Teagasc Annual Report 2002

Chairman's Statement

The year 2002 was difficult for Irish and EU agriculture. The strengthening of the euro, the slowdown in international markets and the wet summer resulted in increased costs, difficult markets and lower margins.

Analysis by the Central Statistics Office showed a drop of 8.1% in aggregate farm incomes, to €2.25 billion. Dairy and tillage farmers suffered the biggest drop in income due to lower product prices, reduced cereal yields and increased costs.

While the beef sector recovered from the difficulties of foot and mouth disease and BSE and experienced some recovery in consumption and prices, the value of output declined by 7%. Incomes of sheep farmers were down slightly on the particularly buoyant year they experienced in 2001.

Estimated gross value–added in the agri-food sector was €9.5billion, accounting for an estimated 8.4% of GDP. Employment in the sector, at 166,000, was 9.5% of total employment.

The integrated research, advisory and training services provided by Teagasc were utilised to the full in helping the industry confront the short-term difficulties and provide the essential technologies for longer-term innovation, competitiveness and sustainability in farming and food production. The developments and achievements which are detailed in the Director's review and in the main body of the report demonstrate the role that Teagasc is playing in assisting the agri-food sector to adapt to an ever-changing European and world policy and market environment for food products.

The year under review also saw the publication of radical new proposals on changing the EU Common Agricultural Policy. Our economists helped to inform the debate and assisted in formulating Ireland's negotiating position on the proposals through in-depth analysis of their likely impact.

The fact that research, advice and training are integrated in the one body confers unique advantages on Teagasc and ensures that essential technologies are transferred in the most effective manner to our key clients. Many of our initiatives in 2002 were operated as integrated programmes thereby ensuring maximum return from the resources deployed.

Developing and fostering partnership between Teagasc and public bodies in the agri-food, educational, environmental, heritage and food safety areas is a majority priority of the Authority and management of Teagasc. Joint activities in research, advisory and training services with a wide number of public bodies were further expanded last year.

Acknowledgements

In order to effectively deliver its programmes to its stakeholders and clients Teagasc relies on the support of many individuals and organisations in the public sector and the agri-food industry.

We are again grateful for the invaluable support we received from the Minister for Agriculture and Food, Joe Walsh and Ministers of State, Noel Davern and Eamon O'Cuiv who served in the Department until June 2002. We extend our gratitude to their Minister of State successors, Noel Treacy and Liam Aylward.

We also record our appreciation to the Secretary General of the Department of Agriculture and Food, John Malone, and his officials for their continued commitment and assistance.

We value our linkages with our colleagues in universities and research institutes, at home and abroad. These were further enhanced in 2002, leading to an expansion and tighter focusing of our programmes.
Our partnership with industry in the delivery of joint advisory and development programmes in dairying, beef and sheep has ensured the most effective deployment of resources in the public and private sectors. I want to thank all of the co-operatives and companies who operated joint programmes with us. These linkages have added value to our activities and ensure that our programmes are firmly focused on local needs.
Our close relationships with the farming and rural organisations and the bodies representing the inputs, processing and marketing sectors contribute enormously to the effectiveness of our activities. I thank them for their continued support during 2002.

Finances

The significant reduction in state funding for Teagasc in 2003, contained in the Government's Book of Estimates published in November 2002, had serious implications for the organisation. The challenge for the Authority and management is to ensure that the available budget is managed in a manner which will ensure that priority services are protected. This absorbed significant Authority and management resources at the end of 2002 and in the early months of 2003.

Staff

In May 2002, Dr Liam Downey retired as Director and was succeeded by Jim Flanagan, former Chief Inspector of the Department of Agriculture and Food. I wish to record my appreciation to Dr Downey for eight years of dedicated and inspired leadership in Teagasc and wish Mr Flanagan every success.
Also during the year, our Director of Administration, Sean Gilroy retired after 40 years service to Teagasc and its two predecessor organisations. I wish him well in his retirement.
Professor Jim Roche, Director of Research for the previous two years returned to the Faculty of Veterinary Medicine, UCD. I thank him for the contribution he made to our research programme in agriculture and food. I welcome Tom Kirley, previously Head of Advisory Services, who took up the position of Director of Administration and Dr Seamus Crosse, previously Head of Moorepark Research Centre, who was appointed Director of Operations, Production Research.
Teagasc's key resource is its staff. I again wish to record my appreciation to all our staff for their commitment and loyalty during 2002 and look forward to their continued support during more difficult times in 2003.
Finally, I want to record my appreciation to my colleagues on the Teagasc Authority for their continuing commitment and generosity. It is an honour to work with them.
Tom O'Dwyer
Chairman

Director's Review

Teagasc programmes in 2002 continued to focus on the development and dissemination of the technologies which are essential in building a more competitive, innovative and sustainable agriculture and food sector in Ireland.

I am pleased to report a number of important new developments and achievements in our research, advisory and training services. Substantial advancements were made in the delivery of our new nationally accredited third level and vocational training programmes for young entrants to agriculture, horticulture and the agri-food sector. Our new advisory structures aimed at securing a strong commercial farming sector and maintaining the viability of rural areas were bedded down. In the research area, significant progress was made in the establishment of facilities geared towards enhancing our expertise in biotechnology and a number of important innovations were generated which have significant commercial potential in farm production and food processing.

Research

A total of 327 research projects were conducted by 200 scientists, supported by over 100 post-graduates, at our nine research centres. Research covered food processing, livestock, tillage, horticulture, forestry, environmental control, economic analysis and rural development.

Researchers published a total of 134 reports in international scientific journals. A further 704 scientific and technical reports were issued detailing the outcome of research.

Substantial investment was undertaken in new research facilities. New biotechnology laboratories were completed at our National Tillage Research Centre at Oak Park, Carlow and construction of a new biotechnology centre at Moorepark, Fermoy got underway. The new facilities, combined with the recruitment of new scientific expertise, will underpin an expanded biotechnology research programme in animal production, crop production and food processing.

Collaboration with research institutes and universities at home and abroad was expanded further during the year. Our two food centres, the National Food Centre and the Dairy Products Research Centre, achieved major success in winning two EU-funded research projects against stiff scientific competition. The projects, which involve the development of safety blueprints for meat and enhancing health-promoting fatty acids in milk, include a large number of international scientific and industry partners. Another project, being led by economists in our Rural Economy Research Centre and involving the development of a modelling system to evaluate the impact of policy changes on the EU agri-food sector, has partners in all 15 member states.

Food

Highlights of our food research programme include the development of new beef processing technology which has potential significant benefits for the Irish beef industry. The technology, involving hot boning and improved packaging, has moved to an industry trial in 2003. Our food scientists also achieved a world-first in the development of a new detection method for pathogens in food.

Several developments in the food biotechnology programme demonstrate new Teagasc scientific strengths. Progress was made in developing molecular tools for diagnosing and enhancing meat quality and our researchers were involved in using

new genetic technologies to improve cheese flavour and ripening. We were also active with industry customers in developing new cheese varieties, new infant food formula and other new food products.
A joint strategy involving Enterprise Ireland, the Teagasc Dairy Products Research Centre and UCC, aimed at attracting foreign companies active in functional foods into Ireland, was launched in 2002. Our involvement in this national initiative reflects the scientific reputation of the Dairy Products Research Centre in functional foods research.

Production

In production research, the intensive research programme on fine-tuning blueprints for low cost, grass-based milk, beef and sheep production was continued. The results of two years of research on outwintering animals on pads constructed of woodchips were published. They showed that, relative to conventional winter housing, these pads had a positive effect on animal growth rate, health and welfare. The research also showed reed beds and constructed wetlands to be effective in treating animal effluents emanating from outwintering pads. Further research on environmental impacts will be carried out.
Studies on animal welfare were expanded in 2002 and new information was generated on the welfare impacts on animals exported live and of other potential stress-inducing activities. Work also got underway on using satellite telemetry technology to track the grazing behaviour of sheep on hillsides. This is part of comprehensive research on environmentally sustainable hill sheep production. Also in sheep research, a provisional patent was filed to cover the discovery by Teagasc scientists of novel gene mutations which have a profound effect on ovarian function. In addition to having significant benefits for sheep production, this discovery is likely to provide important insights for human fertility.
With labour becoming a growing problem in dairy farming, research work continued on measuring labour input and developing more work-friendly practices. In animal health, researchers developed bacterial viruses with activity against bacteria causing mastitis in dairy cows. This has the potential to lead to an alternative to antibiotics. In our tillage research programme, researchers found that reduced cultivation, or 'Eco-tillage', can reduce establishment costs by over 30%, with environmental, pest and disease benefits. The Teagasc potato and grass breeding programme continued to deliver new varieties for the domestic market and seed export trade.

Environment

A major research programme got underway on quantifying the environmental impacts of a range of production systems and comprehensive work was carried out on pathways of phosphorus loss to water. The major Teagasc project on forest soils classification made significant advances, with mapping and productivity ranking completed for much of the country.

Economics

In economic analysis, Teagasc economists undertook an in-depth analysis of the impact of the EU proposals for changes in the Common Agriculture Policy. The results helped to formulate Ireland's negotiating position. Economists also continued to provide up to date assessments on the performance of and prospects for the full range of farm enterprises.

Advisory Services

The re-structured Teagasc advisory services were fully introduced in 2002. Services are now geared towards two distinct groups of farmers, the commercial farming sector and those whose viability is under threat.

The Technology and Business Services is concentrating on disseminating the best production technology and business management practices to the commercial farming sector. The Rural Viability Service is directed towards farmers whose viability is under threat and who are not capable of making an adequate household income from farming alone.

A vital component of the Rural Viability Service is the Opportunities for Farm Families Programme where expert confidential assistance is given to farm families in assessing their current position, examining the on-farm and off-farm options open to them and identifying the best opportunities to boost household income and quality of life.

Almost 3,000 farm families participated in the Opportunities for Farm Families Programme in 2002 and the vast majority have found the experience beneficial. Many have made decisions which were 'long-fingered' for a long time.

