://www.fb.org/index.php?action=newsroom.agendas&year=2012&file=ag10-2012.html

the farm, helping with control of weeds and insects and "freeing up the plant to live up to its full potential". For him, labelling initiatives such as Proposition 37 would have significant negative impacts on genetic engineering policy in his country.

### 3b.iii. Position of farmers in America's political landscape

When I was in Washington D.C I also took the opportunity to ask about the position of farmers in America's political landscape. This was particularly relevant considering that November 6, 2012, would not only be the vote on Proposition 37 but also the Presidential election, which would see Barack Obama take a second term.


Presidential election night, San Francisco

Rough estimates pitch the number of lobbyists trying to influence politicians in Washington D.C. at around 15, 000, which is about the same as at the EU in Brussels. The rural vote in the USA is considered to be pivotal and I saw many parallels with the UK Farmers' Unions when dealing with regulatory affairs. For example, just like in the UK, the Farm Bureau is regularly consulted for its expertise when the government makes laws on agriculture. In addition, farm representatives are called upon to give evidence in front of the state and federal agriculture committees.

However, quite contrary to my experience with the UK National Farmers' Unions, I was surprised to learn that the AFBF routinely endorses candidates running for Congress, as well as giving out a "Friend of Farm Bureau" award to Congress members[8]. In contrast, at election time the UK farming unions remain a-political and do not back any running politicians.

I saw both pros and cons in the American approach. On the one hand, the endorsement of candidates is an excellent way to call the attention of politicians, invite them to engage with farmers and hold political parties to account on their actions. On the other hand, in my own experience politicians can be unpredictable in their voting patterns, they can very occasionally be pressured to act within party lines or in circumstances out of their control. This means that "committing" to particular candidates on behalf of a membership organisation comes with risks. However on balance, the way that the AFBF spreads endorsements across a wide range of candidates and the political spectrum is a good way to mitigate such risks.

**The USA in my Nuffield year**

- November '12: Proposition 37 referendum on the labelling of genetically engineered food in California
- November '12: Presidential elections. I was in San Francisco to see Barack Obama gain a second term
- June '13: Connecticut is the first state to agree a law requiring GM food to be labelled
- July '13: A delayed New Farm Bill is passed, 10 months after many programmes in the old one officially expired. Welfare aid in the form of food stamps was the major controversy

8 http://www.fb.org/index.php?action=legislative.112c

## 3c. Elite academia in the USA

### 3c.i. Scientist views on GMO labelling

I wanted to get answers from US scientists on new technologies and so visited Stanford University California (UC), Berkeley and UC Davis, which are all top US universities. My meetings with them took place in the run-up to the GM labelling vote in California on November 6.

The first scientist I met was Dr. Belinda Martineau, a geneticist who helped develop the world's first ever GE food – the Flavr Savr tomato. The tomato was on supermarket shelves from 1994 until 1997.


**GM tomato label, 1990s. Today there are no GM tomatoes on supermarket shelves, though research is underway to improve nutritional traits**

As an American genetic scientist with more than 30 years of experience in the discipline, Dr. Martineau was a key person to talk to. Dr. Martineau is a champion of GMO labelling and, importantly for her, the Flavr-Savr tomato she helped develop in the 90s was openly labelled as being "grown from genetically modified seeds". Given her background as a scientist who helped develop and market the world's first genetically engineered food, she was also instrumental for the "Yes on Proposition 37" campaign, which suffered criticism for being based on emotion. However, whilst many of her comrades in the "yes" camp vehemently opposed the use of genetic engineering to produce food, Dr. Martineau clearly believes in the technology, though she has argued the case for tighter regulatory controls from the US government.

Appropriately, I then conducted further interviews at the UC campuses of Davis and Berkeley. It is important to note that these universities are famed for research into agricultural biotechnology, home to GM animals such as goats, and also host the website www.ucbiotech.org, focussing on communication with the public. The other scientists I spoke to there were against Proposition 37 and had concerns about its effect on public research. I heard that their biology is becoming "a dying art", with grants going to research elsewhere and, with this, Proposition 37 may have served to unnecessarily demonise food and create half-truths about the science they work on.

Above all, the message I took away from these meetings was that scientists can become caught up in the politics of genetic engineering and this can potentially divide their community. All of the biotechnology researchers I spoke to were in no doubt about the benefits that their science can bring to food supply and, because of this, none of them was against labelling or open information *per se*. To me, any opposition to Proposition 37 in the science community seemed instead to be based on a feeling that it is "too late" to bring in labelling now with so much misinformation in the public domain.

### 3c.ii. Wider debate on politics and science in the USA

The final scientist I met was Ken Caldeira, who researches issues related to climate, carbon, and energy at the Carnegie Institution for Science, Stanford University. The nature of Dr. Caldeira's work puts him at the frontier between politics and environmental science and for this reason he was a useful person to meet. Caldeira has been involved in United Nations climate negotiations and has advised both the UK and USA governments on policy. He believes that there is a "political currency of science" in policy making today and that the truth is critically important. However, for him a problem exists among a proportion of politicians, for whom "winning votes is more important than truth and science".

Caldeira is known for his research into geoengineering or "intentional climate modification", which is currently discussed as a potential way to mitigate climate change. It can include simple actions such as painting roofs white in order to reflect the sun's rays. It can also mean the release of stratospheric sulphate aerosols to artificially reinforce the ozone layer, "cloud seeding" with dry ice, or even ocean fertilisation to benefit the marine food chain.

Geoengineering is truly an emerging science that stands to affect the use of our natural resources. Caldeira himself acknowledges the potential environmental risks and questions the effectiveness of the measures under discussion. However he believes that scientific study is necessary to assess whether it can be a viable option in the future.

## 3d. Results and reflections on California's labeling referendum

### 3d.i. Result

In the end, Proposition 37 was defeated by a narrow margin: 53.7% "No" and 46.3% "Yes". However, the campaigners I met have a legacy – since Proposition 37, more states have begun to call for their own labels on genetically engineered foods. Connecticut has passed a bill for labelling, as well as Maine, though caveats apply on their implementation.

### 3d.ii. Reflections

The take-away message that I took from my interviews was just how easy it is to scare people when it comes to food and this impacts on everyone involved in the supply chain. Furthermore, with increased efficiency and expansion in agriculture, people are increasingly disconnected from their food.

Almost all my interviewees, on both sides of the debate, implied that Proposition 37 was American food politics at its worst, full of polarised opinions, exaggerations and inaccessible truths. Despite the different viewpoints of the people I met, I feel that they would all agree with Ken Caldeira's reflection that when politics meets technology "winning votes is more important than truth and science".

Contrarily to my interviewees, I believe that Proposition 37 could count as an example of food politics in the USA where there was an open space for campaigners, farmers and agri-businesses all to have a voice. This is because, even as a foreign visitor, it was easy for me to be exposed to the arguments on both sides. This came right down to the "Official Voter Information Guide" given to all Californian residents. In it, Proposition 37 was given a double page spread with the points in favour and against, set out using similar word-counts. Underneath this, there were rebuttals. The most exciting and interesting thing for me, as somebody working in politics and agriculture, was that the text put forward was not from government "neutral" civil

servants but campaigners themselves. This meant Center for Food Safety and Pesticide Action Network in the “Yes” camp. It meant California Small Business Association and California Taxpayer Protection Committee in the “No” camp. Furthermore, the names of individual farmers were put down as supporters on each side.

So whilst biotechnology in the USA is increasingly politicised, in my opinion Proposition 37 served to inspire a real public debate where people had access to information about technology and food production.

# 4. Argentina

I spent March 2013 in Argentina. I interviewed industry bodies, farm groups and politicians in the capital Buenos Aires. I visited Rosario in Santa Fe, home to South America's foremost grain stock exchange and a major port that sends grain shipments to Europe. I stayed on a beef "feed-lot" in Lujan and "helped" vaccinate cattle; I attended the agricultural show *Expo-Agro*; and I saw the town of Mendoza, with its high planes, cotton shrubs and abundant vineyards.

From my interviews with farmers, government officials, technology agencies and biotech companies, it was clear that Argentina considers itself to be a global leader in agricultural technology. This technology is used to maximum effect for sustainability, sanitary requirements and production efficiency.

