



FUTURE FARMING:

CLA POLICY ON BIOTECHNOLOGY



Country Land &
Business Association

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FOREWORD

As an organisation that values the importance of long-term decision-making in food production and land management, the CLA recognises that the debate on technology in agriculture has fundamentally changed. Politicians, scientists and the media are now emphasising the need to address ways to provide food for an increasing global population, whilst protecting resources and biodiversity.

Biotechnology has a clear role to play in addressing the added challenges to cereal and livestock sectors arising from climate change. In 2012 alone we saw unprecedented weather patterns that led to both drought *and* flooding in the UK. Such patterns show the importance of seeking science-led solutions for landowners, farmers and land managers.

Genetic Modification provides one of the most significant tools to address increased yields, healthier livestock and environmental protection, but there is much more to biotechnology than genetic modification. The concept of biotechnology in food and farming has been in place for centuries, with science continuously focused on how to improve the output of food on increasingly strained resources. Biotechnology provides a much broader application of science than GM; GM is just one of many areas comprised by biotechnology.

GM products in Europe undergo one of the most rigorous safety authorisation processes in the world. It has been estimated by the European Commission that due to rigorous safety assessment procedures, more than two trillion (two million million) meals containing GM products have been consumed worldwide.

While landowners should be allowed the opportunity to use the full range of available technologies on their land, those who choose *not* to make use of biotechnological alternatives should equally be protected from any potential excessive seed or pollen transfer from those who have chosen to use these technologies. For those neighbouring conventional or organic producers, a balanced approach must be taken in ensuring that GM and non-GM products can cohabit. Examples from other countries have shown that this is entirely possible.

It is crucial that the public debate takes into account the wide range of applications for biotechnology. The livestock sector arguably has more to gain from biotechnology, where genetic-based research is preventing disease, improving overall welfare and reducing input costs.

The UK has one of the best traditions of agricultural technology research in the world, and the Government needs to champion our excellence in the sector. The CLA argues that this sector's existing work must be further encouraged and supported by Government for it to flourish.



A handwritten signature in blue ink that reads "Harry Cotterell". The signature is written in a cursive, flowing style.

Harry Cotterell
President, CLA

LIST OF ABBREVIATIONS

AI	Artificial Insemination
AIC	Agricultural Industries Confederation
AIV	Avian Influenza Virus
BBSRC	Biotechnology and Biological Sciences Research Council
BIS	Department for Business, Innovation and Skills
BSPB	British Society of Plant Breeders
BVD	Bovine Viral Diarrhoea
CPA	The Crop Protection Association
FMD	Foot and Mouth Disease
FSA	Food Standards Agency
FSEs	Farm-Scale Evaluations
DEFRA	Department for Environment, Food and Rural Affairs
GM	Genetic Modification / Genetically Modified
GM-HT	Genetically Modified Herbicide Tolerant
GMOs	Genetically Modified Organisms
IBERS	Institute of Biological, Environmental and Rural Sciences
ISAAA	International Service for the Acquisition of Agri-biotech Applications
NFU	The National Farmers Union
PCR	Polymerase Chain Reaction
SBV	Schmallenberg Virus
SCIMAC	The Supply Chain Initiative on Modified Agricultural Crops
SIGMEA	Sustainable Introduction of GMOs into European Agriculture
TSB	Technology Strategy Board

Future Farming

CLA policy on biotechnology

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EXECUTIVE SUMMARY

In recent years, the issue of biotechnology has been raised a great deal by politicians, the media and industry stakeholders within the UK and Europe in the context of addressing challenges to food security caused by changes in consumer preferences, increased demand and overall consumption. The UK Government is also now raising the level of this debate, bringing with it discussions on the merits of biotechnology.

There is a great deal of misinformation within this debate. Biotechnology is often perceived to be synonymous with Genetically Modified Organisms (GMOs), but this is not the case. It is crucial that agricultural biotechnology is recognised as a sector that encompasses a broad range of technological applications, including in the areas of livestock, disease, cereals and feeds, and respective genetic, conventional or mechanical modifications. There are equal misconceptions over the nature of GMOs and GM products in food, and their perceived effects on the environment, non-GM producers, livestock and human health, which are further explored in this report.

The scope of the debate does not only relate to improving productivity to meet future food challenges. Agricultural biotechnology in the UK already makes a significant contribution to the national and rural economies; providing some of the leading private and public research facilities in agriculture. With other European and non-European states putting further resources into their biotechnology sectors, it is important that the Government continues to support research in biotechnology tailored towards British agriculture, while better co-ordinating industry stakeholders and funding bodies to deliver more tangible benefits on the ground.

It is arguably in the interests of landowners that the CLA promotes a comprehensive biotechnology strategy to ensure that producers and landowners are able to choose from the full range of technologies available to them. It is equally important that there are necessary safeguards in place for those who choose *not* to use such biotechnological methods.



1. INTRODUCTION

As outlined in the Government Office for Science's Foresight Report entitled *The Future of Food and Farming*, it has been projected that the global population will increase from nearly seven billion today to eight billion by 2030, and to around nine billion by 2050. Against this was set a clear generational challenge: the UK will need to produce twice as much food with half as much land, energy, water and labour. Consumers and policymakers have become concerned by diminishing natural resources and the increased role of climate change. At the same time, consumers expect the maintenance and promotion of biodiversity and the natural environment.

Expenditure on food as a percentage of income per household in the UK and food consumption in developed countries are both increasing rapidly. The continued application of biotechnology offers

potential solutions in addressing these pressures. However, the agricultural and science industries are united in the belief that the debate on *how* this can take place must have greater prominence.

It is also clear that these demands provide a unique opportunity to build upon the world-class agricultural biotechnology research and development sector in the UK, at the same time bringing significant benefits to the regional and national economy. To achieve this, there must be greater co-operation of biotechnology across academic, scientific, political and industry sectors to ensure these goals are met.

Because of the CLA's role and diverse membership, it is well positioned to comment on the merits of biotechnology from the perspective of landowners and producers, the environment and the rural economy.



2. BIOTECHNOLOGY DEFINITION

There are many varying perceptions of biotechnology and how it is applied across different research sectors. For the purposes of agriculture it is best described as the application of scientific and engineering principles to any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products for specific use¹. It relates to any technique that uses living organisms or substances from organisms to make or modify a product for a practical purpose.

It is crucial that agricultural biotechnology is recognised as a sector that encompasses a broad range of applications, including livestock, disease, cereals, resource protection and biodiversity. The intentions of these applications vary. However, they predominantly relate to welfare and productivity improvements in livestock and increased yields in plant or crop production. While the science that underpins biotechnology has made exceptional advances over the past decade, it should be noted that the concept and intention of biotechnology is not new. It is one that has been in place for centuries.



1. The Convention on Biological Diversity. Article 2. UNEP 1992

3. POLICY DEVELOPMENTS IN THE UNITED KINGDOM

Since the 2010 UK General Election, the issue of biotechnology has been significantly raised as the Government attempts to implement budgetary restrictions, while trying to encourage growth in the economy. As part of delivering this growth, there have been notable representations from MPs on the need for a greater consideration of biotechnology, and the contribution it can make towards employment and training opportunities, food security, protecting the environment, and research and development in the UK. The following chronological events show the increased interest in biotechnology.