Discussion groups and monitor farms are an increasing feature of our national advisory programme. Over 400 discussion groups were co-ordinated by Teagasc advisory staff and some 200 monitor farms were used in setting performance benchmarks and adapting new technology to local needs.

The year was also characterised by an increase in the number of joint Teagasc/industry development programmes. More than 20 joint programmes were operational, ensuring that the combined resources of the state and industry were optimised.

Advisory staff also played a central role in ensuring that the effects of the very difficult weather in summer 2002 were minimised. Expert advice was provided to farmers on animal nutrition, forage conservation, feed budgeting and financial planning.

Education and Training

I am pleased to report that the level of enrolment in third level and vocational training courses for young entrants to the agri-food sector increased by almost 10% in 2002. This broke a five year cycle of declining numbers and reflects the impact of the fundamental changes in agricultural training which were introduced in 2001. A number of courses were run at night and weekends with a significant distance learning component. Plans were also put in place for the introduction of e-learning and a pilot programme was scheduled for early 2003.

Over 9500 adults participated in courses run by Teagasc in 2002, covering all aspects of farm business management, rural viability, information technology, environmental protection, food safety and alternative enterprises.

Teagasc was again a major provider of training for the food industry with over 2,500 participants in courses on food safety, innovation management and consumer foods.

Information Technology

Following a comprehensive review of Information and Communications Technology (ICT) an ICT strategy and plan was produced in 2002. While acknowledging that major strides had been made within Teagasc in IT infrastructure and applications, it highlighted investment needs in new technology, networks and modern operating

systems together with skilled staff at all levels. An implementation plan will be operational during 2003.

Quality Customer Services

A full-time customer services officer was appointed at the end of 2002 and a quality customer service action plan was being formulated. The plan will include performance indicators and customer service protocols for the full range of services provided by Teagasc.

Programme Evaluation

Plans to establish an evaluation unit within Teagasc were advanced during 2002 and the strategies for performance evaluation were developed. The evaluation unit will oversee the design and conduct of the performance measurement system and will develop a cyclical plan for the systematic evaluation of the impact of the key programmes of Teagasc.

The key highlights and achievements of our research, advisory and training services are outlined on the following pages.

Jim Flanagan
Director

Food Research and Development

The food research and development programme, carried out at the National Food Centre in Dublin and the Dairy Products Research Centre, at Moorepark, Fermoy, generated a number of new technologies in 2002 with significant commercial application.

A total of 117 food research projects were undertaken, 67 at the National Food Centre and 50 at the Dairy Products Research Centre. Many projects were run in partnership with universities in Ireland and with research institutes in the EU, US, Australia and EU accession states.

Both food research centres achieved success in winning major EU-funded contracts against stiff scientific competition. Teagasc scientists were selected as leaders of two EU-funded projects, on developing safety blueprints for meat and on enhancing the levels of health promoting fatty acids in milk. In a number of other EU-funded projects awarded during the year, Teagasc scientists were selected as key partners.

A measure of the scientific depth of the Teagasc food research programme is reflected in the publication by scientists of 68 reports in peer reviewed international scientific journals.

The construction of new biotechnology laboratories at Moorepark got underway during the year and will be completed in 2003. The new facilities will underpin an expanded biotechnology research programme in food and animal production. New biotechnology resources were also provided at the National Food Centre, leading to the generation of important new information on food safety and meat quality.

Nutritious Grass-fed Beef

Beef from natural grass-based systems is more nutritious than beef from cattle fed concentrates and has superior shelf-life during retail display. This was the result of a joint research project by scientists at the National Food Centre and the National Beef Research Centre at Grange.

Finishing beef on grass increased its nutritional value by reducing the fat content of the lean meat, increasing the conjugated linoleic acids (CLA) content and bringing the fatty acid profile more in line with human dietary needs, compared to cattle fed concentrates. The increase in omega-3 fatty acids and CLA in lean meat was proportional to the length of time on grass. New data shows that beef from natural grass-based systems is more resistant to rancidity and discoloration during retail display. Results from cooking trials suggest that heating does not destroy or change the relative proportions of the beneficial fatty acids in grass-fed beef.

This research was published in three peer-reviewed papers and nine other publications in 2002. Results were also presented to the meat industry and at an international conference in Spain.

New Beef Processing Technology

The Irish beef industry could benefit substantially from new technology developed by scientists at the Teagasc National Food Centre. The technology, involving hot boning and an improved system of packaging, has the potential to enhance the tenderness of beef, cut processing costs and deliver a more uniform product to the consumer.

The conventional way of handling beef is for the carcass to be chilled immediately after slaughter, for up to 48 hours. It is then boned and the meat is allowed to 'age' or mature for up to 14 days.

With this new system, the high value cuts are removed from the carcass within one and a half hours of slaughter. Then, through a process called PiVac, the meat is sucked into a tube of elasticated packaging, which effectively means that it cannot get tough. The resulting meat is called TenderBound.
Consumer testing and scientific measurements show a more consistently tender product than with the conventional chilling system. The research results also show that the hot-boning system results in only around 0.5% in weight loss compared to up to 2% with the carcass hanging in the chill room. This could lead to substantial benefits to processors and beef producers.
The research was carried out by the National Food Centre in conjunction with a major German engineering company which specialises in innovative systems of food packaging.
While hot-boning is practised to some extent in the US, New Zealand and in some northern European countries, this is the first time a scientific trial on the combined hot-boning/TenderBound system has been carried out.
The next stage will involve an industry trial, where the technology can be tested at meat factory level and the actual advantages quantified.

Detection Method for Food Parasite

A European research team, led by the National Food Centre, achieved a world-first in the development of a new method to detect the parasite, *Cryptosporidium parvum* in food.
Cryptosporidium parvum is an emerging parasite in food and infected humans can suffer acute diarrhoea with abdominal pain, accompanied by nausea, vomiting and low grade fever. The disease usually lasts up to three weeks but for people with low immunity, it can become chronic and persistent.
The parasite is found in the intestinal tract of cattle and sheep and is excreted in the faeces. It can be transmitted from animal to person, person to person, through ingestion of contaminated water or food or by direct contact with contaminated environmental surfaces.
Using the newly developed detection system, scientists at the Teagasc National Food Centre have carried out the first studies on the prevalence of *Cryptosporidium parvum* in meat and salads and have also investigated its survival rate in these foods.
The new detection method will be of considerable benefit in allowing continued research and monitoring of this emerging parasite in foods.

Enhancing Meat Quality

Working with the Meat Functional Genomics Group in Michigan State University and the molecular biology laboratory in the Faculty of Veterinary Medicine, UCD scientists at the National Food Centre made progress in developing molecular tools for the enhancement, control and diagnosis of meat quality. DNA and RNA were extracted from Irish beef of desirable quality for the preparation of microarrays to analyse gene expression. In particular, genes influencing the nutritional composition and tenderness of meat are being targeted. The aim is to identify differentially expressed genes at the time of slaughter in carcasses with extremes of quality traits. Also, protein expression patterns during the ageing of meat are being linked to the sensory, nutritive and technological properties of meat.
The capacity to carry out this and other research work at the National Food Centre resulted from the establishment of new biotechnology resources in 2002.

Research on Food Chemical Safety

Teagasc joined the European Mycotoxin Awareness Network and is providing a wide ranging body of information on mycotoxins to the food and animal feed industries. The Network shares a body of information from seven specialist institutes on the occurrence of mycotoxins in food, how to prevent them during harvest and storage, as well as methods for sampling and analysis, legislation and control.

Scientists at the National Food Centre developed a new method for the detection of nitrofurans in Irish meat and imported chicken and shellfish This coincided with the publication of three EU decisions requiring testing for nitrofurans in all chicken and shellfish imports from designated third countries. Arrangements are being made to acquire more powerful mass-spectometry techniques in order to expand the range and sensitivity of residue studies, including nitrofurans.

A study also got underway at the National Food Centre on establishing the extent of coccidiostat residues in poultry and eggs. Coccidiosis is a disease to which poultry are susceptible resulting in routine drug treatment. The study will also identify industry practices which may lead to residues.

EU Food Safety Initiative

The National Food Centre was selected to lead a major EU-funded contract to develop European-wide food safety blueprints for farm production, meat processing, retailing and catering. It involves a consortium of scientists and industry partners in 13 EU states as well as Poland, Hungary, US and Canada.

In addition to developing critical safety practices for vital stages in the food chain, the initiative will also review how food poisoning outbreaks are investigated and will advise on effective communications strategies with consumers on food safety issues.

Over the last three years, Teagasc has developed and published food safety blueprints for Irish beef, pork and lamb slaughter. Called HACCP (Hazard Analysis Critical Control Point), they detail the critical safety practices which must be undertaken from the time the animal reaches the factory until the carcass enters the chill room.

A HACCP for poultry has also been developed in collaboration with UCD and safety blueprints for the catering and vegetables sectors were due to be published in 2003.

Researchers at the National Food Centre also undertook work on risk assessment of the pathogen, *E.coli O157-H7*, from farm to fork. It involves a comprehensive assessment of where most risk of infection occurs. This is the first such assessment of a food pathogen in Ireland and is being carried out in collaboration with research partners in UCD, University of Ulster, Food Safety Authority of Ireland and the Food and Drugs Administration (FDA) in the US.

Research on Convenience Foods

Research has found that the incorporation of dietary fibres in processed meats is associated with healthy bowel function. Dietary fibres have also been found to act as fat replacers, thereby giving low-fat meat products equal technological and eating quality to their full-fat counterparts. These results give conventional products such as sausages and burgers some of the characteristics of new generation functional foods.