Climatic conditions and domestic politics have hampered the optimism of Argentinian farmers over the past few years but I found the mood among producers to be buoyant. To take a quote from one of the major farm magazines during my visit, Argentine farmers "are building the country".

Indeed, Argentina is the 8th largest country in the world in terms of land expanse and this is used to the benefit of food, fibre and fuel production. Grain exports contribute enormously to the economy, with 100 million tonnes per year produced and this puts agricultural producers in an important position.

Argentina is also the second largest organic food producer in the world, with 2.5 million hectares of organic production. Aside from cereal and oilseed exports, organic onion and garlic goes from Argentina to Europe in huge quantities.

Argentina cultivated 23.9 million hectares of GM crops in 2012, putting it in third place after USA and Brazil[9]. Just as in Brazil, Argentina's GM crops are maize, soy and cotton. Argentina is also one of the world's wheat superpowers, though no GM varieties are commercially grown.

It is important to note that the government of President Cristina Fernández de Kirchner has defined the development of biotechnology as a national policy in Argentina. As a result it cannot be said that politics are an obstacle directly "standing in the way" of the adoption of such technologies. However, as we shall see in this section, there are other factors that may indirectly block the access of farmers and growers to new and emerging technologies.

**Argentina in my Nuffield year**

- February '12: Rosario stock exchange states that corn yields have been hit by drought
- March '13: Argentine farm union *Sociedad Rural* marks five years of "oppressive government policy"
- May '13: China approves 11 Argentine bovine genetic centres for export of semen and embryos
- May '13: A memorandum of understanding was signed in Buenos Aires between the US, Argentine and Brazilian corn growers' associations to, amongst other things "find solutions to biotech and phyto-sanitary trade barriers"
- June '13: China approves three strains of Argentine GM soybean and one corn for import
- August '13: drought and frost hit crops - 83% of expected soy harvest lost in productive Salta region

[9] ISAAA report 2012

## 4a. Rosario and Lujan : exports

### 4a.i. Rosario: Grain exchange

The huge significance of cereal and oilseed exports in Argentina led me to the port town of Rosario. Rosario's port directly services Santa Fe, the surrounding province that produces of a large part of Argentine exports. Owing to its strategic location, the port also indirectly serves the whole Mercosur trade bloc.

Likewise Rosario is home to the "*Bolsa de Comercio de Rosario*" or "Rosario Board of Trade". During my guided tour I learnt how the facility acts as both a grain market for almost all of Argentina's cereals and oilseeds, as well as a forum for trade negotiations. It is also a futures market, bringing together the agricultural commodities of soybeans, wheat and corn with gold and oil operations.

Gauchos on a feedlot in Lujan

### 4a.ii. Lujan: Feed lot

Prior to Argentina, I had seen mainly grass-fed beef cattle in the valleys of Wales and the hills of Northern England. A stay on a "feedlot" in Lujan was therefore quite a contrast. I learnt that feedlots make up an increasingly large percentage of Argentine beef production, with varying reports putting the figure at around 40%. This is partly owing to increased demand for soybeans. It is also because farmers say that feedlots are more efficient in terms of feed conversion for cattle.

Regarding grain, this puts pressure on harvest both in terms of quality and quantity. It also means cattle farmers have to be savvy about when they buy their feed. This style of beef farming is actively supported in Argentina, for example by the *Cámara Argentina de Feedlot*, which promotes Argentine grain fed beef.

Lunch at the agricultural show ExpoAgro

## 4b. Buenos Aires : Political perspectives on the EU

### 4b.i. EU policies through Argentinian eyes

My first experience of Argentinian agriculture was in October 2011 when I was working in Brussels. I witnessed a difficult debate between the EU and the Argentine Ministry of Agriculture which inspired the topic of my Nuffield Farming Scholarship investigation.

The "honey scandal" had broken just one month before in September 2011 - the European Court of Justice made a ruling that honey containing traces of pollen derived from GM crops could no longer be marketed according to existing rules. This had major consequences for Argentina, traditionally one

of the main honey exporters to the EU[10]. Government departments were said to be on "major alert", importers had stopped buying Argentine honey and according to the WTO Goods Council at the time, it was said that "thousands of Argentinian beekeepers and small farmers have been affected by this ruling"[11]. Consequently, I witnessed the Argentine Ministry of Agriculture explaining to the then EU head of GMO policy, Commissioner John Dalli, that the decision was costing the Argentine economy and disrupting the EU's honey supply. This was all to the puzzlement of Argentina, for whom apiculture and GM crops had previously coexisted under the relevant regulatory controls without problems.

Some 16 months later I was in Buenos Aires, sat in front of the very same Agriculture Ministry representative I had seen in Brussels. We discussed the aftermath of the honey dispute and the wider question of Argentina's relationship with Europe - its main export market for the last 100 years.

Today honey exports are back up and running, following a legislative amendment proposed by the EU in 2012. Nevertheless, to quote a report from the Food and Agriculture Organisation of the United Nations, the EU is "the hardest market for potential exporters to access" in terms of honey, owing to the "most stringent" criteria on chemicals, antibiotics and other residues[12].

Though the mass of regulatory red tape is more tightly wound around its own producers, I heard that the EU does put pressure on Argentine farmers to produce in a certain way in exchange for market access.

Whilst in Europe we see this red tape as a response to debates on the environment and food safety, in the countries I visited it was perceived largely as a way of protecting EU domestic markets. For example, sat in Buenos Aires, one of the most forthright statements I heard from the Ministry of Agriculture representative was that "restrictive GMO policies can be seen as a cheap alternative to subsidies in regards to agri-food trade protectionism".

In a similar vein, I was interested to learn that EU trade policies feature in the collective consciousness of mainstream farming in Argentina. The example I cite for this is from my attendance at the major agricultural show *Expo-Agro*. I was surprised that, among the themes of biotech, agricultural certification, falling wheat production and meat exports, "EU protectionism" was a regularly occurring theme of the day. The feeling on the ground was that the EU was deliberately making use of barriers such as phyto-sanitary requirements to protect its own agricultural sector.

### 4b.ii. A-synchronous authorisations

The theme of a-synchronous GMO approvals is particularly relevant to the topic of GM animal feed, which the EU imports in huge quantities. A-synchronous approvals occur when a GMO is fully authorized for commercial use in food and feed in an exporting country such as Argentina but is still making its way through the slower approvals system in the EU. This is not only a problem for trade operators in exporting countries but also for the EU. For example, a European Commission report in 2010 stated that animal feed supply in Europe stands to be threatened because "the logistical capacity of segregation in the main exporting countries to the EU ….is

10 http://www.fintrac.com/cpanelx_pu/Ethiopia%20CIAFS/12_06_4949_CIAFS%20_1%20Honey%20Final%20Oct%2011.pdf

11 http://www.wto.org/english/news_e/news11_e/good_07nov11_e.htm

12 HONEY MARKETING AND INTERNATIONAL TRADE, FAO ftp://ftp.fao.org/docrep/fao/012/i0842e/i0842e16.pdf

not able to cope with the requirement of segregating GM material that is EU-authorized from unauthorized". As a result, "if there were to be a loss soymeal imports [sic] to the EU from Argentina, Brazil and the USA simultaneously, this would represent a loss for the EU of 20 million metric tonnes of soymeal from these three countries. The overall short-term price increase would be in the order of 220% for soybeans and 210% for soymeal[13]".

In Buenos Aires I heard that, to a certain extent, Argentina has lost patience with the EU GMO approval system. For example, until 2009 the country mirrored EU GMO policy, in that it would process the products along the whole regulatory pipeline and wait for the EU before making its own final approval. Today, Argentina is willing to mirror China but not EU on GM approvals and to quote my interview with the Agriculture Ministry, "the EU is becoming a less relevant market for Argentina especially in terms of maize".

Furthermore, in May 2013 Argentina joined a coalition of the governments of USA, Brazil, Canada, Paraguay and Australia to announced their intentions to collaborate on plant biotechnology research, asynchronous authorisations and "low level presence" of GMO traces authorized in one or more countries, but not in the country of import.