- In September 2010 it was announced by the Government that it would discontinue its Genetic Modification dialogue project with the Food Standards Agency. Ministers had decided that they wished to reconsider the position of the Government to GM food and “future public engagement”.
- In July 2011, the House of Lords European Union Committee published its report, *Innovation in EU Agriculture*. In it, the committee stressed the need for the European Commission and member states to formulate strong research indicators in assessing socio-economic outcomes of GMOs. In addition, the Committee felt that on the subject of GMOs: “reluctance to take a risk can be a risk in itself if, for example, global food security is likely to be threatened”.
- In September 2011, Defra announced its approval of the UK’s first wheat trial, to be undertaken by the Rothamsted Research Institute, Hertfordshire, in 2012 and 2013. The aim of this trial is to test whether the crops in question are able to resist aphids under normal field conditions.
- The Green Food Project, a joint initiative between Defra, industry and environmental stakeholders, is seeking to reconcile improving the environment and increasing food production. As part of this, it has endorsed the Foresight Report, stating that “ongoing long-term investment in innovation and research and development is essential so that we can improve our domestic performance, reduce environmental impacts and maintain our competitiveness”, adding that “new technologies such as biotechnology could play a role in addressing the challenges identified by the Green Food Project, but lack of investment and the emotive nature of the debate around genetic modification in particular, have affected the progress of these technologies across the EU”.
- In December 2012, Secretary of State for Defra Owen Paterson publicly spoke in favour of

authorising the cultivation of GM crops in the UK and Europe. He expressed his view that there are potentially significant benefits in genetic modification, and that opposition to such technologies is a “complete nonsense”. In addition, he stressed that more should be done in providing research into GM products, and that the overall case should be made “emphatically”. In the same month, the Department for Business, Innovation and Skills (BIS) stated its intention to put in place an ‘Agri-Tech’ strategy for the UK that links together the research, commercial and farming sectors. Both these developments represent a significant shift in the UK Government’s approach to biotechnology, stating the environmental and economic potential benefits it could bring.

While Defra and BIS have shown a degree of support for biotechnology through wheat trials and public statements, the *overall* position of the Government has been less explicit. Because of the British public’s indecision to biotechnology in food, the Government is yet to take a proactive role in either supporting or dismissing it. The Department for Business, Innovation and Skills has, however, appeared supportive to the role of biotechnology, funding research projects under the Technology Strategy Board (TSB) and the Biotechnology and Biological Sciences Research Council (BBSRC) for the benefit of UK agriculture.

The Welsh Government has taken an apparently contradictory stance by banning the use of GM crops in Wales despite the widespread use of animal feed containing GM products by the livestock industry. However, the livestock sector in Wales would benefit greatly from biotechnological research in livestock health and grassland nutrition. This contradiction is neither satisfactory nor sustainable.

At the 2013 Oxford Farming Conference, the issue of biotechnology, and in particular GMOs, accounted for considerable discussion and debate among speakers and delegates, underlining further the interest in the issue across the agricultural sector. Of particular interest was a keynote speech made by the journalist and environmental advocate Mark Lynas, who detailed his conversion from a critic and activist against the use of GM technology, to a supporter of its use. He stated that he previously had very little comprehensive knowledge of the subject, and had not fully engaged with the scientific detail. He concluded that after having studied the technology in detail, his outright opposition conflicted with his desire to see a protection of the environment and a reduction in carbon emissions, while improving sustainable food production worldwide.

4. POLICY DEVELOPMENTS IN EUROPE

In June 2011, the European Commission announced a maximum threshold (Low Level Presence) of 0.1 percent of GM products in imported animal feed. Prior to this, a zero tolerance approach was taken toward unintentional GM product levels in feed.

In July 2011, sites growing GM wheat and potatoes were attacked in Eastern Germany. Following this, security guards were assaulted in Saxony-Anhalt at a similar research facility. The GM wheat testing trial at Rothamsted, Hertfordshire, has required significant security measures.

Aware of the need to consolidate Europe's place in addressing food security, the European Commission has continually shown a willingness to implement regulations that provide better market conditions for biotechnology industries and producers. The allowance of trace elements of GM products in animal feed is evidence of this.

The Food Standards Agency (FSA) announced in May 2012 that it would change its advice on the scope of the EU Novel Food Regulation in relation to the immediate offspring and further descendants of cloned cattle and pigs². Previously, the FSA interpreted the Regulation as applying to food from a clone *and* to food from an animal with a clone in its ancestry. The European Commission and other

member states have considered that food from an animal descended from a clone should *not* be classed as novel and subject to authorisation. The FSA considered results from a recent consultation before deciding to adopt the Commission's position in relation to the descendants of cloned cattle and pigs.

In January 2012, Denmark took over Presidency of the Council of the EU, initiating a compromise proposal that would allow decisions on banning or admitting GM cultivation to be administered at state level rather than at EU level. This was initially rejected by 10 member states. However as of March 2012, this had been reduced to a smaller blocking minority. Reasons behind the opposition range from trade harmonisation principles to environmental and health concerns. When the Danish Presidency finished in June 2012 no final agreement had taken place during its tenure.

In August 2012 John Dalli, then EU Commissioner for Health and Consumer Policy, stated that member states must have greater freedom in deciding on the cultivation of biotechnology, expressing his disappointment that no political agreement could be found under Danish-led proposals. He added that the Commission would remain committed to continue working on the text under forthcoming presidencies.

2. Meat and milk from cloned animals are classed as novel foods because they are obtained from animals that have been created by breeding practices that were not traditional when the EU Novel Foods Regulation came into effect in 1997.



5. GENETICALLY MODIFIED ORGANISMS

GMOs have a wide range of definitions. However, most refer to a living organism that has been genetically altered using molecular genetic techniques, allowing chosen individual genes to be transferred from one organism into another, including genes between non-related species. It also includes the ability to switch genes on and off to express or prevent the expression of traits within an organism.

Genetic modification as a technology has made exceptional advances in our understanding of the role of individual genes, and there is a number of techniques that arguably come under the GM banner and, therefore, GM regulations. These techniques include intragenesis³, mutagenesis⁴ or agroinfiltration⁵.

The CLA recommends:

- Genetically Modified Organisms should be considered as only a *part* of biotechnology. There are many complementary applications needed to address food security and livestock management.
- further measures to be applied that focus upon the potential effects of biotechnologically altered organisms, such as GM crops, that have been scientifically deemed to present no proven risk to the health of consumers, during trials that take into account the comparable effects against conventional alternatives of those organisms.

The CLA supports:

- in principle, the right of landowners to be allowed to choose from all of the available biotechnological tools, including genetic modification techniques that have been scientifically deemed to present no proven risk to the health of consumers, to improve the productivity of their produce.

5.1 The Role of Genetic Modification

The rationale behind proposing GM is that it enables plant breeders to make breakthroughs at a much quicker rate than alternative methods. It is equally important to consider that modifying genes to improve overall crop yields and minimise environmental impacts has been in operation for more than 60 years. However, selective breeding of crops has been in

operation for hundreds of years. GM should be viewed as one of many tools available to plant and livestock breeders and not a panacea that is relevant to every application. It is, nevertheless, a powerful technique when applied to an appropriate target. It is precise in that single genes can be transferred, and genes can be designed to be active at different stages of an organism's development or in specific organs, tissues or cell types, a phenomenon that can achieve results comparatively quickly.