Scientists at the National Food Centre also developed a freeze-chill process and conducted commercial scale tests using a tempering unit capable of defrosting up to 5,000 ready meals at a time.
In a further development of chill-chain technology, food products were vacuum packaged before cooking and then frozen for distribution rather than handled as chilled products, as is the current practice in industry. The research married the heat treatment with the follow-on freezing step to deliver ideal product texture for a range of components, including vegetables, fish, rice, pasta, and potato. Six ready-meal companies co-operated in product testing and scale-up.
In another development in convenience foods, a unique blend of potato and rice starch with novel hydrocolloids is undergoing commercial trials with six bakery companies. The new formulation gives eating quality equivalent to conventional white bread, and much superior to currently available gluten-free breads. Because conventional products use wheat starch they are not well tolerated by many coeliacs and persons with wheat allergies/sensitivities. The findings were presented to the Coeliac Society of Ireland and at research conferences and workshops.

Helping Food Entrepreneurs

As part of Teagasc support to small food companies, the National Food Centre examined the factors that significantly affected innovation in 60 small enterprises, 30 in border regions and 30 in the south west. Guidelines are being prepared in order to guide future policy.
The potential for internet marketing was also investigated. Preliminary results showed a potential to increase internet-based speciality food sales by almost 200% over the next 10 years, albeit from a low base.
Arrangements were finalised with Enterprise Ireland for training small companies in technology, innovation and business strategy. A new pilot programme was schedule for 2003 with Country Enterprise Boards in Louth, Monaghan and Cavan.

Leading Functional Foods Technology

The scientific reputation which the Dairy Products Research Centre (DPC) has earned in functional foods research is reflected in the new strategy developed by Enterprise Ireland in 2002. The strategy involves a joint approach between Enterprise Ireland with the DPC and UCC, aimed at attracting foreign companies active in functional foods into Ireland. The companies can avail of the considerable scientific and technological capacity now available at the DPC and UCC.
An important development in functional foods research at the DPC during the year was the development of new systems which improve the survival of probiotics both during storage in powdered form and during gastric transit. This has the potential to result in the more effective use of probiotics and to the development of more varied probiotic products.

Using Probiotics for Salmonella Control

A major project at the Dairy Products Research Centre (DPC) involves the development of probiotics that inhibit salmonella and thereby control by natural means the high salmonella levels in Irish pigs. The project is based on the existing DPC expertise in probiotics for human application. A significant advance in 2002 was the isolation of five cultures with strong anti-salmonella activity, as a result of a major screening programme of pig intestinal bacteria. A pig feeding trial with these

strains was undertaken. Initial results indicate that some of the strains successfully populated the intestine which is a critical indicator of anti-pathogen potential.

New Cheese Varieties

A new blue-veined cheddar cheese variety, which was initially developed at the Dairy Products Research Centre (DPC) and subsequently transferred to Carbery Milk Products, Co. Cork, won the premier award at the IFEX exhibition in Belfast. The DPC and the pilot plant, Moorepark Technology, were also active with customers in the development of three other new varieties, a cheddar hybrid, a blue brie and a Gruyere variety.

Other highlights of the cheese research programme in 2002 included a project on the potential to improve the functional characteristics of low fat mozzarella cheese and a survey of all cheddar cheese manufacturing plants in Ireland with a view to establishing cheese-making practices and efficiency. It showed large variations in yield levels resulting in financial loss to the industry. The DPC has commenced a programme of efficiency improvement with individual companies.

In another project, plans were finalised to transfer a cheese starter culture developed by scientists at the DPC, to a major cheese manufacturer. The culture has already been demonstrated to have commercial potential.

New Irish Coffee

Technologists at the Dairy Products Research Centre (DPC) took a lead role in the development of an 'instant' Irish coffee product which is currently on market trial for a small Irish food company. The technological properties of the product are unique and the development relied heavily on the DPC's technological expertise. Development and scale-up took place at the Moorepark Technology pilot plant, which is now manufacturing the main product components under contract. This product provides a good example of the versatility of DPC skills and the support it can provide to entrepreneurial food companies.

Forefront of Biotechnology

Several developments in the biotechnology programme demonstrate that the Dairy Products Research Centre (DPC) is at the forefront of new genetic technologies. A gene sequencing project on a cheese flavouring culture, which is being done under contract with a German company, progressed well in 2002 and is expected to be fully completed by mid-2003.

A research team has been assembled at the DPC to fully 'harvest' this genomic information for applications in cheese ripening and in development of flavour ingredients. The DPC is collaborating with the USDA Western Region Research Centre in California in proteomics and has access to the superb proteomics facilities of that centre for the progression of several DPC projects.

DPC staff and students are now conversant with the technology of proteomics and will be in a position to integrate it into the programme of the new Moorepark Biotechnology Centre. The recruitment of a senior scientist in 2002 has enabled gene technology, which is at the front edge of genomics, to be established at the DPC. These new technologies are additional to the standard range of genetic skills that has been built up over many years, and leave the DPC biotechnology group well positioned to participate in new biotechnology in the future.

New Infant Food

The Dairy Products Research Centre (DPC) has been working with the infant foods sector for many years in the development of nutritionally-enhanced whey protein fractions for use in a new generation of infant formula.
A process developed by Moorepark for production of alpha lactalbumin-enriched proteins was taken up by a major infant formula company and, using the Moorepark plant, the full industrial process was developed and prototype product was manufactured for clinical trials. These trials were successfully concluded and the alpha lactalbumin-rich infant formula was launched on the market in 2002.
It is envisaged that this new formula will be the company's main humanised formula in the future. The DPC has therefore played a central role in this significant evolution of the international infant formula industry, and its relationships with the major manufacturer is regarded by Enterprise Ireland as an important contribution to embedding a foreign multinational food company into the Irish economy and into the Irish innovation system.

Research on Johnnes Disease

Johnnes disease is widespread in many countries and is present in an unspecified number of herds in Ireland. The pathogen responsible for Johnnes is suspected of being the causative agent for Chrone's disease in humans. The fact that this pathogen may not be killed by pasteurisation of milk is leading to public health concern.
A special isolation facility has been set up at the Dairy Products Research Centre for research on pasteurisation of the Johnnes pathogen.
This entailed the construction of a modular, sensor-controlled pasteuriser capable of creating the precise pasteurisation conditions of an industrial plant. In 2002, the plant was fully commissioned and validated. A HACCP system was introduction and the first of a series of trials on milk from Johnnes-positive herds were conducted. Further trials are being carried out in 2003 and the results should be of great importance to the dairy industry.

Enhancing Milk as a Health Food

In recent years researchers at the Dairy Products Research Centre and Moorepark Production Research Centre have developed a feeding regime for dairy cows which results in elevated levels of the health inducting fatty acid, conjugated linoleic acid (CLA), in milk. This offers the opportunity to Irish companies to place dairy products with elevated CLA on the market.
In 2002, researchers linked up with a major milk processor in a pilot farm study aimed ultimately at the manufacture of high CLA dairy products for the European market. This programme demonstrates the belief in industry that these products can be the basis of a successful new consumer market strategy.
Progress was also made in 2002 on microbial production of CLA, as an alternative to the natural levels occurring in milk. Successful development of a micobial alternative will be the basis of a new approach to probiotic foods, based on metabolite-specific physiological activity.
Important information was obtained on the specific strains of bifidobacteria which are optimal for CLA production. It was discovered that some of these strains produce a new variant of CLA which was more potent against colon cancer cells in *in vitro* trials. This information will support the concept of using CLA-producing probiotics for improvement of gut health.

Breakthrough on Chocolate Technology

Scientists at the Dairy Products Research Centre made a major breakthrough on chocolate technology in 2002. It involves the production of milk powder for use in chocolate, using spray drying as a replacement for the outdated and expensive technology of roller drying, which up to now was the only technology capable of delivering the required functionality. It also enables manufacturers to vary and customise the chocolate making properties of milk powders in a controlled and scientific way. This would enable Irish processors to become specialists in supplying to the chocolate industry rather than relying on one, commodity-type, undifferentiated powder.

The new process is recognised by the chocolate industry as being entirely novel and patentable. Dairy companies can now produce chocolate ingredients more economically and have an opportunity to develop a more specialised business in chocolate ingredients which is a major volume outlet for milk. Production plans for the new ingredients are now being made.

Agri-Food Economics

Researchers in the Rural Economy Research Centre undertook 33 projects in 2002. The projects were focused on the impact of national, EU and world policies on the agri-food sector and rural areas and on assessing the performance of farm enterprises and changes in market demand for food products.

Teagasc economists attached to the FAPRI Ireland policy analysis unit conducted a major analysis of the EU proposals for changes in the Common Agricultural Policy, which were published in July. The results of the analysis were presented to the Department of Agriculture and Food and helped to formulate Ireland's negotiating position.

A number of the research projects involved collaboration with partners in other European Countries. One major project, involving the development of a modelling framework which would enable policy changes to be evaluated in each EU member state, has partners in all 15 member states. This project, which is being led by economists in the Rural Economy Research Centre, completed its first year in 2002.

Analysing Industry Performance

In a detailed analysis of the major enterprises in 2002 and prospects for 2003, economists reported that a combination of higher costs and lower prices resulted in an average drop of 20% in margins in dairy farming. Milk prices dropped by an average of 2.8 cents per litre, or 8.5%, during the year. In the absence of the EU support system for dairy products, the fall in milk prices would have been much larger, as happened in other major export dependent countries. Lower prices and reduced yields results in a drop of around 25% in the margins of the two major cereal crops, winter wheat and spring barley. Potatoes was the only tillage crop to have improved margins in 2002.

Beef farmers were expected to suffer a drop in margins of around 7% and a further 5% drop in margins in 2003 was projected. Margins in sheep farming were projected to decline by around 5% in 2002 and are expected to fall by a further 5% in 2003. While pig feed costs were reduced in 2002, a substantial drop in pig prices led to declining margins. The pig sector was projected to be under continuing pressure in 2003.

Economists also predicted that changes in EU and world trade policy would lead to continuing income pressure in dairy farming. Farmers who are committed to continuing in dairying must grow their business and adopt the most effective cost cutting methods. Under current quota policy, the limited amount of quota becoming available will not allow sufficient expansion in milk production to maintain income. Therefore, huge emphasis must be placed on cost-efficiency.