### 4b.iii. Public and institutional acceptance of biotechnology in Argentina

There is strong institutional support for biotechnology in Argentina and in 2011 President Fernández de Kirchner launched her "Agribusiness Strategic Plan 2", which aims to increase grain production by 60% to 160 million tonnes by 2020, with GM soy rising by 20%.

During my visit I spoke to Argentina's biotech council, Argenbio, who told me that GM crops have brought wealth to the Argentine economy over the past 15 years. According to them and the National Institute of Agricultural Technology, INTA, the reduction of production costs and expansion in productive area have brought the total gross benefits to USD 65,435.81 million.

In addition, INTA has said that the emergence of Round-up Ready® (RR) soybean varieties resistant to glyphosate "have become the most important genetic breakthrough in the agriculture of the region over the last years"[14].

The Argentine government often talks about the environmental benefits that GM crops have contributed to the country. According to them, the technology has brought in reductions in the overall environmental impact of plant protection product use. It has also developed synergies with low carbon agronomic practices such as no-till, which is also associated with reducing soil erosion and fuel use for mechanical tillage.

Dialogue on biotechnology extends to livestock cloning for food production, which the government is likewise willing to explore. The country has made clear its ambitions to be a leading exporter of both cloned and transgenic products. As an illustration, President Fernández de Kirchner was famously photographed in June 2010 "cuddling" a cloned baby goat during a visit to a laboratory exploring the use of cloning for goat meat production[15] . Speaking from the laboratory, the President stated "Technological development is one of my obsessions, because that's where we are

[13] http://ec.europa.eu/agriculture/analysis/external/asynchronous-gmo-approvals/summary_en.pdf

[14] ADOPTION OF HERBICIDE RESISTANT SOYBEANS IN ARGENTINA: AN ECONOMIC ANALYSIS, Chapter X, Julio A. Penna and Daniel Lema

[15] http://www.cmilenium.com/

going to make our agricultural advantages competitive"[16].

Argentina's biotech council, Argenbio, confirmed to me that both cloning and genetic engineering are accepted by "the majority of stakeholders, including politicians" and are not under discussion in the political environment. Rather they are "taken care of by the specific technical departments of the corresponding ministries".

### 4b.iv. Contrast in attitudes of politicians compared to Europe

I considered the statements I heard on EU policy from Argentine government representatives and farmers to be strong ones. However, the idea that GMO policies are "cheap alternatives to subsidies" can be explained by the fact that in Argentina, there is no discussion about whether GM crops are "safe" in terms of environmental or human health. This is because the government believes in the regulatory controls, the safety approvals system and the benefits of the technology.

Another example I heard about was a contrast in attitudes between MEPs in Brussels and their Argentine equivalents. It is important to note that in my experience in Brussels, MEPs are the most vocal denouncers of GMOs and a proportion are known to dispute the associated science. At the time of my Nuffield Farming Scholarship investigation, for example, MEPs were backing a petition that criticised the GMO risk assessments of the EU food safety body, EFSA, continuing a sustained campaign to try and undermine the EU approvals process[17].

On the other hand, in Argentina, the EFSA equivalent, CONABIA, is universally respected. Crucially, Argentine MPs actually value the contribution of biotechnology to the country's food production and have even been known to write congratulatory letters to the authorities when approvals are made.

When hearing about this I wondered how the letter-writing politicians in Argentina can be so different from the "no" voting MEPs in Brussels. As politicians they are surely generalist in their knowledge and it is fair to say that the nature of the job makes it difficult to gain a high level of technical expertise in any area, including biotechnology.

What is important is that all politicians are on the front-line when it comes to public opinion and they are reliant on viewpoints and information from the outside world. The contrast in attitudes to biotechnology, therefore, reflects how they see public acceptance.

Talking to Argentine farmers bears testimony to this. For example, a farmer at the UN Rio+20 Conference in June 2012, when talking about the presence of GM crops in his country since 1996, explained to me that at the beginning it was simply like "a new type of mobile phone", i.e. a useful and acceptable technology.

In addition, Argenbio told me that technologies such as cloning and biotechnology are "not themes of concern for the general public in Argentina" and do not affect food shopping choices among consumers.

16 http://online.wsj.com/article/SB10001424052970204323904577040740528525910.html

17 http://www.gmfreecymru.org/petition/petition_June2013.html

This goes further when looking at the country's environmental campaigns from Non-Governmental Organisations (NGOs), which are of a different character to those in Europe. Gustavo Idigoras, Director at Business Issue Management in Buenos Aires, told me how environmental NGOs are growing in Argentina but campaigns tend to focus on the misuse of herbicides such as glyphosate, or the perception of "big business" dominating access to seeds and "corporate control of food". Whilst these themes also regularly come up on European shores, I found the discussion in Argentina to have a much narrower focus and unquestioning of biotechnology in itself.

## 4c. The politics of weed resistance

In March 2013 I attended the agricultural show, *Expo-Agro*, a few hours' drive outside Buenos Aires. A recurring theme in the interviews I conducted was the emergence of "weed resistance" to glyphosate, a herbicide used with genetically engineered "Round-Up Ready" technology. According to reports there is just one type of weed actually resistant to glyphosate in Argentina but 21 others have been identified as "barely controlled by glyphosate[18]".


**Nuffield Farming Scholar Katy Lee at Argentine agriculture show, ExpoAgro**

[18] http://www.greenpeace.org/argentina/Global/argentina/report/2011/bosques/resumen-ejecutivo-glifosato-ctapa.pdf

The subject merits discussion in my Nuffield Scholarship paper because it has provoked polemic in all three of the countries I visited. It has also caused some portions of the public to question the environmental benefits of the technology.

Greenpeace Argentina and GM Freeze, for example, published a report in 2011 called "*Por qué el mundo debería estar preparado para abandoner el glifosato*[19]" or "Why the world must be prepared to abandon glyphosate". In it, weed resistance is used as one of the reasons to call for a ban on approvals of further glyphosate tolerant crops. The report also states that "sustainable solutions will not come from GM crops and definitely not herbicide tolerant GM crops".

On the other side of the debate, Graham Brookes from PG Economics recognises that herbicide use has tended to increase since the mid-2000s as farmers have incorporated different products into their weed management practices. However, he points out that weed resistance is not exclusive to GMOs and maintains that overall herbicide use is inferior to "the alternative if GM technology was not used[20]".

### 4c.i. What is weed resistance?

"Weed resistance" refers to the emergence of weed populations that are resistant to herbicides. Weed resistance is an outcome of the repeated or misuse of many types of herbicide and has been recorded since the 1950s[21], long before the adoption of GM crops. Statistics from 2012 show that "372 unique, herbicide-resistant biotypes have

[19] http://www.greenpeace.org/argentina/Global/argentina/report/2011/bosques/resumen-ejecutivo-glifosato-ctapa.pdf

[20] http://gmoanswers.com/ask/why-are-genetically-modified-crops-increasing-use-herbicides-and-pesticides-i-thought-claim-was

[21] http://wssa.net/weed/resistance/

been confirmed worldwide"[22] and this includes some non-GM, conventional crop cultivars.

In the field of genetic engineering, resistance occurs with soy, corn, cotton, sugar beet and rapeseed crops that have been modified to resist herbicides, most notably glyphosate. The same statistics from 2012 show that there are currently 21 glyphosate-resistant biotypes. Thirteen of these are in the United States where GMO adoption is high.

It is important to note that weed resistance is not the same as weed "tolerance" although the two are often confused. Weed tolerance refers simply to weeds that can naturally tolerate commercial doses of glyphosate.

### 4c.ii. Government and industry response

Martin Lema of the Argentine Ministry of Agriculture recently stated that glyphosate-resistant weeds do exist in Argentina but "are not a big problem yet". However, according to him they "could develop into something more serious"[23].

The Argentine government sees numerous responses to the problem. Working in particular with the Argentine no-till association Aapresid, there are initiatives in research, education and extension services currently taking place in order to combat weed resistance.

"Diversified programmes" of weed control and integrated management practices are recommended by Aapresid and also by bodies such as the Weed Science Society of America. Supported by the Argentine government, Aapresid has also set up a national rapid alert system to which growers are obliged to report any cases of resistance.