5.2 Practical Benefits to Crop Production

It is important to outline the potential beneficial applications of GM and why it has attained such renewed significance.

5.2.1 Herbicide Tolerance

This is the most successful and widely used GM crop trait, engineering a crop to tolerate a broad-range herbicide; that is, a herbicide that kills any plant not carrying the tolerance gene. The first Genetically Modified Herbicide Tolerant (GM-HT) variety to be introduced was a "Roundup-Ready" soybean, which was produced by Monsanto and has been marketed since 1996. Varieties carrying this trait now dominate global soybean production. Another key benefit to producers has been that GM-HT crops have facilitated the adoption of no tillage systems, which have assisted in minimising input costs, machinery impacts on soil, as well as reducing the potential for soil erosion and improving organic matter.

5.2.2 Insect Resistance

The success of GM technology has brought notably improved yields to producers abroad, taking away much of the concern of significant pest damage. An example of this is evident in the wheat trials which took place at Rothamsted, Hertfordshire, in 2012 where scientists used an alarm pheromone odour to prevent aphids causing significant damage to wheat yields. The odour, farnesene, is produced by aphids and also plants such as potatoes, but does not naturally occur in wheat in the necessary amounts or with the required purity to be effective.

While this offers obvious benefits to yields, another outcome of insect resistant crops in the USA has been seen in farmers using stacked corn traits (containing insect resistant and herbicide tolerant traits together) being offered discounts on crop insurance premiums (for crop losses) equal to almost \$13 per hectare in 2010.

3. Plants that are genetically modified with genes from other plants within their own species.

4. Changes of a genetic structure.

5. Methods to induce temporary expression of genes to produce a desired outcome, for example, a protein in plants.

5.2.3 Economic Returns

The net global economic benefits at farm level added by cultivating GM crops rather than conventional varieties of crops have been estimated at \$14billion in 2010, and by 2011, almost 17 million farmers around the world planted GM crops, up from 15 million in 2010. Studies by the University of Reading indicate that European producer margins would increase by €443million to €929 million if farmers were allowed to grow GM crops in Europe.

As a consequence of the mild and wet climate, fungal diseases represent a significant challenge to British arable farmers. Septoria and Fusarium are the principal fungal diseases of wheat, and their traditional disease control has been complicated with the recent emergence of fungicide-resistant strains. Research from the Teagasc Crops Research Centre in Ireland has shown GM winter wheat varieties expressing resistance to either Septoria or Fusarium could serve to benefit a farmer through reduced chemical input. The savings of these inputs has been estimated at around €30 per hectare.

PG Economics undertook research into the use of GM oilseed rape in the USA from 1999-2010. It found that while the cost of the technology had been \$12/ha-\$17/ha for glufosinate-tolerant varieties and \$12/ha-\$33/ha for glyphosate-tolerant varieties, cost savings (before inclusion of the technology costs) were between \$18/ha-\$45/ha (compared to \$21/ha in 2010) for glufosinate-tolerant oilseed rape and \$40/ha-\$79/ha for glyphosate-tolerant oilseed rape. At US level the total farm income benefit in 2010 was \$31million and the cumulative benefit since 1999 has been \$225.5million.

It is estimated that without GM, additional plantings of 5.1 million hectares of soybeans, 5.6 million hectares of corn, three million hectares of cotton and 350,000 hectares of rape seed would have been globally required in 2010 to maintain existing output.

5.2.4 Disease Resistance

Similar to insect resistance, growers would benefit from GM traits that seek to prevent infection from disease. Ongoing research has shown that it is possible to genetically engineer plants to be resistant to viruses by exploiting the phenomenon of cross protection, in which infection by a mild strain of a virus induces resistance to subsequent infection by a more virulent strain.

Improved resistance to diseases caused by fungi is also a target for crop biotechnologists. There have been several field trials in Europe of GM potato lines engineered to be resistant to the *Phytophthora infestans* (causing late blight). One of these lines was produced by BASF using a gene from a wild potato species. BASF obtained sufficient data to apply for consent to market their blight-resistant potato for cultivation in Europe. However, early in 2012, BASF

announced that it was abandoning attempts to develop GM crop varieties for Europe and would be concentrating on easier markets, meaning that it is likely that the technology will be transferred to North American potato varieties. However, two potentially blight-resistant GM potato lines have also been developed at the John Innes Centre in Norwich where researchers continue to evaluate application to varieties suitable to the British climate.

5.2.5 Drought Tolerance

Plants may avoid late summer drought (typical of the UK and northern Europe) by growing, flowering, and setting seed before this time. They can also avoid becoming water-stressed by developing deeper and more extensive root systems. Plants have also evolved tolerance traits that enable them to survive even if they become short of water.

5.2.6 Climate Change

It is clear that erratic weather patterns and the effects of climate change will also bring about a renewed need for cereal crops to be able to address increased likelihoods of drought or prolonged periods of rain, as witnessed in 2012. By investing in technologies and research that seek to address unpredictable weather patterns, the UK could be best placed to overcome associated drops in yields and subsequent global commodity fluctuations. It would be unsustainable for the British agricultural sector to compete in a global market with existing resources if such weather patterns remain the norm, not the exception.



5.3 Protection of the Natural Environment and Biodiversity

In assessing the role of GMOs, it is crucial to establish that there are no harmful effects on the natural environment. It is plausible to suggest that neither the public nor policymakers would consider supporting relaxing GM legislation unless the full range of impacts is adequately researched and assessed against conventional alternatives.

5.3.1 Insecticides and Herbicides

Assessment of the impact of GM crops on insecticide and herbicide use requires comparisons of weed and pest control measures against the “conventional alternative” form of production. The only country in which pesticide usage data is collected (by private market research companies) on an annual basis and which allows a comparison between GM and conventional crops to be made is the USA. Unfortunately, even where national survey data is available, the data on conventional crop usage may fail to be reasonably representative of which herbicides and insecticides might be expected to be used in the absence of biotechnology. When GM traits dominate total production, for example soybeans, corn and cotton in the USA since the early 2000s, the conventional cropping data used to identify pesticide use relates to a relatively small share of total crop area and, therefore, is likely to underestimate what usage would probably be in the absence of biotechnology.

Therefore, the main problem has been the difficulty of measuring environmental impact against conventional alternatives where there is a market dominance in GM of particular crops. It is evident that a reduction in the use of insecticides and pesticides would be beneficial to the natural environment. However, a more thorough approach is required in assessing the impact of GM crops and wider biotechnology applications against their conventional alternatives.

5.3.2 Application of Nitrogen

Another development in addressing environmental impacts of GM crops has been in plant roots enabling a plant to utilise reduced nitrous compounds supplied by bacteria. In modern agriculture, the use of fertilisers represents a major potential source of nitrogen contamination in the atmosphere and in surface and ground water, resulting in public pressure for a reduction in their use. The John Innes Centre in Norwich is responding to this need by leading a five-year, \$9.8million project into the possibility of nitrogen uptake of cereal crops from the air, reducing the need for a chemical alternative. In addition, it will investigate the possibility of engineering cereals to associate with nitrogen-fixing bacteria and of delivering this technology through the seed.

5.3.3 Weed Resistance

All weeds have the ability to adapt to selection pressure. There are examples of weeds that have developed resistance to a number of herbicides and to mechanical methods of weed control.