Survey of Incomes in 2001

The Teagasc National Farm Survey for 2001 showed an increase of 17.3% in farm incomes, bringing average income per farmer to €15,840. This is the second annual increase in incomes following a period of decline in the late 1990s. Incomes in 2001 for the first time exceeded the previous high level of €14,326 in 1995.

The improved position was due mainly to higher output in the dairying, cattle and sheep sectors, resulting from higher prices and increased direct payments. Overall farm output increased by 11% while farm production costs increased by 8%. Direct payments increased by 16%.

In spite of the increase, the relationship between farm incomes and average industrial earnings has disimproved. In 1995, average income per person employed in agriculture was 61% of the average industrial wage. This dropped to 40% in 1999 and was at 50% in 2001.
Dairying was the highest income earned with an average of €34,400. Tillage incomes average €24,100 while incomes on beef farms averaged €7,500.
The survey showed a total of 47,000 full time farms – with a minimum of 0.75 labour units – with an average income of €31,000. Sixty per cent of these farms are dairying, 32% beef/sheep and 8% tillage. The average income of the remaining 73,000 farms was €5,900. Almost 90% are involved in beef/sheep and on 80% of these farms the farmer and/or partner had another source of income either from off-farm employment, pension or social assistance.
On 45% of all farms, the farmer and/or partner have an off-farm job, compared to 32% a decade ago. When income from pension or social assistance is included, farming is now the sole source of income on just 36% of all farms.

Prospects for Agriculture to 2010

Analysis by Teagasc economists attached to the FAPRI Ireland policy analysis unit showed that a continuation of existing EU policies would result in a drop of 3% in the value of agriculture output by 2010, compared to 2000.
The analysis pointed to a drop of 7% in the value of milk output and a drop of 10% in the value of beef output. The pig sector was projected to increase by 9% while the sheep sector would remain static.
Subsidies on products were projected to increase by €146 million while direct payments to farmers would rise by €297 million over the 10 year period. The proportion of farm income accounted for by direct payments would be 72% by 2010.

Impact of Payments Change

A further tightening of the stocking rate eligibility criteria and a corresponding increase in payment levels under the EU Extensification payments scheme would have little impact on Irish beef incomes but would lead to a drop in the suckler cow herd, according to an analysis by Teagasc economists published in 2002. The impact of the tighter extensification rules would bring the greatest benefit to smaller-scale beef producers.
A reduction in stocking rate on these farms would be more than compensated by the higher extensification payments, leading to an increase of 10% in income. Larger-scale farmers, not currently availing of extensification, would have to reduce livestock numbers by 20 per cent in order to avail of the new payment. This would reduce incomes by 40%. Therefore, it would not pay these farmers to change stocking rates.
In a separate analysis, greenhouse gas emissions were projected to fall by 5% between 2000 and 2010. This represents a 3% decline on 1990 – the base year for the Kyoto Protocol. The extensification scenario performed on the FAPRI-Ireland model resulted in emissions from agriculture falling by a further 1% by 2010.

Comparing Regional Job Growth

Teagasc rural development researchers stated that while the record growth in employment during the 1990s was shared by all regions the gains in rural regions were much weaker than in urban areas. The growth in foreign investment and internationally traded services favoured Dublin and the eastern counties. Irish

enterprises showed a more balanced regional distribution but the growth in employment was weaker.
Current industrial policy acknowledges the need to cluster related investments in a limited number of key regional centres as counter-magnets to Dublin and its surrounding counties. However, the policy of balanced regional development is, of itself, no guarantee that the benefits will extend to the rural hinterland.
Rural enterprises can capitalise on changes in the mainstream economy. Large industries subcontract functions, such as transport and servicing. Rural enterprises can benefit from the development of niche markets, from the demand for customised products and consumer preferences for products of traceable origin and geographical identity.

Changing Structure of Farming

Analysis by the Rural Economy Research Centre showed that average farm size in Ireland has increased by 6 hectares since 1993. This represents an increase of over 20%, bringing the average size of farm at present to 33.6 hectares. Increased uptake of off-farm employment, either by the farmer or partner, has alleviated income pressure in up to 40,000 farm households during the past decade.
The increase in part-time farming has made a major contribution to the income base of rural areas. In 2000, it is estimated that €1 billion - €1.3 billion was earned by farmers and their spouses from off-farm employment.
Almost 30% of farmers with off-farm employment were involved in the construction industry. A further 28% were involved in farm-related employment, such as machinery contracting and the provision of farm relief services. In contract, almost 40% of partners with off-farm jobs were involved in professional occupations. Over one-quarter were involved in clerical work and over 10% in service industries.

Assessing Pig Costs

Pig production costs in Ireland are lower than in the UK, Holland and Denmark, the three major competitors for Irish pigmeat exports to the UK market, according to Teagasc analysis. The highest production costs were in Holland. In 1999, the cost per kilogram of pigmeat carcass was €1.04 in Ireland compared with €1.41 in Holland. The figures for the UK and Denmark were €1.32 and €1.14 respectively.

Meat Production

The Teagasc meat production programme in 2003 continued the emphasis on the development of internationally competitive and environmentally sustainable production systems.

Research activity on beef at Grange Research Centre was strongly focused on the further development of the most cost efficient grass production blueprints and on fine-tuning forage conservation technology. Important new research results were generated on outwintering animals on wood bark bedding, with the effluent being treated in reed beds/constructed wetlands.

Work continued on the development of animal breeding programmes which enhance the quality and value of Irish beef while new information was generated from research on the impact of transport and other stress-inducing practices on animal welfare.

The sheep research programme at Athenry Research Centre included work on the role of an all-year-round grazing system as well as the finalisation of a research blueprint on a high output sheep system. The results of on-farm recordings demonstrated the potential for genetic improvement. In hill sheep production, a new project was initiated, using technology to track the movement and grazing behaviour of hill sheep.

The pig research programme at Moorepark Research Centre evaluated the impact of new diet regimes on meat quality and also investigated the impact of a range of practices as welfare indicators in pigs.

The key objectives of the beef and sheep advisory programmes were to maximise weight gain from low cost grass, to enhance breeding strategies at farm level and to increase profitability through reduced costs and optimised premia payments. In pig production, the Teagasc specialist advisory service was focused on the adoption of rigid cost monitoring and control systems at farm level.

Farmers Benefit from Beef Technology

Beef farmers using the latest technology and adopting best financial management strategies made double the national average beef income in 2001.

The Teagasc National Farm Survey for 2001, published in October 2002, showed that the income of farmers participating in the intensive Teagasc beef advisory programme averaged €517/hectare. This compares with an average of €266/hectare on all beef farmers. The top performing farmers involved in the Teagasc programme achieved an income of €742/hectare. This highlights the potential which exists to increase income from beef farming.

The key factors in achieving higher incomes are breeding, performance and cost control. Farmers who are on the highest income level have lower fixed costs and are producing very high levels of beef from well-managed grass.

There is a difference of at least 100 kg in beef liveweight gain per hectare between farmers who made an income of €750/hectare compared to those who made €500/hectare. The top performers also produced higher quality beef. They also had fixed costs of up to €250/hectare lower than their €500/hectare counterparts.

The Teagasc income target in beef farming is €600/hectare. For farmers involved in beef sucking system this involves retaining 90% of all premia as profit. For those involved in producing beef from weanlings or stores, between 60% and 70% of all premia would need to be retained as profit.

Impact of Joint Programmes with Industry

The use of discussion groups in effectively transferring new production and financial management technologies to beef producers was again a vital component of the Teagasc beef advisory programme. Some 100 beef discussion groups were co-ordinated by Teagasc in 2002. The majority of these were associated with the nine joint development programmes operated by Teagasc and partners in livestock marts and meat processing plants. These programmes ensure that production is firmly focused on industry needs and that the combined resources of state and industry are deployed in the most efficient manner.

The objectives of these programmes include better breeding, better quality assured beef, improved marketing and increased profitability through better technical and financial management.

New initiatives by group members involved in these programmes in 2002 included finished cattle at under 12 months for the Italian export market, premium schemes for the purchase of high index bulls, beef supply agreements with supermarkets and direct selling of stock via the internet.

Monitoring Beef Performance

The use of monitor farms is now firmly established within the Teagasc beef advisory programme. Over 40 beef farms participated in the monitor farm programme in 2002 The selected farms implement a management programme with the support of Teagasc advisory, specialist and research staff. A comprehensive recording programme of all management practices, animal performance and financial transactions is undertaken on each farm.

Information from the monitor farms is disseminated to other beef farmers through discussion groups, farm visits, farm demonstrations, seminars and newsletters. The information can also be used as benchmarks whereby farmers can compare their own results with those from the monitor farms.

For example, in 2002 over 5,000 animals were weighed on monitor farms in order to assess performance and provide local data for farm walks and demonstrations.

In spite of the difficult weather conditions, performance of weanling animals in 2002 was good, with an average liveweight gain of 1.1 kg/day. Days at grass, at 223 for suckler cows and 221 for 12-18 month olds, were also satisfactory and in line with Teagasc targets.

The weight of 18 month old steers at housing averaged 573 kg. This demonstrated excellent management and ensured that these animals were on target to easily reach slaughter at under 30 months. Overall lifetime performance of animals on monitor farms was good, averaging liveweight gains of 0.87kg/day for steers and 0.80kg/day for heifers.

Research on Outwintering Pads

Research at Grange has shown that, relative to conventional slatted floor accommodation, outwintering pads have a positive impact on animal growth rate, health, welfare and reproductive performance. However the system produces a large volume of effluent with a high pollution potential, which must be properly managed to achieve environmental sustainability.

The outwintering pads were constructed from a bed of woodchips over a lined and artificially drained surface. The results over two winters showed that cattle had higher liveweight and carcass gains (+15% for finishing steers) than those in slatted floor sheds. They also had better feed conversion and lower fat scores.

The Grange research has also shown reed beds/constructed wetlands to be effective in treating effluents generated by animals on outwintering pads. Earth bank tanks, properly constructed, were also shown not to pose problems for ground water and were a cheap and effective means of slurry storage.
This major research project is continuing. It is expected that outwintering pads will require planning permission, with construction of the system completed according to standard specification.