Herbicide companies such as Dow AgroSciences in Argentina maintain that the probability of a weed population becoming resistant to glyphosate is lower than for other families of available herbicides[24]. For them, it is important to ensure the correct application of the product taking into account appropriate dosage and weather conditions.

### 4c. iii. Reflections, *sencillologia*

In Argentina I heard industry representatives talk about "*sencillologia*", a neologism to describe the "simplification" of crop management that "broad spectrum" herbicides such as glyphosate have brought. Yet in order for growers to make the right choices and truly reap the benefits of this *sencillologia*, they need clear information and strong messages about crop husbandry in order to avoid resistance.

Overall it is up to producers to weigh up the environmental benefits of herbicide tolerant crops. This is because they are the ones who will deal with the consequences both in terms of their soil and civil society. Nevertheless, in my opinion weed resistance is a crucial example of when governments and companies must have the foresight to pre-empt necessary action and must work with farmers to anticipate responses.

## 4d. Farmer-government relations: all time low

It is not only international politicians that affect the lives of Argentine farmers. Like Nuffield Farming Scholars before me such as Alex Page in 2009, there seems to be one unmistakeable conclusion: the major

22 http://www.wssajournals.org/doi/pdf/10.1614/WS-D-11-00206.1

23 http://noticias.terra.com.ar/buscan-dar-alternativas-al-glifosato-y-evitar-malezas,f2f0497f8cc1f310VgnCLD2000000dc6eb0aRCRD.html

24 http://msdssearch.dow.com/PublishedLiteratureDAS/dh_02b1/0901b803802b1c4d.pdf?filepath=ar/pdfs/noreg/013-53006.pdf&fromPage=GetDoc

challenge for producers in Argentina is domestic politics.

Unfortunately for them, Alex Page's observation in 2009 that a "large tax on farm exports has been implemented to support public spending" [25], coupled with the expensive Argentine peso still rings true.

I met the Argentine farm union *Sociedad Rural* (15,000 members) which, days after my arrival in Argentina, had marked "five years of oppressive government policy". It was the anniversary of the 2008 implementation of "Resolution 125", passed by the then fledgling government of Cristina Fernández de Kirchner. It provided for a sliding tax on exports of soybeans, corn, wheat and sunflower. As harvest was about to begin in March 2008, soybean export duty went from 35% to 44% per tonne[26].

**Argentina: Know your Argentine economic liberals**

"The biggest enemy to wealth is fiscal wealth"
- Juan Bautista Alberdi

The farming community responded with protests, road-blocks and mass mobilisation in the streets of Buenos Aires. Despite it causing a fall in her ratings, President Fernández de Kirchner was not sympathetic. Her cabinet publicly responded by saying "farmers' profits have never been higher than they are today"[27] - a statement which was taken as proof that the administration was unconcerned with the huge impact its policies were having on the lives and businesses of producers. Crucially, Resolution 125 was overturned after four months. According to the Sociedad Rural, such a confrontation between government and farmers "had never been seen before".

Today what the Sociedad Rural holds the government to account for is low productivity, frozen producer prices and "record" tax burdens for producers. I was glad not to be a government representative walking into the Sociedad Rural's offices – there are huge framed posters on the wall to remind visitors about the farm protests that took place in 2008. It is clear that the psyche in the agricultural community has been marked and relationships with government have not been restored. Furthermore, Sociedad Rural says that Fernández de Kirchner has avoided all meetings with the sector since then. In 2012 and 2013, at a time when Argentina's farmers are experiencing crippling droughts, rising costs in labour, oil and the cost of implementing sanitary laws, farmers feel that they are again being neglected by their government.

See : "Detour in Colombia" on next page.

[25] Influencing the Policy Makers, Alex Page, Nuffield Scholar http://www.nuffieldinternational.org/rep_pdf/1298576032Alex_Page_report_edited.pdf

[26] http://www.sra.org.ar/newsite/interna.php?inc=inc_hojas/notas_detalle.php&id=5593&sec=1

[27] http://news.bbc.co.uk/2/hi/americas/7316170.stm

**Detour in Colombia: coffee & James Bond**

In January 2013 I visited the steep slopes of Colombia's coffee region, which generate $2800 million worth of exports per year (International Coffee Organization stats 2011).

Celebrity farmer Juan Valdez can be credited for his part in the strong presence of Colombia on international coffee markets. Complete with moustache, donkey, straw hat and poncho, Valdez has appeared on coffee commercials and packaging since 1958. He has successfully merged national identity with the idea of high quality, rich coffee. But what many people don't know is that he isn't real. The "Juan Valdez" we see in marketing campaigns today is Carlos Castañeda, current and third figure-head of the brand.

When I visited 'Hacienda Venecia', a large coffee farm of 200 hectares, I heard how Castañeda beat 380, 000 competitors auditioning for the role in 2006. According to them "it is easier to become the new James Bond than the new Juan Valdez".

Today many brands, especially in North America, see it in their interest to commit to 100% Colombian coffee. Certification also plays a part on international markets e.g. Fair Trade, UTZ, Café de Colombia and religious schemes such as Halal.

The EU also set up a "Colombian Coffee" Protected Designation of Origin scheme in 2007.

Despite the secure export markets and competitive edge, Colombian coffee producers have challenges to face. Those I spoke to told me about the difficulties of labour availability during the twice-yearly harvests (done by hand), when 400 – 500 pickers are required. In addition there are the commonly isolated and difficult landscapes to contend with, and coffee borer beetles.

# 5. Brazil

In January 2013, not long into my Brazil journey, I participated in an audience with the country's President Dilma Rousseff. I sat among hundreds of municipal politicians who had come to the capital city in order to raise their local gripes, and heard her bravely declare "*são felizes os brasileiros*" – "Brazilian people are happy". Some five months later she would have to reconsider those words. In June 2013 the largest anti-government protests for 20 years broke out and urban riots on the streets of Brazil made headlines around the world. Nevertheless, outside the political realm, I would have to agree with her statement and it is for this reason that Brazil was my favourite country. I had never been anywhere so optimistic and so "foreign" compared to European ways. I was moved by the beauty and diversity of the landscape and the candour of the agriculturalists I met.

My journey there was roughly organised in the following way:

- Two weeks at the heart of Brazil's most industrious cropland in Minas Gerais and Mato Grosso, guided by agri-business intelligence firm Celeres
- Two weeks in the capital Brasilia
- Two weeks in the Amazon rainforest
- One week in the Southern *Gaúcho* or cattle ranching region
- Two weeks on an organic horticulture farm
- Ten days interviewing industry bodies in the megalopolis of São Paulo, a major hub for global agri-business

Agriculture is a driving force behind the Brazilian economy and the country has enough natural and technological resources to plan for further expansion. Currently the sector represents 5.2% of the Gross Domestic Product (rising to around 25% when including agribusiness and industry). It employs 15.7% of the work force[28] and generates 40% of exports[29], of which coffee, soybeans, wheat, corn, cocoa, citrus and beef represent the majority. Current forecasts show that farm incomes in 2013 are expected to be 8.1% higher than 2012[30].

Brazil is the second biggest GMO cultivator in the world, second only to the USA, with 36.6 million hectares in 2012 or 21% of global

**Brazil in my Nuffield year**

- June/July '12: United Nations Conference on Sustainable Development, Rio de Janeiro
- October '12: Resignation of Pedro Arraes, President of public biotech research agency Embrapa
- November '12: First 'Agricultural Dialogue' takes place between EU and Brazil. Mutual recognition of organic standards and geographical indications discussed. Next instalment September '13.
- April '13: Brazil committed to use 25% ethanol in gasoline (increase of 5%)
- June '13: Civil unrest sees largest anti-government protests and urban riots for 20 years
- July '13: Monsanto launches its herbicide tolerant, insect-fighting INTACTA soy
- July '13: Monsanto comes to agreement on seed royalties with 47 Brazilian farming unions, following months of disputes

[28] CIA Factbook 2011 & 2012

[29] http://sustainagro.org/en/files/2012/06/Executive-summary-Unicamp-C%C3%A9leres-Socio-economic-development-and-agriculture-in-South-America-final.pdf

[30] CNA figures, 2013

hectarage[31]. The GM crops commercially cultivated are soy, maize and cotton.