In recent years, there has been a growing consensus among scientists of a need for changes in the weed management programmes in GM-HT crops, because of the evolution of these weed populations that are resistant to glyphosate. While the overall level of weed resistance in areas planted with GM-HT crops is still low (equal to between five percent and 10 percent of the total USA cropping annually planted with GM-HT crops), growers of GM-HT crops are increasingly being advised to be more proactive and include other herbicides (with different and complementary modes of action) in combination with glyphosate in their weed management systems, even where instances of weed resistance to glyphosate have not been found. This presents an important area for further research, so that growers are not in a scenario in which they are more frequently applying herbicide than initially anticipated.

However, it should be noted that an increase in the use of herbicides on conventional alternatives for crops such as soybeans in the USA also reflects the ongoing development of weed resistance. Again, this underlines the possibility that the development of weed resistance to herbicides could instead be a problem faced by all farmers, regardless of production method.

5.3.4 Carbon Footprint

In 2013, supported by national governments and UNESCO, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) calculated the effects of GM crops on the environment. It concluded that GM crops alone saved the equivalent of 473 million kilograms of pesticides in 2011, saved 109 million hectares of new land being ploughed up and reduced greenhouse gas emissions by 23 billion kilograms of carbon dioxide equivalent.

5.3.5 Pollinators and non-target Species

Whereas transgenic insect-resistant crops continue to grow in importance in countries outside the European Union, inside the EU there is concern about the environmental safety of such crops. Specifically, reports of possible negative effects on the biodiversity of non-target insects in and around fields of GM crops have fuelled growing public and political concerns.

Examples studied have indicated that pollinator behaviour (particularly bees) may be affected. However, it has also been made apparent that external factors such as location (for example, distance to commercial bee colonies) can strongly affect pollinator composition and thus the outcome of

behavioural studies. The reaction of some national governments to collapsed European bee colony numbers has prompted the immediate ban of particular treatments altogether. While studies into these effects are still in their infancy, there must be increased scope for research and trials on the overall impacts of GMOs and their conventional alternatives on pollinators and non-target species. Additionally, the focus on bee colonies and neonicotinoid treatments underlines the need for greater biotechnological solutions in seeking a sustainable solution to ensure high crop yields and the maintenance of pollinator numbers.

5.4 Forestry and Woodland

As with agricultural crops and livestock, technical innovations in genetics and genomics, and related disciplines, are also being developed for trees. Biotechnology in trees has developed at a slower rate compared to conventional agriculture, emerging since the 1980s as a means to aid research, breeding and propagation. As with agriculture, a multiplicity of biotechnology applications has been developed to advance disease resistance, stress tolerance and improve propagation, in particular, opportunities to make use of GM techniques that go beyond traditional breeding methods. The evolution of such research has allowed genetic markers to be integrated into traditional breeding programs to enhance genetic diversity, improve the traditionally slow rate of progress over generations, and to reduce the costs of selection.

In recent years biotechnology has progressed to include a range of DNA-based molecular techniques. One such method is the polymerase chain reaction (PCR), a means of amplifying small quantities of DNA, which has been used to generate genetic traces of commercial poplar clones. The large-scale rooting of Sitka spruce cuttings taken from juvenile, genetically improved stockplants is a recognised commercial success which originated with basic biotechnology research, and is widely employed in UK forestry.

While the vast majority of biotechnology research into trees lies in the USA, there are clear potential benefits to European and British forestry and woodland sectors. As in conventional agriculture, genetic modification has helped provide environmental and economic incentives in the sector. Examples of these include herbicide tolerance, pest tolerance, protection of native trees from introduced pests, modified wood content and salt tolerance from soil. The 2012 outbreak of the fungus *chalara fraxinea* in England and Wales has unquestionably brought the issue of better disease resistance in trees to greater prominence.

Applications from the USA have demonstrated the benefits of “bioremediation”, where trees are engineered to take up or break down chemicals in the soil, lowering costs and providing less environmentally damaging ways to reduce toxicity. As stated earlier, it is likely that policymakers and consumers will continue to demand improved outputs in food using existing resources. Similarly, it is important to stress that owners of forests and woodland will be expected to maintain and improve tree populations. It is therefore crucial to assess the role of biotechnology in adding to ecosystem services, rather than simply protecting them.

The use of genomic, cloning and molecular markers all contribute to the ongoing biotechnological research within the sector, in particular, studies into the possibility of using GM to tackle Dutch Elm Disease. In the UK, there is active research and development for GM forestry applications. However this is not expected to be made commercially available soon. It is conceivable that until conventional breeding programmes are no longer effective in the forestry and woodland sector, this approach to GM will not change. Future research into GM breeding programmes in the sector should be considered as a possibility if these conventional approaches are unsuccessful.





5.5 Cohabitation

Cohabitation, or coexistence, relates to the management of GM and non-GM species within a defined area. It represents a significant component to any CLA biotechnology policy, as it should be for landowners to be able to choose whether or not they wish to make use of GMOs.

However, while landowners should be allowed the opportunity to use the full range of available crops on their land, those who *do not* choose to make use of these biotechnological alternatives should be protected from any potential excessive seed or pollen transfer. For those conventional or organic producers in particular, a balanced approach must be taken to ensure that GM and non-GM options can cohabit adequately.

Since 1999, there has been a set Code of Practice in the UK for individuals wishing to plant GM crops in their land to follow in respect of other landowners within close proximity. The Code of Practice was drawn up by SCIMAC (the Supply Chain Initiative on Modified Agricultural Crops), with membership consisting of the AIC, CPA, NFU and BSPB. The role of the Code was to ensure that minimum guidelines were met by landowners and farmers during the Government's four-year programme of Farm-Scale Evaluations (FSEs) from 1999-2003.

SCIMAC's guidelines are based on existing principles of sound agricultural practice, and closely reflect the system operated for more than 30 years to produce certified seed crops. All aspects of on-farm activity is covered, from seed storage, planting procedures through to crop separation distances, harvesting procedures, post-harvest management and record-keeping.

Central to SCIMAC's approach is the issue of liability in the event of pollen or seed transfer from one site to another. Although this did not occur during the farm-scale trials in the UK, and is very rarely reported worldwide, it still remains a fundamental issue for landowners that a process is put in place for such events. SCIMAC has therefore "committed to the development of an industry 'Redress Charter', delivered through existing supply chain systems, and with the single objective of restoring – through private settlement – the marketing position of non-GM growers who experience demonstrable financial losses as a result of GM admixture through no fault of their own".

The CLA will seek to play a more active role in SCIMAC, with its technical expertise on legal, land and property rights. One area that would need to be considered in particular is the role of tenants and landlords who may have conflicting views on the use of GM crops.

5.5.1 Cross Seed and Pollen Transfer

Many organic producers or producers who opt for non-GM status have expressed concerns that the proximity to such sites may impact on their organic/non-GM status and premiums associated. The dispersal of trace amounts of pollen and seed between GM and non-GM plants is clearly a possibility if there are no attempts to manage this. However, as a result of careful coexistence measures put in place, there have been no incidents of cross-pollination above the 0.9 percent threshold put in place by European law.

It is important to note, however, that the natural dispersal distance of pollen varies between crops. For

example, rape seed has a high risk of pollen and seed transfer through seed banks resulting in volunteer populations that admix with and pollinate non-GM crops.