Studies on Animal Transport

Work on the impact of transport and other potential stress-inducing activities on animal welfare continued during the year. In one study involving live animal exports, researchers found that animals transported by road and boat to France lost 7.6% of their bodyweight. They re-gained 3.3% by the time of arrival in Spain and fully recovered to pre-transport liveweight values within six days of arrival in Spain. Another study involving young bulls showed that there was no animal welfare advantage in increasing the space per animal in cattle export trucks above the standard stocking density of 0.85 square metres/animal. The study measured the welfare effect on animals during a 12 hour journey.

Assessing Animal Identification Systems

A three year project involving over 2,000 animals found that two commercial electronic rumen boluses were equally effective with a reading rate of 99%. Similarly, with two commercial electronic ear tags it was found that the reading rate was similar when the tags were secured correctly to the ear. The choice between an electronic rumen bolus and an electronic ear tag will depend on the level of security required in the system. The electronic rumen bolus provides the greater level of security but also requires higher labour demands with recovery at slaughter than an electronic ear tag.

Beef Cow Fertility

The preliminary results from an examination of fertility in the Teagasc Grange spring calving suckler herd over a 13 year period shows that from a total of 925 calvings only 6% were not pregnant at the end of the breeding seasons. Calving interval ranged from 347 to 381 days, with the lower interval applying to the early calving (up to March 6) cows.
This data shows that, despite relatively low winter feeding levels, good fertility can be obtained when the herd is supplied with an adequate quantity of leafy pasture in spring.
Other work on breeding and fertility included the assessment of calf performance from different cow breeds. Initial results showed that crossbred cows, comprising continental breeds and Friesian/Holstein, had progeny with higher pre-weaning daily gains than progeny from either pure-bred Charolais or Limousin. This was mainly due to the higher milk production by the continental/Friesian/Holstein crossbreds.

Profitable Sheep Systems

The first year's results from an all-year-round sheep grazing system at the Knockbeg sheep research farm were promising. Animal performance was as good as the conventional system, where ewes are housed for the winter and lambed indoors.

Productivity of 1.8 lambs reared per ewe was particularly high. However, outdoor lambing was not problematical and the all-grass system required significantly less time for feeding during the winter months. The impact of the all-grass system on the environment is now being studied.
Another project on a high output sheep system, at Athenry Research Centre, was completed in 2002. The objective was to produce 500 kg of lamb meat/hectare, combining best breeding, feeding and management practices.
The early March lambing flock consisted of Belclare-type ewes crossed with Suffolk rams and was managed in a rotational grazing system. The target of 500 kg lamb meat/hectare was achieved in each year of the three year experiment. The essential inputs were: 221 kg of nitrogen/hectare and 23 kg concentrates per ewe. All lambs were sold for slaughter by mid September each year.
The results of this research demonstrate the potential for well managed grass-based sheep production systems and will provide an important benchmark for technology transfer and performance evaluation at farm level.

Patent for Gene Mutations

A provisional patent was filed to cover the discovery of novel gene mutations which have a profound effect on ovarian function in sheep. The discovery, which involved a team led by scientists at Teagasc Athenry and involving collaboration with scientists in NUI Galway, France and New Zealand, is part of the expanded Teagasc programme in biotechnology research. As well as having significant potential benefits for sheep production, the discovery is likely to provide important insights for human fertility.
A further biotechnology research project showed that the gene controlling resistance to the disease, scrapie, has no connection with prolificacy. Initial results also indicate no effect on lamb growth rate or fatness. Therefore, selection programmes to eliminate the susceptible alleles will not adversely affect production traits.
Other work by Teagasc researchers showed significant stomach worm resistance to anthelmintics in 2002. This has major significance for on-farm worm control programmes.

Tracking Hill Sheep

As part of comprehensive research on environmentally sustainable hill sheep production, a new project got underway at the Teagasc Hill Sheep Research Farm at Leenane, Co. Mayo. The project involves the use of satellite telemetry technology to track the movement and grazing behaviour of sheep on open hillsides. This is being done by receivers fitted on individual sheep. The results will enable us to relate the grazing preferences of hill sheep to the vegetation types and other aspects of the environment in hill areas.

Advisory Pay-off in Sheep

The Teagasc sheep Technology Evaluation and Transfer project (TET) showed that farmers availing of intensive advice continue to achieve 20% higher lamb output than the national average. This is worth an extra €150/ha in lamb sales.
Under the TET project, detailed flock performance and animal health information was collected on a national network of sheep farms. This information was used by the sheep advisory service as benchmark data in farm walks, seminars, newsletters, leaflets, farm visits and other advisory activities during the year.

Lamb prices were down by 11% on the exceptional high prices achieved in 2001, due to the impact of the foot and mouth crisis on UK exports to France. However, the increase in the value of the EU ewe premium, from €9.09/head in 2001 to €22.20/head in 2002, resulted in overall returns from sheep in 2002 being down around 5% on 2001.
The improved profitability of the sheep enterprise has lifted morale and has led to a more active demand, especially by the more committed producers, for new production technologies. There is also an increase in investment by sheep farmers, fuelled by better margins and a response to the Teagasc campaign to enhance facilities in order to reduce labour demands at farm level.
The improved financial position also contributed to a stabilisation in sheep numbers, following a ten year decline. Total applications for the EU sheep premium at the end of December 2002/early January 2003 were 3.891 million, compared to 3.887 million the previous year. However the number of producers, at 34,900, was down by 1,100 on the previous year.

Pig Margins Under Pressure

The recovery from the deeply depressed pig prices of the late 1990s which took place in 2001 was short-lived. The industry experienced another difficult year in 2002.
The effects of the continuing poor returns began to take their toll from mid 2002. The Teagasc bi-annual pig census, carried out in December 2002/January 2003, showed a decline of 8% in the number of commercial pig units during the previous two years. The census showed a total of 510 units, containing just over 160,000 sows with a capacity to produce 3.43 million pigs per year.
The average herd size has increased from 355 sows to 383 sows and the exodus from the industry was almost totally confined to producers with less than 300 sows, which showed a reduction of 20% during the previous two years.
The integrated pig research and advisory service continued to concentrate on cost monitoring and control, improving productivity and in assisting producers to comply with major changes in EU welfare legislation
The Teagasc computerised pig management information system showed that producers availing of Teagasc services improved average daily gain from weaning to slaughter, increased average slaughter weight and improved margin over feed.
New information from Teagasc research showed that feeding a high density diet in the later stages of growth appears to improve meat quality. In the welfare area, a number of projects were undertaken aimed at expanding the information base on the factors affecting pig welfare. These included the inspection of over 2,000 sows on a representative sample of farms as part of a welfare survey.

Milk Production

The Teagasc dairy programme in 2002 continued to concentrate on the development and promotion of production blueprints aimed at underpinning a more internationally competitive milk production sector. The milk production research programme at Moorepark Research Centre generated new information on dairy breeding, fertility and labour use.

Research was also carried out on the impact of reduced inputs of nitrogen on milk output and efficiency. This has particular application in the context of the implementation of the EU Nitrate Directive. The comprehensive research programme on grassland management was continued and important new information was produced on the role of late heading grass varieties. In the animal health area, significant advances were made in the development of non-antibiotic therapies for disease treatment in dairy cows.

The Teagasc dairy advisory programme focused on the adoption by farmers of the best technologies to minimise production costs through optimum use of grass, cost-efficient concentrate feeding, effective business management systems and improved milk composition. Many of the advisory activities were centred upon the 12 joint Teagasc/industry programmes which involved 234 discussion groups and 120 monitor farms.

Benefits from Teagasc Milk Campaign

Dairy farmers who are participating in the Teagasc intensive dairy advisory programme are reaping the benefits of increased milk prices, lower costs and higher profits.

The top performing farms in the Teagasc programme are now receiving almost 2.5 cent/litre more for their milk than those at the bottom. This is due almost entirely to higher milk protein levels. This is the equivalent of €6,500 in additional net profit per year for dairy farmers with a milk quota of 182,000 litres.

The Teagasc target is to increase milk protein levels to 3.47% by 2006. Despite the very difficult weather, protein levels were maintained at 3.28% in 2002. The 120 dairy monitor farmers, which are used by Teagasc as benchmarks, achieved average protein increases of 0.02% while the top performing dairy herds achieved and surpassed the Teagasc 2006 target in 2002, demonstrating the scope for protein improvement through better utilisation of grass and superior animal breeding.

As well as being a vital determinant of profitability, protein also plays a crucial role in expanding the range of value-added products produced by the Irish dairy industry, thereby maximising export returns and ensuring a more internationally competitive industry.

Emphasis on Financial Control

The establishment of the new Teagasc Business and Technology Service in 2002 led to a greater concentration on financial management in advisory programmes. This involved courses for farmers in financial management, the installation of the Teagasc cost control computer programme on dairy farms and the establishment of an internet-based Dairy e-profit monitor. Profit monitoring and control also featured prominently at monthly meetings of the 234 dairy discussion groups.

An analysis of costs on the 120 dairy monitor farms showed no change on average in 2002. The average cost on monitor farms was 12.1 cent/litre. Given the increase in

price of inputs and the abnormal weather conditions in summer and early winter, this shows that monitor farms were successful in controlling inputs.
The average cost of production on all Teagasc client dairy farms in 2002 was 15.8 cent/litre, an increase of 0.5 cent/litre on 2001. This amounts to an increase of 3%, half of which was due to input price increases. Considering the very difficult weather this was a reasonable performance. The Teagasc target is to reduce costs on client farms to 14 cent/litre by 2006.
An indication of the potential for cost control and income improvement on dairy farms can be seen from the results of the joint Teagasc/Tipperary Co-op/Thurles Co-op development programme. Dairy monitor farms involved in this programme increased common profit by €12,238 per farm over the three year period 1999 – 2001. Members of discussion groups increased common profit by €5,416 per farm during the same period.
The six monitor farms in the Tipperary and Thurles Co-op areas are the subject of intensive advice by Teagasc and are the focus for demonstrating and adapting the latest research findings in a commercial farming environment. The production and financial information collected on these farms is being used to underpin production in the catchment areas of the two co-ops. The farms have become the benchmark for good practice in grassland management, dairy breeding and cost control. The same approach is being used in the 11 other joint programmes run by Teagasc and milk processors.