According to agri-business intelligence agency Celeres, the adoption of agricultural biotechnology increases every year, with producers investing in the technology because it can lower costs and facilitate management of weeds, diseases and infestations. The majority of growers I spoke to agreed with this viewpoint and had a clear preference for genetically modified crops, also saying that it is a "cleaner and greener" technology.

Brazilian farmers do not receive much in the way of public financial support from the government. A recent study from the FAO puts this at less than 6% of agricultural GDP, compared with 25% in OECD countries and 18% in India[32]. However, there is comparatively high public investment into crop varieties and livestock genetics that are deemed to provide concrete "public goods". This section will show that although the Brazilian government can be seen as very "pro-technology", there are political barriers that stand in the way of farmers taking full advantage of these technologies.

## 5a. Brasilia: farm lobby in Brazil's capital

Brazil's largest farming union is called the CNA or the *Confederação Nacional da Agricultura* and represents 1.7 million rural producers. Unlike most farmers' unions in Europe, membership of the CNA is mandatory. Fees are raised by a levy system provided for in national law and the organisation even receives public funding.

The President of the CNA is Katia Abreu, also a Senator in the Brazilian government. Having worked for a farming union myself, one of the first questions I put to the producers I met was whether they think she is doing a good job at representing their interests. From small-scale organic producers to beef farmers, to soybean giants I did not hear any criticism of Abreu worse than "she is brilliant but she has no power". The most common response was "we need her there". All in all, I got the impression that she is considered to be a national farming hero and this is a feat considering the breadth and diversity of members she has to please.

**National treasure: Katia Abreu**

- Female rancher from Tocatins, a state in a remote part of Brazil
- President of Brazil's main farming organisation, Confederação National da Agricultura (CNA) with 1.7 million members
- One of Brazil's 81 government senators
- Difficult climb to the top: a helicopter accident killed her husband in 1987, leaving her alone with two sons and a farm
- She admits to knowing nothing about ranching to begin with and the journey to become a respected farmer was not easy
- She is said to have cut her hair short to look less girly and despite the heartache of losing her husband she would only give in to her grief when alone after work, never in front of the farmhands
- Helped negotiate a deal on the *Código Florestal*, the most controversial agricultural law ever made in Brazil. It saw an end to deforestation and requires farmers to take 20-80% of land out of production for nature preservation
- Key quote on government red tape and bureaucracy: "'farmers are not criminals, they are producers of rice and beans!'

The CNA, like most of the world's farm interest groups, has representatives permanently installed at the national capital to ensure proximity to government and law makers. However, uniquely to the Brazilian union, offices have also been set up in China and at the EU in Brussels in order to monitor legislation and promote Brazilian food on

[31] ISAAA report 2012

[32] http://www.fao.org/docrep/018/i3325e/i3325e.pdf

lucrative export markets. Both offices were set up fairly recently, during my Nuffield Farming Scholarship year.

So the CNA seems to have a lot going for it: an international presence, a strong leader, almost two million members, secure funds and a direct voice at the heart of government. I was therefore keen to go to their headquarters in Brasilia to find out exactly what are their challenges and whether these have any effect on the adoption of new and emerging technologies.

### 5a.i. Biotechnology and public research in Brazil

Research into agricultural biotechnology does not seem to be one of these challenges. Both Abreu and her government believe in the benefits of agricultural technology in Brazil and, like those in Argentina, give the impression that the country's agricultural prowess is down to a *"conquista tecnológica"* or a "technological conquest".

Abreu has huge affection for Embrapa, Brazil's state-run biotech agency which develops crop (GM and non-GM) varieties, as well as conducting research on meat and milk production. In speeches she has even referred to "*a nossa querida Embrapa*" or "our dear Embrapa". This is a phrase I heard from other politicians too and the feeling is that Embrapa has helped Brazil to realise its own vision of food production since it was established in 1973. According to Embrapa, every BR$1 invested in their company generates an average return of BR$13.20 for Brazilian society[33].

Publically funded science on biotechnology is happening in Europe, as highlighted in a recent publication by the European Commission "A Decade of EU-Funded GMO Research[34]". However, it is interesting to compare the Brazilian situation to that in Europe where public scientists are not so revered. In April 2013 environmental activist Mark Lynas - who regrets having destroyed publically funded UK GMO field trials in the past - stated that scientists are "the unsung heroes of this entire saga"[1].This is true at least when comparing the situation to Brazil. It may be some time before we routinely hear high-profile figures at Westminster referring to "our darling Rothamsted" or "our beloved John-Innes Centre".

Likewise it would be interesting to hear a politician from France, the land of Gilles-Eric Séralini and José Bové, declare "*notre INRA bien-aimé*" when trying to win favour in a public speech. INRA is the French National Institute for Agricultural Research, which announced in 2010 the abandonment of any plans to develop GM varieties to answer French agronomic problems. The reason cited was public opposition and INRA has long been grappling with the role of public sector in biotechnology research.

### 5a.ii. Bureaucracy a key challenge

One of the challenges for the CNA when wanting swift and effective action from the Brazilian government is bureaucracy. Brazilian academics in the field of agricultural political science, such as Professor Marcos Fava Neves at the University of São Paulo, talk of the "exaggeration of public machinery" in his country[35]. He says that 90% of the federal budget is spent on public administration, that

[33] http://reports.weforum.org/manufacturing-growth/view/brazilian-agricultural-research-corporation-embrapa-brazil/

[34] http://ec.europa.eu/research/biosociety/pdf/a_decade_of_eu-funded_gmo_research.pdf

[35] p178-9, Escenario para el agronegocio y una agenda para el desarrollo sustenable, Marcos Fava Neves and Marco Antonio Conejero, Agronegocios en Argentina y Brasil, Universidad de Buenos Aires, 2007

it takes 152 days to open a business - compared to two days in Australia; and environmental permits can take more than two years to process - compared to five months in the UK. He says that government policies do not recognise the value of food production in Brazil. Importantly, this extends even to disease prevention, which he believes impacted on the outbreaks in Brazil of foot-and-mouth in 2005 and Newcastle disease in 2006.

Fava Neves also talks about the "duplication of work between different ministries" and points to the fact that there is not one but two agriculture ministries in Brazil. One is the "Ministry of Rural Development" and the other is the "Ministry of Agriculture and Livestock" or MAPA. The aim of this is to address the balance between so-called "family" and "corporate" farming. But according to Fava Neves, the separation of Ministries is a "false dichotomy" because there is no difference between family and big agriculture - rather small, medium and big.


**Debate between Brazil's two farm ministers, Brasilia**

I saw the two Ministries in action for myself at the government conference in Brasilia in January 2013. President Dilma Rouseff had opened the event, commenting on the disastrous consequences of drought for farmers in the North East of the country. I then saw a debate between Mendes Ribeiro Filho, at the time of my investigation the Minister for MAPA, and Pepe Vargas, Minister for Rural Development.

Ribeiro Filho spoke about increasing agricultural investments in engineering, machinery, sustainable livestock and knowledge transfer. He applauded what would be the "best harvest in history" in Brazil that year with a high commercial balance despite the world financial crisis. The projection was BR$305 billion of grains in 2013.

Vargas then took the floor and his story was different. The motto of his Ministry is "Family agriculture feeds a growing Brazil". These farmers, who make up 84.4% of the farming population but occupy just 24.3% of farmland[36], face huge hurdles in attracting successors to continue production into the next generations. Vargas also highlighted that 50% of Brazil's poor live in rural areas and he called for a strengthening of family agriculture, which currently represents: 33% of gross value of production, 87% of manioc, 70% of beans, 48% of corn, 34% of rice and 16% of soy.

### 5a.iii. Farmers as stewards of natural resources in Brazil

The CNA has to ensure that its members get a fair deal in the laws that are made in Brazil on natural resources and renewable energ. Latin America is of incalculable biodiversity value for humanity, Brazil in particular is said to represent around 20% of all life on the planet[37] and 12% of global freshwater[38]. The

36 http://sustainagro.org/en/files/2012/06/Executive-summary-Unicamp-C%C3%A9leres-Socio-economic-development-and-agriculture-in-South-America-final.pdf

37 http://www.brasil.gov.br/cop10-english/overview/biodiversity-in-brazil/brazil-a-megadiverse-country/br_model1?set_language=en

role of farmers in looking after these resources is embraced by the CNA, with President Katia Abreu declaring at the time of my Farming Scholarship "we are biggest food and environment power in the world".