A range of agronomic practices is deployed to limit conventional pollen and seed transfer, but the contribution of seed transfer to yield is still highly unpredictable and can range from less than 0.01 percent to more than 10 percent for the same crop variety among variations in management, soil and weather. As a result, the European Commission's Sheffield-based SIGMEA group (Sustainable Introduction of GMOs into European Agriculture) recommends that coexistence measures should be as flexible as possible and depend on local climatic, agronomic and environmental factors. These approaches lead to more cost-efficient measures.

SIGMEA concludes that isolation distance and rows, planting near other crops, different flowering dates, cleaning of equipment, traceability and labelling all provide methods of preventing the potential for seed and pollen transfer. Again, it is important to compare GM applications with methods growers already employ to prevent unwanted volunteer spread between different crop varieties and farm types.



To prevent potential pollen or seed transfer, it is not unreasonable to suggest that those who choose to grow GM varieties should take appropriate methods to mitigate against this, as successfully seen between growers of GM and non-GM maize in Spain.

The CLA recommends:

- that growers of GM products, which have been scientifically deemed to present no proven risk to the health of consumers, follow set guidelines, such as those put forward by SCIMAC (the Supply Chain Initiative on Modified Agricultural Crops), to ensure that the potential for seed or pollen transfer to non-GM sites is kept to a minimum, again compared with conventional alternatives.
- greater co-ordinated research to take place into cohabitation, applicable from the perspective of British agriculture, across crop types and compared with conventional alternatives.

5.6 The Consumer

It has been estimated by the European Union that due to rigorous safety assessment procedures, more than two trillion GM meals have been consumed since 1997, with no linked health risks.

All GMOs used in food, food ingredients, feed and fuel must undergo a rigorous review of their safety as part of the authorisation procedure before they can be put on the market. In the EU, this task is carried out by the European Food Safety Authority, whose panel of independent scientific experts cooperates closely with national authorities on food safety.

The safety of GM products is considered on two levels: the way they are produced and their specific new characteristics resulting from genetic modification. The aim is to ensure that the GM product is safe and does not harm humans, animals or the environment. It is widely accepted among plant breeders that the EU's testing process is, in theory, appropriate in timescale and proportionate in its safety assessments. However, the principle behind the safety of GMOs in Europe is hazard, not risk-based, which explains why authorisations for products are very time-consuming and costly to achieve. In addition, the politicisation of GM technology in food has only added to the difficulties in making GM products commercially available. This further underlines the need for the debate on GM technology in food to be raised among consumers, the media and industry.

It is commonly argued that European and British consumers do not wish to buy GM products. However,



recent media coverage and political sentiments have indicated that consumer perceptions in the EU are becoming more favourable towards GM foods, and when they are put on sale, labelled as required by law, consumers continue to buy them.

The USA encountered reservations from consumers and lobby groups prior to its commercial deregulation of GM technology in food in 1986. Since then, the consumption of GM products has significantly increased year on year. Even if clearly labelled as such, GM products have continued to outsell rival products due to their reduced retail costs.

It can be asserted that opinion polls in the UK have not provided an accurate and consistent reflection of the public's view towards GM products, and should not be relied upon for overall consumer preferences. Interest groups for and against GM products have often been accused of misrepresenting or selectively using opinion polls to correspond to their philosophies on the subject, while polling conducted on behalf of these groups often suffers from data issues such as weight bias, sample size or leading questions to skew results to a particular outcome.

In March 2012, the retailer Morrisons joined Asda in stocking GM-fed poultry for commercial sale. Both supermarkets cited the difficulties their producers had in continuing to provide affordable, non-GM fed poultry, arguing that it was impossible to maintain the exclusivity of this product. While non-GM products are still available, the decision was made to ensure that consumers had a range of production methods from which to choose. While this prompted media interest and reactions from groups that oppose GM technology in food, sales of these products have not been affected.

One consistent concern of British and European consumers is in price. Consumer surveys that make no mention of GM technology in food continuously show price to be the most important factor in determining choice of products, and the overall

experience of the USA's commercialisation of GM technology in food would appear to support this. Instead of focusing on the sentiments of GM technology in food, Government departments and industry leaders must better inform the consumer about what research is taking place in GM products and *why*.

If the public debate on sustainable intensification can be communicated as to how more food can be produced with existing resources, consumers are better placed to appreciate the potential merits of biotechnological applications such as GMOs. Unfortunately, the debate has too often focused upon the particular merits of GM itself, and has not been against the wider context of sustainable food production.

For those countries, such as the USA, that have advanced research and commercial livestock cloning sectors, the issue of labelling has often constrained the potential development for further investment. However, it is now widely recognised that implementing mandatory labelling for meat or milk products derived from animals with a clone in their ancestry is entirely unenforceable and impractical. This is because it would not be possible to trace the genes of cloned animals from within or outside of the UK. Defra has openly supported this view, stating: "As there are no food safety issues, the cost of introducing such a system (which could not in any case deal with imported food or with food derived from descendants of clones already present in the EU) cannot be justified".

The CLA supports:

- the right of consumers to have access to products containing Genetically Modified Organisms (GMOs) that are scientifically deemed to present no proven danger to public health, if they so choose.

6. BIOTECHNOLOGY IN THE ARABLE SECTOR

Although GMOs provide one of the most significant potential breakthroughs in addressing the need for increased yields while protecting the environment, it should be understood that biotechnology in the arable sector, or even biotechnology alone, should *not* be considered synonymous with genetic modification. The application of biotechnology to crops has been in place for well over a century, with science continuously focused on how to improve the output of food on increasingly strained resources.

Contrary to popular opinion, plant breeders and seed developers have been clear that GMOs do not seek to provide a panacea in addressing these challenges. They stress that due to the inevitable financial investment of applying genetic modification to research, where conventional techniques can be applied to bring a particular outcome these would almost certainly be prioritised.

However, where there is no existing genetic marker within a plant identified that can overcome a particular problem, there is no possibility for this to be addressed with conventional breeding techniques.

Instead, the only option is to use transgenic technologies to incorporate a new trait. The introduction of farnesene in wheat at Rothamsted, Hertfordshire, and the introduction of blight-resistant potatoes at the John Innes Centre in Norwich are good examples of this.

Plant breeders, researchers and scientists are equally clear that without having all of the available technologies at their disposal, they are unable to deliver multidisciplinary research into increased yields for growers, and sufficient food to meet an increasing global population and consumption rate.

The CLA calls for:

- further investment from private and public bodies for research and development into conventional or mechanical, non-GM applications in the cereal sector that have been scientifically deemed to present no proven danger to the health of consumers.



7. BIOTECHNOLOGY IN THE LIVESTOCK SECTOR

Biotechnology is often wrongly considered to be applicable only to the arable sector. In fact there is equally important ongoing biotechnological and genetic research within the livestock sector in preventing disease, improving overall welfare and reducing input costs. The challenges identified in the Foresight Report are equally salient in livestock.

The CLA calls for:

- further investment from private and public bodies for research and development into conventional or mechanical, non-GM applications in the cereal sector that have been scientifically deemed to present no proven danger to the health of consumers.

7.1 Feed

Europe currently imports 72 percent of its animal protein feed (for example, soya), most of which derives from GM crops. This highlights an additional problem of maintaining the status quo: the demand for livestock products in the UK and in developed nations is set to increase dramatically as populations and overall consumption increase.