Selecting the Right Dairy Cow

A major research project conducted by Teagasc at Moorepark Research Centre has highlighted the importance of strain of cow for the Irish seasonal milk production system. The research has shown that it is possible to have a 70% calving rate for New Zealand type cows in a six-week period, compared to a calving rate of around 40% for cows selected on milk yield only.
Moorepark researchers have also found that a 10% reduction in the dairy cow replacement rate at farm level would increase net profit by 1.5 cent/litre. The research has also shown that it is possible to achieve a milk yield of around 6,000 litres/cow while selecting for survival traits. Following Teagasc research results, a number of linear traits are included in the new national dairy breeding index as predictors of calving interval and survivability.

Reducing Labour Input

Farmers participating in the Teagasc study on labour efficiency in dairy farming have cut an average of 0.5 hours per day off labour input. A number of farmers have cut labour use by 1.5 hours.
The study, now in its second year, shows an average daily labour input of 10 hours with one-third of this time associated with milking. The farmer participants have formed a discussion group with a focus on labour issues. The majority have made structural and procedural changes in the running of the farm business.
The study shows a wide range in the labour input per cow, with a range of 30 to 50 hours. This represents a difference of €18,000 in income for a 100 cow herd.

Progress with Non-Antibiotic Treatment

Researchers at Moorepark have developed bacterial viruses which have activity against the major bacteria strains causing mastitis in dairy cows. This development has the potential to lead to an alternative to antibiotics. Also, as a result of previous

research by Teagasc researchers at Moorepark, non-antibiotic teat sealers were launched on the market in 2002. This will result in a significant reduction in the prophylactic use of antibiotics in non-lactating dairy cows.
A further development in animal health involved the development by Moorepark researchers of a new technique which allows identification and characterisation of somatic cell populations in milk. Current electronic cell counters are designed for counting the total cell population in milk but do not have the capability to differentiate cell types.
In another research project, a database was established comprising the slaughter data for all cattle slaughtered at a major meat plant. By integrating the disease and production databases, researchers are examining the possibility of quantifying the impact of diseases such as BVD, virus pneumonia and salmonella on animal performance.

Strong Emphasis on Grass

The emphasis on maximising the contribution of grass to milk output continued to be a central feature of the Moorepark dairy research programme. The results of a two year study on grass varieties showed that late heading varieties offer the opportunity to increase milk yield. Cows grazing late heading varieties had an average 4% higher milk yield than those grazing intermediate heading varieties during the two year trial.
The results of another grass study showed that high levels of milk output can be achieved with moderate levels of nitrogen fertiliser. The study, involving researchers at Moorepark and their colleagues at the Environmental Research Centre at Johnstown Castle, concluded that moderate levels of fertiliser nitrogen (250 kg/hectare) is economically competitive with high levels (350 kg/hectare) and also leads to lower potential nitrogen losses. This work is likely to have particular application in the context of the implementation of the EU Nitrate Directive.

Tillage and Horticulture

The tillage and horticultural programmes maintained the emphasis on developing and disseminating the technologies necessary for competitive, quality production. Considerable emphasis was devoted to counteracting the effects of difficult weather conditions on tillage and outdoor horticultural crops.

The bad weather resulted in a substantial drop in cereal yields from the record levels achieved in 2000 and 2001. Winter wheat yields were back by 1.4 tonnes/hectare on 2001 levels while spring barley yields were 1.6 tonnes/hectare lower. National grain output, at 1.95 million tonnes, was 100,000 tonnes higher than the average of the 1990s.

The construction of the new biotechnology research facilities at Oak Park, Carlow was almost completed during the year and four scientists with expertise in key areas of crop biotechnology were recruited. The new research facilities were due to be operational in spring 2003.

The horticultural programme focused on critical areas in efficient mushroom, nursery stock, vegetables and fruit production. Emphasis was placed on planned expansion of nursery stock, increased unit output in mushrooms and more streamlined nutrient management and pest control in vegetables.

Research on Cereal Diseases

Further evidence was obtained by scientists at Oak Park Research Centre to show that leaf necrotic spotting, which reduces the yield of barley, is due to the combined effects of a disease called *Ramularia* and in certain instances some other factors, most likely involving light irradiance. In 2002, *Ramularia* was the most serious threat and reduced yields by up to 1.0 tonne/hectare where uncontrolled. Research indicated clearly that certain fungicide treatments had a positive effect against *Ramularia* and gave a significant yield response in 2002. It also indicates that effective control can be achieved cheaply, with savings to growers of at least 15 €/hectare achievable.

Yield responses of 5-6 tonnes/hectare to disease control programmes based on strobilurin fungicides were obtained in winter wheat. Some of the recently introduced strobilurin fungicides gave very good results generally but most crops showed small areas where disease control was below what was expected. Intensive investigation of samples from these crops indicated the presence of a new fungal pathogen not previously identified in Ireland, called *Didymella*. In addition, some resistance to the *Septoria* pathogen, which is the main target disease of wheat crops, was found in these problem areas. The problem appears to be at a low level but the discovery necessitates the need for anti-resistance measures to be introduced. An expanded programmes on this topic was scheduled for 2003.

In an ongoing experimental programme, winter cereals grown in a low input system gave 10% lower yields than a conventional high input system. However, the low input system gave higher margins. This confirms findings over a seven-year period and showed that there is scope to reduce inputs, especially where disease pressure is not severe.

Eco-tillage Shows Promise

The results of the second year of trials at Oak Park Research Centre on reduced cultivation, or 'Eco-tillage', showed that the system can deliver yields at least as good as conventional cultivation.

The system has faster work rates, lower labour and can reduce crop establishment costs by over 30%. Early environmental findings are also positive, with increased earthworm numbers and less aphids recorded. Lower levels of the diseases, take-all and barley-yellow-dwarf-virus (BYDV) were noted.
While it is early days in this long-term trial, this lower cost system may have a role to play in the increasingly competitive crop production sector.

Emphasis on Technology Transfer

A total of 15 tillage monitor farms were established in 2002, one in each of the main tillage counties. The farms will play an important part in the national tillage advisory programme over the coming years.
Last year also featured a greater concentration on business management in tillage farming with emphasis by advisers on profit monitoring, cost scrutiny and financial planning. A series of business management courses were also run for tillage farmers.
Environmentally sustainable tillage farming was also an important component of the tillage programme. A major campaign on cost-efficient fertiliser use was run leading to an increase of almost 40% in the level of soil analysis on tillage land.
This ensured that a higher proportion of farmers were applying fertiliser in accordance with actual soil needs. Priority attention was also given to correct pesticide application, with a comprehensive advisory and training programme provided by specialists and county advisers.

Assessing the Maize Crop

With a record 20,000 hectares of forage maize grown in 2002, the comprehensive assessment of the crop continued at Oak Park Research Centre. The results showed a drop of 30% in maize yields, due to the difficult weather conditions. The yields at farm level were also very variable, ranging from 5 tonnes to 10 tonnes/hectare for crops sown without plastic. This poor level of performance was last recorded in 1993.
Our trials at Oak Park showed that growing crops under plastic increased yields by 60% in 2002 compared to the normal increase of 35%.

Continued Plant Breeding Success

The Teagasc potato breeding programme at Oak Park has continued to deliver new varieties for the domestic market and seed export trade. During 2002, two new varieties, Camelot and Cristina, were added to the Irish national list of potato varieties. Both varieties are aimed at the seed export trade.
Cristina is a high yielding, early maincrop, partly coloured variety. It has performed well in the Canary Islands and will initially be targeted at that market as an early alternative to another Oak Park bred variety, Cara. Camelot is another early maincrop, partly coloured variety which has an extremely bright, attractive skin finish. It shows promise in the UK market where skin finish is an important consumer attribute. Rooster continues to make progress on the home market. It is now the top variety, accounting for over 30% of the total potato acreage in Ireland.
Work in 2002 confirmed that the Oak Park bred variety, Rooster, is very suitable for processing into chips. Rooster has replaced 3,000 tonnes of imported potatoes for frozen chip production in Ireland and this is expected to increase.
Progress was also made in grass and clover breeding. Commercial production of the white clover variety, Chieftain, got underway and application was made for official

trials in the US, New Zealand and France. Another new clover variety, Pirouette, was listed on the German list of varieties in 2002.
Shandon, a new diploid mid season variety of perennial ryegrass bred at Oak Park, completed its official trials in Ireland. Summary data indicates that this is the best variety in this group and was set for inclusion in the recommended list for 2003.
Glencar, a late tetraploid variety, also bred at Oak Park, completed its official trials and was also set for inclusion in the 2003 recommended list.
Recommended listing, following extensive independent evaluation, means that the selections are among a small group of superior varieties which are recommended for use within each country or region. Inclusion of varieties on these lists represents a very high level of success for the Teagasc breeding programme.

Growth in Nursery Stock

Output of hardy nursery stock grew by 5% during the year, continuing the annual trend which has taken place since 1997. Total output in 2002 was valued at over €30m and is projected to exceed €40m by 2006. Exports are projected to double and reach €10m by 2006, driven largely by increased opportunities for Irish produce in the UK.
The continuing growth is being fuelled by the enormous expansion in garden centre sales. Last year, Irish consumers spent €175m on plants purchased from garden centres.
The Teagasc research programme at Kinsealy Research Centre concentrated on critical components of nursery stock production. Aspects evaluated in 2002 included measurement of the quantities of nutrients lost to the environment from peat-based containers, the common system for growing nursery stock. Also, during the year, 100 rare plant species from the Kinsealy rare plant collection were successfully rejuvenated and distributed to the industry.
The nursery stock advisory programme concentrated on bringing the latest production and business technology to growers through conferences, demonstrations, consultancy visits and topical newsletters.