There is huge political interest in the preservation of natural resources in Brazil, not just domestically but also from the international community. In December 2012 I visited a nature reserve in the heart of the Amazon rainforest. The journey took a day and a half and required two flights, two boats and a strong stomach, with each vehicle getting smaller and more rickety as we got deeper into the forest. During my visit I spoke to food producers in tiny communities of just 50 people who could tell me which trees the laws prohibited them from chopping to make canoes or houses for their families. I heard that there has been 0% deforestation since 2008 in Brazil and that environmental laws there are stricter than anywhere in Europe.

**Grazing cattle in the "Várzea" part of the Amazon rainforest**

Public resources have been mobilised in Brazil to research solutions into biodiversity protection. For example, among diverse projects on flora and fauna, Embrapa is conducting experiments on the cloning of animals in danger of extinction such as jaguars and maned wolves[39].

**Farming in "Green Hell"**

In December 2012 I spoke to food producers in the *Várzea* or flooded part of Brazil's Amazon rainforest. Despite having the world's most fertile soils, producers here have a lot to deal with:

- **Yearly flooding** of up to 12 metres and a cultivation window of just 6 months each year. Manioc a key crop
- **Wet season predators** such as jaguars. They are strong swimmers and can hone in on human and livestock populations when water levels are high and land is densely populated
- **Dry season predators** such as caimans. They get very hungry when water levels and fish populations are low. Farmers travelling by water to make use of the short cultivation window of cropland must proceed with caution
- **National legal constraints and enormous international pressure** to preserve predator populations, meaning that the debate on control methods is difficult
- **Geographical isolation** and communities that are typically no bigger than 50 -200 people
- **Little or no access** to farm inputs and machinery
- **Government controls** on which trees to use for houses and canoes, which fish can be served to feed the family, and more

## 5a.iv. Ethanol fuel and the smell of baking cakes!

Renewable fuels are seen as part of the solution to climate change in Brazil and roughly speaking, half of Brazilian sugar cane goes to ethanol and half goes to sugar[40]. In April 2013, at a time when the EU was scaling down previously agreed targets on renewable

[38] http://www.brasil.gov.br/sobre/meio-ambiente/legislacao-e-orgaos/lei-das-aguas

[39] http://g1.globo.com/natureza/noticia/2012/10/embrapa-estuda-clonar-animal-brasileiro-ameacado-de-extincao.html

[40] Biofuels and food security, UN Committee on Food Security High Level Panel of Experts, p66 (June 2013)

transport fuel[41], the Brazilian government sent a strong signal to ethanol producers and investors by raising the requirement of ethanol in gasoline to 25% (an increase of 5%). At the Rio+20 Sustainable Development Conference I attended in June 2012, Environment Minister Izabella Teixeira was hugely proud to announce to the international audience that she had arrived in a car using domestic bioethanol. Anecdotally, if you visit a petrol station in Brazil to fill up your car it smells of baking cakes!

### 5a.v. The Forest Code: 20-80% of land out of production

In 2012 the review of Brazil's *Código Florestal* or Forest Code was agreed. This is a hugely controversial law of immense environmental importance, applied to all privately owned rural land. The main feature is that agricultural land, at farm level, is required to be set-aside for native vegetation. The requirements range from up to 80% in the Amazon, 35% in the cerrado and 20% everywhere else. Additional rules include the protection of riverbanks, reforestation of degraded areas and the creation of a national "environmental" register of farm holdings.

Much as in California on GMO labelling, the response by the political community when faced with this controversial bill was to separate and, to a certain extent, lose sight of the real questions under discussion. In government, there was a polarisation of positions as the *ruralistas* were set against the urban or some would say "environmental" thinking Senate. In the public sphere, environmental lobby groups accused the *ruralistas* of neglecting their responsibilities and being overly motivated by profit. On the other hand, some in the *ruralista* community were said to disregard the concerns of the environmental NGOs, calling them "*ecochatos*" which roughly means "eco-bores".

### 5a.vi. CASE STUDIES: Regulation and the daily lives of farmers

From my interview with the CNA in Brasilia I heard that the "whole of society" participated in the negotiations on the Forest Code and there were efforts to conduct a balanced debate. But of all the lobbyists, NGOs and senators who worked on the law, farmers would be the only ones to deal with it in their daily lives. They have to plan their futures around its consequences and I wanted to understand what these were.

For this reason, I visited two major crop farmers, one in Minas Gerais and one in Mato Grosso. I wanted to know what the Forest Code and wider government policies mean for them on the ground.

The farmers I visited were far-flung from the country's iconic cities, both in the 'cerrado' or savannah that lie at the heart of Brazil's most environmentally rich crop land. Land there is among Brazil's most industrious and as a result it holds central economic importance. Yet this was not always the case. Technology transformed the cerrado from unproductive agricultural land 30 years ago, to producing 70% of Brazil's farm output today, all of this done without deforestation of the Amazon rainforest. Nevertheless, after the Amazon, this area of land is hugely rich in natural resources and a focal point of many of Brazil's environmental laws.

The first farm I saw was in Minas Gerais, the state with the supposedly smaller holdings. As I saw, this means farms of 2,000 or 3,000 hectares. It means cattle herds of 2,000. It means on-farm seed processing units and employment for a large percentage of village populations.

[41] http://europa.eu/rapid/press-release_IP-12-1112_en.htm

Ma Shou Tao group, Brazil

This is prime agricultural land and the farm I saw, belonging to the Ma Shou Tao group, has 2,000 hectares. The farmer is enormously proud of the agronomic practices carried out on his mainly GM soy crop, citing no-till and low fertiliser applications as key benefits. The company is renowned and has even held regular crop-tech events, attracting more than 3,000 visitors to the farm to share ideas on the future of production.

The strong position of the Ma Shou Tao group also means that new market avenues and innovative products can be explored. One of these brings soy into everyday diets through the manufacture of "Good Soy"[42] cookies, for which reason 7% of land at the farm I visited is under non-GM soy cultivation. State-run crop technology agency Embrapa helped to pioneer the technology for the variety of soy used. The cookies are marketed on the basis of a "healthy countryside for a healthy product", bringing protein and energy to the diet as well as helping with diabetes, heart health and symptoms of the menopause. I can also confirm that they are delicious!

My next stop was a similarly large farm in Mato Grosso, cultivating sugar cane, coffee, corn and soy. Within thirty minutes of arrival, I had seen rare owls endemic to the cerrado and a family of emu flocking through the crops looking like something out of Jurassic Park. Later I saw what the farmer told me was *tatu* (armadillo) trotting around. Even with the gaps in understanding with my Portuguese I could see how excited and proud he was, telling me that there are also wolves and wild boars living there.

Coffee in the cerrado

Despite the work the farmer does maintaining the paradisical landscape, he spoke to me at length about his country's environmental regulations, which he says are "absurd and impossible to carry out" and can ultimately criminalise farmers for producing food. For him, many of the laws are made on political grounds, not on agronomic common sense. One example cited were the arbitrary percentages of land taken out of production under the Forest Code. It was felt that there is little recognition for the many, targeted, environmental practices that farmers carry out alongside the law. Furthermore, the Forest Code is just a start in terms of environmental rules and there are many more requirements regulating land use. And just like in Europe, there are pollution licenses to buy and slurry storage requirements to fulfil for livestock farmers.

In the opinion of the Mato Grosso farmer, biotech adoption in Brazil has been a revolution and so widely adopted that it is a "*caminho sem volta*", or "no way back". He

[42] http://www.goodsoy.com.br

also cultivates conventional soy as 35% of his crop. The reasons for doing this are to manage the risk of weed resistance and because of the premium growers receive for non-GM.