Clearly, increased production for food and feed has to be generated from increased yields on existing land areas. Against a backdrop of increasing demand, the role of GM crops such as soya will undoubtedly come under greater scrutiny as certain British retailers continue to insist on the use of non-GM soya. However, many British livestock owners (particularly poultry sectors) are finding the 20 percent premium on non-GM animal feed unsustainable. Because of the dropping global demand for non-GM soya products (it is estimated that it now represents only 10 percent of the soya industry), there will be unrealistic expectations made on livestock owners to continue using this as feed.

Animals perform in a comparable manner when fed GM feed ingredients as compared to conventional products. Feeding of GM crops has not shown any negative effects of feed intake, whole tract digestibility or animal productivity in studies with poultry, pigs, sheep, beef cattle and dairy cows. Based on the safety analyses required for GM crops, consumption of milk, meat and eggs derived from farm animals fed with transgenic crops are generally considered to be as safe as their traditional counterparts.

7.2 Disease

The most significant associated cost to livestock producers and government budgets lies in animal disease, which is estimated to cost 17 percent of overall livestock turnover in developed countries. The benefits are clear: in addition to enhancing animal well-being, biotechnology in animal health has the added benefit of reducing the need for veterinary interventions and the use of antibiotics and other medicinal treatments. In addition, the use of antibiotics in livestock is generating more disapproval from consumers and policymakers. This has to be considered as part of research and development programmes in the sector.

The economic impact of disease in livestock cannot be overstated in the UK. These costs are direct and indirect, and affect many sectors – for example, the costs to Government brought by outbreaks of notifiable diseases, preventing disease spread, compensation, testing and removal, and the costs to public health, as well as the costs to business such as preventing disease spread on farms, movement restrictions and testing regimes.

Biotechnology offers a number of approaches to fight disease in livestock. Firstly, through genetic profiling, livestock producers can select for certain genetic variations which have been associated with disease resistance. Through this careful selection, populations of animals that are less vulnerable to disease can be developed. Secondly, through genetic engineering, breeders can integrate disease resistance genes from new sources, allowing for improved animal health. Disease resistance benefits not only livestock producers and their animals, but consumers also benefit as a result of safer animal products in the market place, and a reduction in the potential incidence of human-transmissible diseases.

Animal health has been significantly advanced by “molecular epidemiology”, a method that has enabled characterisation of viruses, bacteria and parasites by sequencing for the tracing of their origin. This is particularly important for epidemic diseases, where the possibility of pinpointing the source of infection can significantly contribute to improved disease control.

It is important to recognise that many challenges related to livestock disease are intrinsically linked. For example, the need to address disease and climate change (outlined previously in this report) can be seen in the outbreak of Schmallenberg Virus (SBV) in the UK. It is understood that a change in climate has allowed midges (vectors of SBV) to travel from mainland Europe to the UK, infecting sheep and cattle. This has brought a considerable cost to the farming industry, and is indicative of the need for a

co-ordinated approach in addressing threats to the economic viability of British livestock owners, in particular how to minimise the impact of new infectious diseases in livestock. There are many endemic diseases in livestock that have proven very difficult to vaccinate against within conventional science or research. British livestock farmers would strongly support any initiative that would seek to improve the current testing process for Bovine Tuberculosis in cattle so that it provides a higher degree of accuracy in its results. This could be one such example where the use of genetic technologies could have a profound effect on improving the welfare of livestock.

Further practical applications of disease management and biotechnology are provided under specific sectors below.

7.3 Cattle

The development and application of artificial insemination (AI) in cattle breeding is a powerful and successful example of reproduction biotechnology that has fundamentally changed the breeding of cattle, particularly in the dairy sector. The use of AI in cattle has allowed the introduction of highly successful genetic improvement programmes for increasing milk yield and has reduced the incidence of disease.

Oestrus or heat detection is one of the most important tasks in dairy and beef herds. However, it is also

time-consuming, subjective and inefficient. An objective method of heat detection would be of enormous benefit in increasing output efficiency and reducing the time and labour input. A number of possible approaches to automate oestrus detection have been pioneered such as milk analysis, biosensors designed to respond to the presence of specific biochemicals that emit electronic signals, and behavioural approaches.

One area that has attracted significant research is the development of technology that allows sperm-sexing to pre-determine the sex of the calf. An efficient and accurate system of sperm-sexing combined with AI bears significant promise in the efficiency of milk and meat production. Not only does this provide economic gains to dairy farmers through fewer bull calves being born, it is also supported by animal welfare groups which are concerned by bull calves exported to continental veal markets, or killed shortly after birth. However, greater research is required in genetics and sex chromosome-specific proteins to ensure that this process becomes more cost-effective, practical and competitive.

Applications into the composition of genotypes of Bovine Viral Diarrhoea (BVD) have significantly advanced diagnostic testing procedures within cattle. There is a pressing need for greater research into the accessibility of these diagnostics, including programmes to improve genetic resistance.

Mastitis, a bacterial infection of the mammary gland, bears a significant challenge to dairy farmers. About



one third of clinical mastitis cases are caused by infection by staphylococcus, a pathogen which is particularly difficult to control with traditional antibiotic treatment options. This is mainly due to the pathogen's ability of survival between cells and the consequential high frequency of recurrence of the infection following treatment. However, biotechnological research has demonstrated a successful transgenic strategy for the prevention of mastitis in cattle. Lysostaphin, an enzyme that naturally occurs in staphylococcus, breaks down the cells of the infection using acids within the bacteria. Transgenic cows producing lysostaphin in their milk have shown a high degree of protection when challenged with mastitis infection.

A similar concept, targeting a gene implicated in disease, has been applied to produce cattle which are resistant to the fatal neurodegenerative diseases or transmissible spongiform encephalopathies. In these diseases, which include scrapie and BSE, a misfolded isoform of the cellular protein accumulates and acts as an infectious agent. By introducing mutated protein genes, a natural resistance against this infection has been explored.

7.4 Sheep

Beneficial applications of transgenic biotechnology aimed at disease resistance and improved animal welfare has seen the introduction of an enzyme, chitinase, normally not found in mammals. The targeted outcome of this chitinase in the sweat glands of transgenic sheep has resulted in the killing of parasitic larvae, providing resistance to cutaneous myiasis, or flystrike, a larvae infection that feeds on tissue.

Studies within the UK have focused sharply on how to bring down incidences of foot rot in sheep using genetic markers and selection. The ongoing research has found that resistance in sheep is inherited and, with further research, applications to identify genetic resistance may be possible. With a prevalence rate of six percent, it could provide significant benefits to the welfare of the sheep and input costs to livestock owners.

7.5 Pigs

The modification of milk composition has been proposed as a means to improve livestock growth, health and survivability, particularly for newborns. This concept has been pioneered in pigs where milk production is a limiting factor for piglet growth. Young female pigs with higher levels of certain proteins have seen higher milk lactose and carbohydrate content in early lactation leading to a 20-50% increase in milk yield. As a result, growth and survival of suckling piglets can be improved significantly.

Biotechnology research in Canada has produced a GM pig containing a "phytase" gene, known as

"Enviropig". These pigs secrete an enzyme in their saliva which allows them to digest plant phosphorus more effectively, reducing overall feed costs. They also produce manure with less phosphorus than conventional pigs, reducing potential impact on the environment, in particular water sources.