Tackling the Mushroom Challenge

The twin problems of mushroom price reduction and variable compost quality presented major challenges during the year. The Teagasc mushroom development team provided an intensive service to growers and output increased by 5% despite the exit of 45 growers from the business.
There are now 465 mushroom farms in production. The average number of mushroom houses per grower has increased from four to six. Through improved husbandry and adaptation of existing houses, an average of 80 extra tonnes of compost was used by each grower. This represented an increase of up to €6,000 to grower's incomes. Around half of growers had an average yield of 227 kg of mushrooms per tonne of compost. This represents an increase of 10% on the 2001 figure.
At research level, projects completed in 2002 included trials with sterilised casing material in order to eliminate particular pathogens and the construction of a computer model for the prediction of air-flow patterns in mushroom houses.
Researchers also commenced investigation of a new disease consisting of the random production of off-white/brown mushrooms. Early indicators were that the cause is an infectious agent.

Fruit and Vegetables

Trials have shown that substantially lower nitrogen levels can be used successfully for Green broccoli produced for late summer and autumn in a range of soils. A revised set of fertiliser recommendations for vegetable production has been produced, in conjunction with researchers at Johnstown Castle Research Centre. Good information was obtained from winter cabbage spacing trials regarding the effect on head size and quality. This is important for growers producing for supermarkets whose specifications are very tight for grade and quality.
The project on integrated pest management on strawberries continued and is extended for a further year, due to unsuitable weather in 2002 for insect egg laying. The efficacy of two species of entomopathogenic nematodes for biological control of vine weevil was assessed in strawberries grown in modules outdoors. Both nematode species gave a high level of weevil control, significantly better than untreated plots.

Varroa Mite in Honeybees

A new two-year research project to determine improved methods of controlling *Varroa* mite in bees commenced in 2002. This will look for replacements for the current standard chemical method.
The *Varroa* mite parasitises bees, causing reduction in honey productivity. It also carries a virus, which debilitates bees. *Varroa* was found in samples from counties Cork, Meath, Donegal and Cavan for the first time. The only areas where the mite has not yet been recorded are west Cork, Kerry, Louth and Monaghan.

Environmental Control

Nutrient management and water quality protection dominated the Teagasc rural environment programme in 2002. At research level, a major research programme involving a number of Teagasc research centres on quantifying the environmental responses of agricultural production systems got underway. Co-ordinated by researchers at the Environmental Research Centre at Johnstown Castle, Wexford, the programme is identifying potential problem areas, possible corrective actions to improve environmental performance and potential costs of implementing necessary changes. The programme also includes a new research project on the biodiversity of farmed landscapes and a new project on the measurement and modelling of greenhouse gas fluxes.

Comprehensive work was also carried out on pathways of phosphorus loss to water and the effects of agricultural practice on nitrate leaching. Researchers were also involved in a project aimed at improving the precision of phosphorus advice through better test procedures and improved understanding of soil plant relationships. At the request of the Department of Agriculture and Food, scientists and environmental specialists also provided in-depth advice to the Government on the approach to the implementation of the EU Nitrate Directive.

At advisory level, emphasis continued on the provision of effective Rural Environment Protection Scheme (REPS) planning services and on promoting best environmental practice in all farming systems.

Survey Shows Drop in Fertiliser Usage

A Teagasc survey, published in 2002, showed a significant drop in fertiliser usage by Irish farmers between 1995 and 2000. Farmers purchased 22% less phosphorus fertiliser in 2000 compared to 1995. The usage of potash fertiliser declined by 18% while nitrogen usage was down by 5%.

The survey, based on an analysis of fertiliser usage on a representative sample of over 1,100 farmers in the Teagasc National Farm Survey, showed a wide variation in fertiliser usage between different farm enterprises and different levels of farming intensity. Dairy farmers used almost four times as much nitrogen and nearly twice as much phosphorus and potash/hectare as cattle and sheep farmers. This reflects the higher stocking density on dairy farms.

The survey, conducted by researchers at Johnstown Castle Research Centre, showed that a growing number of farmers are now following Teagasc scientific advice on fertiliser levels for grassland, silage and tillage crops. However, a significant number are over-using fertiliser or are using too little for optimal production.

Developing National Soils Database

A three year project got underway in 2002 on the establishment of a national soils database. Led by researchers at Johnstown Castle, it involves collaboration with NUI Galway and Sligo Institute of Technology. It will involve the collection and analysis of soil samples for a range of chemical and biological parameters. The soil samples will be archived at Johnstown Castle and the results processed and mapped to provide an initial soils database. This will be used for the development of a protocol for the location of national soil monitoring sites, which will be required by the EU. It will lead to the development of a mapping system for the chemical, heavy metals and microbiological status of soils.

Servicing Environmental Schemes

A total of 16,000 farmer participants in the Rural Environmental Protection Scheme (REPS) received professional support from Teagasc in 2002. REPS advisers also ran 106 training courses for participants in the scheme. Analysis shows that REPS farms spent significantly less on fertiliser than similarly stocked non-REPS farms last year. Advisory staff were also involved in giving expert advice on farm building design and planning and in the preparation of nutrient management plans to meet the requirements of agricultural bye-laws, planning conditions and the Pollution Control Tax Break Scheme.

In the area of natural heritage protection, specialists and advisers were involved in the development of management agreements to protect the wild bird population. Also over 500 conservation plans were completed for non-commonage target areas and were certified by Teagasc environmentalists under Supplementary Measure A of REPS. Teagasc specialists were also involved in the Shannon Callows Task Force and the Burren Project.

Forestry

Over 14,000 farmers now have a forestry enterprise. With 1,400 new entrants each year, the number involved in forestry is expected to be around 20,000 by 2007. Currently, 95% of all annual planting is undertaken by farmers.

The annual volume of timber produced from Irish forests will increase from 3 million cubic metres in 2002 to 7 million cubic metres by 2030, of which 60% will come from farmer-owned plantations. Farm forestry will also contribute significantly to alleviating financial penalties which will arise under the Kyoto commitments on the reduction of greenhouse gases. Also woodlands will form the basis for qualifying for extra payments under the Rural Environment Protection Scheme (REPS) due to improvements in biodiversity, landscape enhancement and reductions in nutrient run-offs.

In 2002, the Teagasc forestry service provided independent expert advice on the economics, planting and management of forestry. The opportunity for many farmers to convert a portion of their farm to forestry, thereby substantially boosting income, was highlighted in individual farmer contact, at public events and in public information campaigns. A 2002 study by COFORD, the forestry research agency, revealed that almost 70% of farmers with forestry had attended a Teagasc forestry event. It also showed that farmers regard Teagasc as three times more important than any other agency in providing information on forestry, both to those who have already planted and those who are considering planting.

As a result of the ongoing specialist advisory services provided by Teagasc, farmers are more likely to see the benefits of implementing best forestry management practice, resulting in better quality, certifiable timber crops.

Forestry Research Highlights

The major project on forest soils classification, which is led by Teagasc researchers at Kinsealy Research Centre, made significant advances in 2002. Parent material mapping was completed for 11 counties, covering 55% of the country. Land cover mapping was completed for 19 counties, soil classification for 10 counties and forest productivity ranking for 19 counties.

A new contract, funded by the Department of the Environment, got underway at Kinsealy. This will use remote sensed imagery and field surveys to map soil parent materials and develop a soil classification suitable for use in the EU Water Framework Directive's River Basin District Management System. This contract will also enable the completion of the forest soils classification study for the remainder of the country.

An EU-funded project on improving ash productivity in Europe by testing, propagation and promotion of improved genetic resources is being led by researchers at Kinsealy. The €3.5m project involves 15 partners in eight countries.

In other projects, researchers at Kinsealy micropropagated several selected mature ash trees and established them in the field. A method was also developed to propagate selected trees using conventional methods. In a project involving birch improvement, 28,000 trees were planted on three experimental sites.

Farm Diversification

The farm diversification and rural enterprise programme involved research advisory and training services in sport horse production, deer farming, poultry production, organic farming, rural tourism, outdoor cut foliage, floristry and dairy goat farming.

Sport Horses

The sport horse programme concentrated on better breeding, improved management of breeding mares and young horses and on effective presentation of animals for sale The programme was delivered through training courses, seminars, demonstrations and individual consultancy. Producers who participated in Teagasc activities have reaped the benefits in better quality animals and premium prices.
Teagasc horse advisory staff also processed the majority of the 300 applications for grand-aid under the Alternative Enterprise Scheme.

Poultry Production

Around 500 poultry producers participated in Teagasc training courses in 2002. In conjunction with Bord Bia, a quality assurance scheme and audit for poultry meat was finalised and a quality assurance scheme was drawn up for duck production. Poultry staff were also involved in assisting in the establishment of new poultry businesses, conforming to free range or organic specifications.

Organic Farming Research

The dedicated organic milk research unit at Johnstown Castle continued to establish essential technical and economic data on organic milk production. In 2002, an organic milk output of 7,000 litres/hectare was sustained. The aim is to achieve improved technical efficiencies with stocking levels of 1.7 cows/hectare and milk outputs of over 9,000 litres/hectare.
A new publication containing detailed advice on all aspects of organic farming was published. The 160 pages book gives the full story on the production and economics of organic milk, meat, cereals and vegetables and on market prospects for organic food. It was launched at a national open day held on the organic research farm in June.
The conversion of the 110 hectare farm at Mellows Centre, Athenry to organic status continued during 2002. The farm has been designated by Teagasc as the national organic training and development centre.
There were 1,025 organic producers in Ireland in 2002, farming a total of 30,000 hectares. The target for 2006 is 2,500 producers. The national organic open day at Johnstown Castle Research Centre contained expert guidance on all aspects of organic production. Some fifty special visits were organised for groups to both Johnstown Castle and Mellows. Introductory courses on organic farming were held in a number of counties.