## 5b. Lucas do Rio Verde: the value of new farmers to society

Brazil's farmland, as we know it, is very new compared to Europe. No exception is Mato Grosso, the state that continues to lead Brazil in the adoption of agricultural biotechnology, with 10.7 million hectares planted in the 2013/14 season[43].

For me nowhere demonstrated the idea of new and productive farmland more than Lucas do Rio Verde, a municipality that alone produces 1% of Brazilian grain[44]. It is situated deep in Brazil's bucolic midwest and, as I found, reachable only by aeroplane followed by a full day's drive. With some 45,500 inhabitants, today the *Mato Grossense* city is unrecognisable from 40 years ago when the Agrarian Reform brought people there to farm. The subsequent mechanisation of agriculture and the move to the production of soybean, corn and cotton meant that it rapidly transformed into one of the most important agri-business municipalities in Brazil.

Even as late as the 1990s, residents were not yet connected to the electricity grid and with 12% growth rate per year[45], the city continues to undergo constant changes. A "second phase" of economic growth is now seeing major processing units move into the city and agribusiness job creation is on the increase. Wealth is being generated and the city has been expanded with care. As a result, Lucas do Rio Verde ranks highly in Brazil's Municipal Human Development Index[46] and its green credentials mean that it was put forward at the UN Rio+20 Conference as a model of sustainability.

During my visit, I wanted to hear what it was like to be from the first generation of farmers who saw agriculture change lives so dramatically in the region and more importantly, what it was like to lay the foundations of this change. I had the good fortune to interview Ildo Romancini, producer of soybeans and Secretary of Agriculture at the municipality government office. Romancini is from a *Gaúcho* or cattle ranching family in the south of Brazil. Like hundreds of Gaúcho-Italian-German families in '70s and '80s southern Brazil, his family made the brave journey to migrate hundreds of miles away to farm new and uncharted territory.

Romancini described the story of the region to me in amazement, having arrived as a boy when the small areas of land under cultivation were mainly dedicated to rice. During our interview he spoke with pride about the contribution of Lucas do Rio Verde to Brazilian wealth and jobs since the move to large scale crop cultivation. On genetic engineering, he said that the technology means cleaner soil and explained that the lack of tillage prevents soil erosion and is good for rivers.

Challenges do exist for farmers in the region and among them are the costs associated with poor infrastructure. Transportation has failed

[43] http://celeres.com.br/wordpress/wp-content/uploads/2013/08/IB13011.pdf

[44] http://www.lucasdorioverde.mt.gov.br/principal/Pag_Economia.php

[45] http://sustainagro.org/en/files/2012/06/Executive-summary-Unicamp-C%C3%A9leres-Socio-economic-development-and-agriculture-in-South-America-final.pdf

[46] http://www.ibge.gov.br/cidadesat/xtras/temas.php?codmun=510525&idtema=118&search=mato-grosso|lucas-do-rio-verde|municipal-human-development-index-mhdi-

to keep pace with rapid agricultural growth and this is considered to be a Brazil-wide issue, with farm leader Katia Abreu stating in her blog in May 2013, that "our roads, railways and ports cannot support the weight of our big agriculture"[47]. The problem is particularly important for Lucas do Rio Verde when considering that Brazil transports 82% of its soy by road, compared to just 25% for its competitors in the USA. Estimates have shown that the cost of moving a tonne of soybean from farm to port for Brazilian producers is six times greater than that incurred in America[48]. Furthermore, potholes can cause trucks to lose up to 3% of their cargo in Mato Grosso[49].

During our interview Romancini recalled that at the beginning of his farming career, 2370km of roads were built through a public-private partnership on asphalt led by the Mato Grosso state government in partnership with farmers, which was considered a pioneering initiative at the time. Those roads today, responsible for transporting huge quantities of Brazil's grains for global export, are sadly a perfect demonstration of abysmal infrastructure. Promises from the Rousseff government to invest billions in road, water and rail by 2015 are yet to take effect and my first-hand experience of leaving Lucas do Rio Verde involved sitting for hours on single-lane, potholed roads, blocked with loaded-up lorries and no opportunities to overtake. Television stations came to make news of the traffic jams we were sat in, such was the extent of the queues.

## 5c. Belo Horizonte: local food and Euler's mangoes

In the Americas just as in Europe, there is disconnection between people and their food and this affects the public debate on agriculture.

I found that the demographics of Brazil in particular, where 87% of the 200 million-strong population is urban[50], present a challenge for the farming community. Mato Grosso, where Brazil's agricultural light shines the brightest, is bigger than the combined area of France[51], UK and Ireland but home to just three million people[52]. Some 900 miles away, roughly the distance between London and Rome, there is São Paulo - the largest city in the Americas. São Paulo is home to over 11 million Brazilian consumers - double that of Scotland – and has a trendy gastronomic scene, thriving in home-grown celebrity chefs and food journalists.

So the *Paulistas*, or São Paulo urbanites are clearly interested in enjoying food but are they aware of the farmers who produce it? At the time of my Nuffield Farming Scholarship, São Paulo politician Xico Graziano gave a much quoted interview[53] in which he lamented the poor image of farming in Brazilian society and the "disdain" of urban populations for the sector. He also pointed to this poor image as one of the causes for ineffective public policies and neglect of farmers by the government.

47 http://www.senadorakatiaabreu.com.br/?p=2111

48 http://www.ft.com/intl/cms/s/0/7dd98ed6-059f-11e3-ad01-00144feab7de.html#!

49 http://www.bloomberg.com/news/2013-08-14/brazil-42-billion-rail-bet-to-cut-iron-ore-farm-costs-_freight.html

50 CIA Factbook 2010

51 France Metropolitan area, overseas territories excluded, Wikipedia

52 CIA Factbook, July 2013 est.

53 http://www.srb.org.br/noticias/article.php?article_id=6761

**Beans in Brazil: more than just soy!**

In terms of national fondness, rice and beans are to what Brazil what fish and chips are to the UK. The dish is consumed daily, with a special meat version *feijoada* traditionally served on Saturdays.

In São Paulo I met market intelligence agency and bean enthusiasts UniFeijão. I heard some facts to illustrate the importance of beans in Brazil:

- Brazil is both the biggest consumer and producer of edible beans in the world
- Brazilian law provides for a "national rice and bean week" in October every year
- Health campaigns such as *Meu Prato Saudável* (My Healthy Plate) aim to stimulate bean consumption among urban populations. Local governments and even hospitals have contributed financial support
- More than half of the beans in Brazil are the "carioca" variety, followed by black beans and then other varieties such as yellow, canary, and *rosinha* or "rosy"
- A big proportion of Brazilian bean producers, 80%, are small-scale
- In 2011 the first GM bean was approved for cultivation in Brazil. It resists the "Golden Mosaic" virus which can destroy entire plantations
- Research is underway on a bean variety to provide enhanced nutrition for consumers

Most of the resources invested to genetically engineer beans in Brazil comes from the public purse and is conducted by state-run agricultural technology agency *Embrapa*

These issues compelled me to investigate the boundaries between "urban" and "rural" in Brazil and in doing so I found that a "local food movement" exists and is of increasing relevance among the urban middle class. I went to a small village in the backwoods of Belo Horizonte, the third most populous city in the country, with over two million people. For almost two weeks I shadowed the work of horticulture producers Euler Andrés Ribeiro and his wife Iara, grandparents who run a food delivery scheme once a week with their business DAHORTA (www.dahorta.org). Sales are made online and delivered to homes every Tuesday.

Insert photo of Dahorta local food scheme

Euler explained that his main motivation is to try to "recreate links between farmers and consumers". He says that small producers in Brazil "*não têm jeito*" - they have no way forward. He says they are vulnerable to supermarket practices that "play producers off against each other" and lack the bargaining power of the larger "*agronegócios*" or agri-businesses.

DAHORTA's delivery scheme is a big commitment to his vision of the cause. We were a small team of four working from dawn to dusk in the run-up to "delivery day", picking and packing mangoes, lettuce, rocket, broccoli, citrus fruits and more. Loaded with two vans, we made the 1.5 hour trip to Belo Horizonte on Monday night and got up at 4:30 a.m. the next day to coordinate deliveries. Eighty six cases were sold when I was there. Euler's ambition is 100 cases, but this would be hard work and he says "I will be too old to make deliveries soon."