Research in China has produced a GM pig that has resistance to infection by Foot and Mouth Disease (FMD). Although such a pig would not prevent an outbreak of FMD, it may produce a major reduction in virus transmission and control an epidemic.

Despite restrictions on the use of genetically modified semen in Europe, there are many British firms that export genetically advanced semen to South America. The UK has an excellent reputation in genetic research within the pig sector, with significant demand from non-European countries to improve production of slaughter pigs and female-line breeding stock.

7.6 Poultry

Because of shorter life span, faster generational turnover and increasing consumer demand, the poultry sector is arguably best placed for the application of biotechnology research in the UK.

Following the considerable concern from the H5N1 Avian Influenza Virus (AIV), greater research applications have been targeted in the poultry sector. The Roslin Group from the University of Edinburgh has developed GM chickens that do not transmit AIV once they have been infected, which clearly holds benefits for producers, consumers and governments.



8. HUMAN HEALTH BENEFITS

8.1 Livestock

While animal health understandably remains the priority for biotechnology in livestock, further research explores how human health can be improved by advances in the quality of produce.

Some of the main natural components in dairy milk have been targets for modification to improve health attributes. Milk sugar lactose causes intestinal disorders in a large number of the adult human population due to a lack of adequate intestinal enzyme activity to sufficiently digest lactose after the consumption of milk. Approaches to reduce the milk sugar lactose content have been considered which could provide an alternative to expensive processing after milking has taken place.

Fat is another important nutritional component beside proteins which has a significant impact on human health and provides opportunities for the improvement of food products. Animal fats, in particular milk fat, is very rich in saturated fatty acids which are considered unhealthy and have been associated with cardiovascular and coronary heart disease. A major focus is therefore to decrease the unhealthy fats in favour of the healthier unsaturated fats. Effective approaches to improve milk fat composition have seen the tailoring of the diet of dairy cows through the use of particular forage species or feed additives as well as more direct transgenic technologies.

Scientists at the Institute of Biological, Environmental and Rural Sciences (IBERS) in Aberystwyth in Wales have begun research into identifying and understanding the variation in fat content and fatty acid composition of grass, along with assessing the impact of a forage-based production system on fat composition of beef. The project is seen as a method to increase beneficial fats in diets, using grass that contains high amounts of beneficial omega-3 fatty acids.

While conventional or mechanical biotechnology processes have benefitted many livestock sectors, there is significant scope for genetic modification to address challenges faced by consumer demand arising from feed availability, disease control, welfare and product quality.



8.2 Cereals

While this report has focused predominantly upon the benefits of biotechnology applications for British landowners and business, it is equally important to consider the wider benefits it could deliver to populations in developing countries. The Foresight Report made it quite clear that lower global availability of food will provide the biggest impact to those in poverty or on lower incomes, especially in developing economies. It is estimated that around three-quarters of all individuals in poverty are smallholder or subsistence farmers or farm labourers.

One such success of GM crop production in less developed countries has been the development of "Golden Rice". Golden Rice is a genetically modified product intended to produce more beta-carotene in each rice grain, which in effect increases Vitamin A intake. In Africa, Central, Southern and South East Asia, Vitamin A deficiency has consistently been a cause of malnutrition, especially for those in poverty. It was estimated in 2005 that 190 million children worldwide experienced Vitamin A deficiency, leading to around one million deaths and half a million cases of blindness. For such minor adjustments to staple crops, the global impact can clearly be very significant.

Therefore, it is clear that providing farmers in those developing economies with access to affordable biotechnologies (such as GM seeds) can provide a significant tool in addressing food shortages and low incomes. Although herbicide-tolerant crops are not widely used in developing countries, the use of insect-resistant varieties of cotton and maize are prevalent. The latter is now a staple across many southern African countries. In addressing malnutrition among local populations, governments of developing countries are now realising the potential for GM crops, following previously unsuccessful policies focused heavily on food supplements or fortification.

There still remain many legislative challenges in the developing world for these technologies to be used. Only seven African countries cultivate GM crops, while the vast majority on the continent has adopted the EU's precautionary approach. This has meant that private research institutes or companies have been largely unwilling to invest in biotechnologies. If European countries were to adopt clearer policies on biotechnology or GM cultivation, it is conceivable that this would provide a significant knock-on effect for developing countries. Not only would it provide reassurance over the safety of such products, the greater freedom to research and invest would provide a better transfer of knowledge from developed to developing countries.

9. BIOTECHNOLOGY IN THE ECONOMY

As outlined in the *Going for Growth* report, compiled by the UK-based Agricultural Biotechnology Council, “competition is intensifying and other countries are increasingly better placed to turn this particular form of innovation into economic growth. Government needs to act swiftly to ensure that UK agricultural biotechnology research is at the forefront of meeting the global food security challenge”.

The Government should champion the UK’s excellence in agricultural knowledge by bringing together departments that are best able to drive investment and productivity. The Government has shown its intention to boost growth in the rural economy. Rural businesses, landowners and farmers are best placed to deliver this. At the same time, a biotechnology strategy that is co-ordinated by Government but led by the industry would improve the competitiveness of the agricultural sector. British research institutions and private companies across arable and livestock sectors are clear that to maintain the leading position of biotechnology in the UK, the Government must provide an attractive market for investors.

Although the EU authorisation process itself remains effective, the indecision among member states over the cultivation and import of GM crops is one factor deterring private sector investment. Within the EU, Germany, Sweden, Spain and The Netherlands are all positioning their sectors to make the most of this situation, while New Zealand is actively reviewing its previous non-GM stance to meet rapidly increasing consumer demand from Asia.

There have been concerns expressed over the role of private companies in the development of biotechnologies, particularly GM technologies. The current restrictive regulatory regime in Europe puts significant costs on any businesses wishing to develop a GM trait for approval through the European Food Safety Authority. It is not uncommon for certain products to go through authorisations of up to 10 years as a result of the politicisation of the process. Therefore, only large multinational companies are able to invest in the technology, and ensure its passage through the necessary political and legislative steps. It is therefore conceivable that should the regulation on GM technology be relaxed, a more competitive market could be established as more companies see a higher likelihood of approval for a certain product. It is important that any future changes to the regulatory approach of GM technology take into account the need for businesses to protect their investments via intellectual property rights, but at the same time ensure the market is not monopolised by a handful of parties.

The UK sector must also maintain its competitive edge and prepare to be one of the first to capitalise on any improvement in the EU approvals process. This position can be improved further if the UK Government uses its influence to champion the role of biotechnology, adding its name to those member states that have come out in clear support of biotechnology, calling for a review of European GM legislation.



The Government still has a role in promoting and showcasing the excellence in British agricultural innovation to foreign investors and foreign markets. There are many emerging economies with rapidly expanding agricultural sectors that the UK stands well poised to take advantage of. There are many British agri-businesses that specialise in resource-intensive markets, such as sexed semen in livestock, that export all over the world. However, there are many other businesses that have limited resources in marketing their product, and the Government can help expand this further. Trade delegations led by the Environment Secretary to countries with emerging economies, to showcase British produce, are a good example of how the Government can actively promote the expertise of British agricultural science and biotechnology.

As with British produce, there is growing demand from economies in Asia and South America for agricultural, scientific research to address population growth, and overall consumption in those economies. The UK biotechnology sector is unquestionably best placed to export this research, to help fulfil that demand. Many British companies are already doing this. However, the Government has a clear role to consolidate this activity to benefit the national economy.

In the short term, the role of confidence in the industry cannot be overstated. By making a firm commitment to a biotechnology strategy and delivering tangible objectives on the ground, confidence will be provided to farmers, researchers and private businesses that the Government regards innovation in agriculture as a priority.

The limited opportunities for research or practical applications means that intellectual capital is increasingly at risk of diminishing in the UK; private and public bodies have openly expressed their concern at the number of promising graduates seeking employment opportunities elsewhere. Those private and public bodies involved in biotechnological research remain key components of the rural economy. It is in the interest of the CLA to ensure their ongoing work is supported. The recent withdrawal of BASF's genetic modification testing regimes from Europe in favour of the USA is indicative of this concern.

It is clear that other European countries have implemented biotechnology strategies to identify particular regions to develop "clusters" of excellence. This could be adopted in the UK. Indeed, this is wholly consistent with the Government's roll-out of "Enterprise Zones". Building upon areas of excellence for agri-science and technology would be beneficial to the rural economy. As seen with the Ghent Technology Park in Belgium, a "cluster zone" is based on specified and set criteria, for example, journal articles, product development and university research projects. The cluster is obliged to meet these criteria to achieve public funding. This has provided

a very effective way of ensuring the accountability and dialogue between policymakers, private companies and research institutes.

As outlined in *Going for Growth* and the Green Food Project, a proactive approach is required from the Government to work with European partners, public research bodies and the private sector to realise the economic value from the biotechnology sector. This will ensure that Europe, and specifically the UK, benefits from the sector's growth potential in a similar way to other science-based sectors, such as healthcare biotechnology.

The CLA supports:

- policy shifts made by the Government and its departments to promote British agricultural technology to benefit landowners and consumers and boost the British agricultural economy.

The CLA recommends:

- that the Government continues to provide meaningful investment and support for the UK's world-class agricultural research sector in order to maintain its leading global position.



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10. CONCLUSION

Unless the Government and industry work closer together using conventional and newly established channels, the UK's fragmented research base in biotechnology is at risk of being further alienated from those producers who apply the research. One current problem that exists within the agri-science sector is that research priorities are often reactive and set against existing challenges, as opposed to proactively seeking to address future issues. Clearly, there are serious long-term concerns relating to food security and environmental security, and only a proactive approach from government and industry can address this. It is therefore crucial that landowners have access to the full range of technologies available to them, so that they are able to choose the most appropriate production methods for their businesses.

The UK is naturally placed to increase its reputation as a world leader in agricultural technology. One key benefit in the UK comes from its diverse agricultural and research base. The UK has research centres that specialise across a range of sectors; for example, grass science at IBERS in Aberystwyth, cereal production at Rothamsted in Hertfordshire and the National Institute of Agricultural Botany in Cambridge, microbiology at the John Innes Centre in Norwich, livestock disease at the Pirbright Institute in Woking and veterinary science at the Roslin Institute in Edinburgh. This diversity across farming sectors means that the UK is best placed to identify future research needs in the UK and abroad, reflecting the wide variation in domestic agricultural enterprises. In addition, it also allows for greater harmonisation between agricultural sectors, facilitating skills and knowledge transfer.

The debate on biotechnology has often been drawn into very emotive discussions that focus specifically on the perception of GM technology in foods. European governments have made the mistake of

assuming that those groups or individuals that speak strongly in favour for or against GM represent the opinions of the wider consumer. This has led the debate to erroneously assume that biotechnology and GM technology are synonymous, as well as assuming that these issues are being discussed for their own sake, or to promote the interests of large companies.

No biotechnology advances should be made at the expense of the natural environment or biodiversity. However, those technologies must remain grounded in the comparative research against conventional alternatives. Many arguments against the use of GM crops, for example, have failed to take into account similar problems faced within conventional agriculture.

This report has provided an overview of the potential role of biotechnology in the UK, and how it could seek to benefit landowners, consumers, livestock and arable producers. It is clear that while biotechnology represents a significant tool in addressing the need for more sustainable food production, greater responsibility for the promotion of these methods must be placed on the industry. The emerging dialogue between the European Commission and the UK Government on biotechnology should be welcomed. It is equally apparent that public bodies and membership organisations are reviewing their approach on the subject. It is for these reasons the CLA should join this debate.

The CLA supports a biotechnology policy, inclusive of GM and non-GM applications which have been scientifically deemed to present no proven danger to the health of consumers, that can help deliver the required demand in global food production, protects the environment and provides landowners with the freedom to choose whether or not to use these technologies.

11. SUMMARY OF RECOMMENDATIONS

The CLA supports a biotechnology policy, inclusive of GM and non-GM applications which have been scientifically deemed to present no proven danger to the health of consumers, that can help deliver the required demand in global food production, protects the environment and provides landowners with the freedom to choose whether or not to use these technologies.

To facilitate the delivery of tangible benefits of biotechnology in the UK's arable, livestock, forestry and biodiversity sectors, the CLA believes the following actions are necessary.

5. Genetically Modified Organisms

The CLA recommends:

- Genetically Modified Organisms should be considered as only a *part* of biotechnology. There are many complementary applications needed to address food security and livestock management.
- further measures to be applied that focus upon the potential effects of biotechnologically altered organisms, such as GM crops, that have been scientifically deemed to present no proven risk to the health of consumers, during trials that take into account the comparable effects against conventional alternatives of those organisms.

The CLA supports:

- in principle, the right of landowners to be allowed to choose from all of the available biotechnological tools, including genetic modification techniques that have been scientifically deemed to present no proven risk to the health of consumers, to improve the productivity of their produce.

5.5 Cohabitation

The CLA recommends:

- that growers of GM products, which have been scientifically deemed to present no proven risk to the health of consumers, follow set guidelines, such as those put forward by SCIMAC (the Supply Chain Initiative on Modified Agricultural Crops), to ensure that the potential for seed or pollen transfer to non-GM sites is kept to a minimum, again compared with conventional alternatives.
- greater co-ordinated research to take place into cohabitation, applicable from the perspective of British agriculture, across crop types and compared with conventional alternatives.

5.6 The Consumer

The CLA supports:

- the right of consumers to have access to products containing Genetically Modified Organisms (GMOs) that are scientifically deemed to present no proven danger to public health, if they so choose.

6. Biotechnology in the Arable Sector

The CLA calls for:

- further investment from private and public bodies for research and development into conventional or mechanical, non-GM applications in the cereal sector that have been scientifically deemed to present no proven danger to the health of consumers.

7. Biotechnology in the Livestock Sector

The CLA recommends:

- that the commonly held perception of agricultural biotechnology being only applicable to the arable sector should be strongly challenged.
- that greater investment must take place in the British biotechnological livestock research sector.

9. Biotechnology in the Economy

The CLA supports:

- policy shifts made by the Government and its departments to promote British agricultural technology to benefit landowners and consumers and boost the British agricultural economy.

The CLA recommends:

- that the Government continues to provide meaningful investment and support for the UK's world-class agricultural research sector in order to maintain its leading global position.



Future Farming: CLA policy on biotechnology

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