A former vet experienced in homeopathic fertility treatment for cattle, Euler believes that his IBD-certified organic production is also a commitment to the environment. He does not use any fertilizer or chemical control of weeds and is willing to deal with the complications that this entails. He says he is against productivity "at any cost", that it is important only up to the point that it starts compromising quality in terms of reduced nutritional value, chemical waste and low natural resistance to pests.

# 6. My reflections

## 6a. USA

My USA journey focused on California, in the run-up to a momentous public ballot on GMO labelling on November 6, 2012. The referendum on "Proposition 37" would let the Californian public decide whether they wanted to introduce mandatory labelling requirements on food products derived from genetic engineering technology. In the end the Proposition was defeated by a narrow margin: 53.7% "No" and 46.3% "Yes".

My interviewees included farmers, environmental NGOs, scientists and biotechnology companies. From them, I was surprised to learn that the USA faces challenges similar to those in the EU in terms of public debate on agricultural technology. On both sides of the debate, the people I spoke to implied that Proposition 37 was American food politics at its worst, full of polarised opinions, exaggerations, inaccessible truths and the notion that "winning votes is more important than truth and science".

However, in my opinion, whilst Proposition 37 served to politicise California's debate on biotechnology to a certain extent, overall it inspired a real discussion. Even as a foreign visitor, I found it very easy to be exposed to each side of the argument in its entirety and communication was efficient and clear. Overall, I felt that Proposition 37 could count as an example of food politics in the USA when there was an open space for campaigners, farmers and agri-businesses all to have a voice.

## 6b. Argentina

From Presidential cuddles with cloned goats, to the rapid adoption of Round-Up Ready soybeans, of the countries I visited, Argentina demonstrated the least complicated relationship with new and emerging agricultural technologies.

There is strong institutional support for biotechnology in Argentina and the government believes in the regulatory controls, the safety approvals system and the benefits for society. Like Brazil, Argentina has a public research agency in INTA, which helps develop home-grown technology solutions for farmers, who also have the option to invest in products from multinational companies. I found that for farmers in Argentina, the path to adoption is relatively smooth once a technology has been developed and approved.

However, politics still impact upon the innovative capacity of Argentina's food producers in spite of the effective institutional framework on technology adoption. For one, the country is hugely dependent on market access for its farm exports to places like the EU and China, even if they do not share the same technological vision. For another, the country's farmers have been struggling for too long to engage in constructive dialogue with domestic politicians on farm profitability, taxes and export regimes. I learnt that relations between the farming union *Sociedad Rural* and President Cristina Fernández de Kirchner hit an all-time low in 2008 and have not fully recovered since.

## 6c. Brazil

Brazil is a tropical food giant of incalculable biodiversity value for humanity. The enormous attention lent to Brazil's natural resources, both at national and international level, means that policies are particularly mindful of how the country places its huge agricultural footprint. An example of this is the revised Forest Code, which requires land to be taken out of production at a rate of 20-80% in order to protect native vegetation. The policy means that, even in Brazil's most productive crop areas such as Mato Grosso, land can be set aside at a rate of 35% at farm level.

In political circles, it is not unusual to hear Brazil's state-run agricultural technology agency referred to as "our dear Embrapa". The agency employs scientists to develop a multitude of agricultural technologies, including animal genetics, GM and non-GM crop varieties that are felt to be of real benefit to society. Crucially, Embrapa's engagement with farmers and politicians contributes to a smooth path of adoption for new and emerging technologies.

Brazil's farmers have strong leadership through farm union President Katia Abreu. Also a government senator, Abreu is an asset for Brazilian food producers and can help them overcome political obstacles such as the lack of investment in infrastructure and navigation through the country's not one, but two farm ministries.

**Rio + 20 United Nations Conference on Sustainable Development**

- In June 2012 I attended the Rio+20 UN Conference on Sustainable Development with the World Farmers' Organisation.
- We were among more than 18,000 stakeholders trying to influence the direction Conference and the text on agriculture.
- More than 100 heads of state were present and the Brazilian host government was said to welcome fifty thousand people to the famous seaside city.
- As a Nuffield Farming Scholar volunteer, my role was to help coordinate the on-site activities of the delegation of farming leaders. These included the Australian National Farmers' Federation, the Federated Farmers of New Zealand, the Himalayan Farmers' Organisation, the Ugandan Farmers' Federation and the Specific Union of Women Farmers in Jordan.
- Outcomes included the signature of the Rio Declaration on Environment and Development and Agenda 21, which acknowledges that an increase in productivity will need to take place.

# 7. Conclusions and Recommendations

1. Scientists must be enabled to continue identifying responses to modern day challenges to food and energy production.

2. Farmers are highly innovative and should have the choice of a wide range of safe and proven technologies to benefit agricultural production and natural resources.

3. A farmer-centred approach on agricultural technology policy will bring real benefits for society.

4. Lack of expertise and accountability in the political community should not be allowed to hamper the transfer of technology to farmers.

5. Government foresight is needed to develop effective policy frameworks that match rapidly emerging and increasingly complex agricultural technologies

6. Governments should "get ahead" on policy and engagement with the public on technology, or be forced to spend a disproportionate amount of time and resources on debates further down the line.

7. Governments have a responsibility to ensure dialogue between science and society. Appropriate policy responses on agricultural technologies must involve honest debate between research communities, food and energy producers on the ground, technology companies, civil society and democratically elected representatives.

8. Today consumers enjoy food that is safer and more sustainable than ever before but this message is not getting through.

9. The EU must sustain efforts to resolve its most serious problem: the lack of communication and public trust about food science.

10. On-farm technology transfer must go hand-in-hand with best practices and sound farm management.

# 8. Life after my Nuffield Farming Scholarship

In ways both big and small, Nuffield Farming Scholarships have been changing lives for years and this was no exception for me.

The most obvious change since my Scholarship is that I now live in Rome, having moved there at the end of May, 2013.

My main duty is to help coordinate the Secretariat of the International Agri-Food Network (IAFN), an informal coalition representing thousands of international companies, and hundreds of national associations involved in the agri-food sector at global level. Together they represent tens of thousands of small and medium enterprises, thousands of co-operatives, and millions of farmers.

The role of the IAFN is to engage with the United Nations Committee on Food Security on issues such as biofuel production and food security, agricultural investment and the role of smallholder farmers.

As my previous professional experience focused mainly on the 27 (now 28) Member States of the European Union, my Nuffield Farming Scholarship has directly informed me about agriculture in countries that sit on the Committee on Food Security, notably the USA, Brazil and Argentina.

# 9. Executive Summary

New and emerging technologies promise to advance the plight of agricultural producers facing increasing pressures such as climate change, land scarcity, animal feed availability, price stresses and soaring input costs. Existing "tools in the toolbox" such as plant breeding and other gene technologies have been embraced by farmers across the world to varying degrees.

The primary aim of my report was to uncover new truths about the political path to the adoption of agricultural technologies once they have been approved. In order to do this, I firstly wanted to evaluate the legislative and political frameworks currently in place. Next, I aimed to tap into key public debates such as that on GMO labelling in the USA, in order to assess public awareness and acceptance. Finally and most importantly, I interviewed farmers to hear about how they see the opportunities and challenges of agricultural technology adoption.

In the USA, Brazil and Argentina I organised 64 formal interviews: 26 in Portuguese, 25 in English, 12 in Spanish and 1 in French. I spoke to producers, farm organisations, politicians and industry bodies. I heard that, on a political level, the most successful way to ensure effective technology transfer is to put in place policies that are farmer-orientated and effectively communicated to the public.

My paper also raises questions:

- What impact does the UK's membership of the European Union have on access to agricultural technologies?
- What kind of foresight structures are in place within European governments to deal with emerging agricultural and environmental technologies?
- How are farmers keeping track of new and emerging technologies that are being developed in their own country and also places like the USA, Argentina and Brazil? What is the role of farm organisations and the Nuffield Farming Scholarships Trust in this?

Katy Lee

The Cottage
Marston Lane
Marston
Northwich, Cheshire.

Mob. : 0039 331 838 3136
Email : kate.elizabeth.lee@hotmail.co.uk