Rural Tourism

Teagasc staff continued to work closely with other groups, particularly LEADER, to guide the development of rural tourism marketing. A further four courses in rural tourism were provided by Teagasc in partnership with CERT and institutes of technology. This brings to 30 the number of such courses which have been run in recent years. Teagasc staff also organised a number of workshops for rural tourism

co-operatives and provided technical assistance and advice to County Development Boards, LEADER companies and government departments.

Cut Foliage

One hundred hectares of cultivated cut foliage were grown in counties Kerry, Waterford and Wexford in 2002 with an output value of over €1.5 million. Over 80% of output is exported, mainly to the UK and Holland. The industry now provides employment for 30 people full-time and 40 people part-time.
A promotional campaign carried out by Teagasc in 2002 was projected to result in an increase of 60 hectares in 2003. Training and technical advice for existing and new growers continued while research identified four new species.

Floristry

The vocational certificate course in Rural Business/Floristry run jointly by Teagasc at Kinsealy Research Centre and Dundalk Institute of Technology continued in 2002. The course, which is certified by the Further Education and Training awards Council (FETAC), is aimed primarily at adults interested in developing careers in floristry. A total of 13 graduated last year, of which seven have since established their own floristry business while the remainder have found employment in the industry.

Dairy Goat Farming

There are currently around 200 Irish farmers involved in dairy goat production, with herd sizes ranging from 10 to 550. Home production of goat's milk is still far short of consumer demand and an average of 10,000 litres/week is imported.
Last year saw a further increase in the size of the larger herds and a new 1,000 goat unit was being established in Westmeath. The larger producers continued their efforts to overcome the seasonality problem of milk production through light manipulation and hormone treatment. A number are now producing high quality milk all year round.
Teagasc ran a number of husbandry courses and group meetings for producers. Specialist advice was also provided through farm visits, phone consultation and newsletters.

Education and Training

The new course structure for training of young entrants to agriculture, horticulture and the agri-food industry was bedded down in 2002. All Teagasc courses are now accredited by the national awarding bodies, the Higher Education and Training Awards Council (HETAC) and the Further Education and Training Awards Council (FETAC).

Nine third level courses were offered on the Central Applications Office (CAO) list. These course are provided by Teagasc college/institute of technology partnerships. Participants in these courses have the opportunity to progress from certificate to diploma and up to university degree level.

A total of 327 students accepted CAO offers for third level certificate and diploma courses in agriculture and horticulture. This compares with an enrolment of 237 in 2001, the first year these courses were introduced. This represents an increase of almost 40%, demonstrating student interest in these courses. A breakdown of enrolment in third level courses is given in Table 1.

Table 1: Enrolments and Participation in Third Level Courses

Courses		**2000**	**2001**	**2002**
National Cert in Agriculture	Year 1	0	54	88
	Year 2	0	0	41
National Dip in Horticulture	Year 1	0	87	117
	Year 2	0	0	59
National Cert in Agricultural Science	Year 1	34	36	38
	Year 2	31	25	19
National Dip in Agricultural Science	Year 3	3	11	23
National Cert in Agri-Business	Year 1		34	45
	Year 2		36	34
National Cert in Business Studies – Equine	Year 1	7	16	22
	Year 2	9	4	18
National Cert in Agricultural Mechanisation	Year 1	0	0	17
	Year 2	0	0	0
Total – Higher Courses		**84**	**303**	**521**

A total of 700 students enrolled in first year vocational certificate courses in 10 Teagasc colleges and at local Teagasc training centre last year. Courses covered many aspects of agriculture, horticulture, horse production and forestry. All courses are accredited by FETAC. Participants in these courses have the opportunity to transfer via the Higher Education Links Scheme to third level courses.

A breakdown of enrolment in vocational certificate courses is given in Table 2.

Table 2: Enrolments and Participation in Teagasc Vocational Courses

Courses		**2000**	**2001**	**2002**
Vocational Cert in Agriculture	Year 1	875	551	397
	Year 2	591	759	358
	Year 3[1]	1988	1721	1723
Vocational Cert in Horticulture	Year 1	156	74	119
	Year 2	110	137	75
Dip in Horticulture	Year 3[2]	109	99	131
Cert in Horse Breeding & Training	Year 1	20	28	26
	Year 2	16	16	24
Adv Cert in Dairy Herd Management	Year 1	34	30	42
	Year 2	22	34	28
Adv Cert in Machinery & Arable Crops	Year 1	35	36	26
	Year 2	30	34	37
Vocational Cert in Agriculture	Year 1	150	30	47
(Mature Students)	Year 2	60	165	26
	Year 3	210	195	26
Vocational Cert in Horticultural Skills			7	4
Vocational Cert in Forestry	Year 1	14	24	22
	Year 2	11	9	20
Advanced Cert in Farm Management	Year 1		24	17
Total		**4431**	**3973**	**3148**

[1] Participants in the final year of the former Teagasc Certificate in Farming
[2] Participants in the final year of the former Teagasc Diploma in Horticulture.

Total first year enrolments in third level and vocational certificate courses in 2002 was almost 10% up on the previous year. This follows a marginal increase in enrolments in 2001, which broke a five year cycle of declining numbers.

The investment programme aimed at ensuring that facilities in agricultural and horticultural colleges are as good as those available internationally was continued last year. A total of €6.5m was allocated for college upgrading, bringing total investment for 2001 and 2002 to €14m.

The consolidation of college facilities continued during the year. Multyfarnham Agricultural College ceased to provide courses in June.

A number of vocational training courses run at local Teagasc training centres were held at night and weekends and contained significant distance learning components. With the growing number of part-time farmers, Teagasc is committed to organising training for young entrants and adult farmers at times which suit the work-schedules of participants. The provision of e-learning is also being given priority. Last year,

the technology and staff training was put in place for e-learning and a pilot course was scheduled to get underway in 2003.

Adult Farmer Training

Over 9,500 adults attended courses runs by Teagasc in 2002. These courses covered technology and business management, rural viability, information technology, environmental protection, food safety, alternative enterprises and advanced management. A breakdown of adult training is given in Table 3.

Table 3: Teagasc Adult Training Provision in 2002

	No. of courses	No. of participants
Technology and Business modules	58	961
Rural Viability modules	190	1978
Information Technology modules	108	1202
Environment/Food Safety modules	147	3720
Alternative Enterprise modules	52	860
100/80 Hour courses	21	548
Advanced Courses	7	138
Other courses	10	168
Total adult participants	**593**	**9575**

Special courses in basic agriculture and farm management were run for people under 35 who had not completed formal agricultural training and required training in order to quality for stamp duty relief, investment aid and quota-based schemes. Many of the participants in these courses, involving 100 hours training in agriculture and 80 hours training in farm management, were in full-time employment outside of farming and were taking over the running of the family farm business on a full-time or part-time basis. A number of the courses were run through distance learning in order to complement the work schedules of participants.
Some 40% of all adult training programmes were in the areas of environmental control and food safety, reflecting the growing importance of these areas.
Information technology was also a very important element of training. Over 1,200 members of farm families participated in information technology training. They had the benefit of computer laboratories which have been established in colleges and designated local training centres.

Food Industry Training

Over 2,500 participants completed training courses in all aspects of food processing in 2002. Among the areas covered were food safety, innovation management and consumer foods. The vast bulk of the training was conducted at the National Food

Centre where 1,750 food industry personnel participated. An outline of the courses and participation levels is given in table 4.
The National Food Centre also provided training for over 500 regulatory staff in government departments and also in the Cypriot Ministry of Health. The breakdown of these courses is given in Table 5.
National Food Centre training specialists, in conjunction with FAS, also supervised the implementation of a new training programme for 500 industrial abattoir workers in the major beef export plants. A similar new programme for pork abattoirs was jointly assessed by Teagasc and the Department of Agriculture and Food.
Staff at the Dairy Products Research Centre focused on the needs of senior executives and technologists in the dairy foods sector. High level workshops and training courses were run at the Dairy Products Research Centre and at locations around the country.
A Food Training Advisory Board representative of the main industry stakeholders was established under the chairmanship of Dr Patrick Wall, Chief Executive of the Food Safety Authority of Ireland. Its role is to advise on all aspects of food training in Teagasc. The committee met three times during 2002. It endorsed a curriculum development and training plan developed by Teagasc for the period 2002 – 2006. It also sanctioned two courses incorporating the latest Irish standard on food safety management. Both courses were submitted to FETAC for validation and certification.

Table 4: National Food Centre Training of Food Industry Personnel in 2002

Course title	**No. courses**	**No. participants**
Food Safety		
Hygiene	62	883
HACCP	43	505
Food safety auditing	9	77
Food law updates/Legal labels	2	38
Trainer skills in food safety and hygiene	2	26
Meat assessors training	2	15
Meat hygiene workshop	2	66
Thermal process validation seminar	1	32
Food Innovation Management		
Innovation management	2	20
Sensory analysis	3	59
Laboratory accreditation	1	14
Laboratory management Grain quality	1 1	9 6
Total	**131**	**1,750**

Table 5: Training of Food Regulatory Officers in 2002

Course title	**No. courses**	**No. participants**
HACCP auditing	3	44
Food safety auditing (postgraduate)	6	62
Internal audit	2	35
Internal laboratory audit	1	14
Animal welfare module	10	163
Hygiene module	4	84
Anatomy and physiology module[7]	6	144
Total	**32**	**546**

Farm Safety

A Teagasc survey carried out in 2002 showed that over 3,000 accidents occurred on Irish farms in 2001, resulting in 24 deaths and significant injury and loss of income. The survey, which was conducted among a representative sample of over 1,100 farm families, showed a decline in the number of farm accidents since the last major Teagasc survey in 1996.

It also revealed a significant decline in the number of accidents involving farm machinery. However, the number of accidents caused by livestock and trips and falls in the farmyard increased.

Ten per cent of all farms experienced an accident of varying severity in 2001. The total number of accidents reported was 3,077. Livestock were the dominant cause, accounting for over 25% of all accidents. Trips and falls accounted for 22% while machinery accounted for just under 20%. In the 1996 survey, machinery made up 35% of total farm accidents. Almost half the victims reported that they had not fully recovered from the injuries sustained in the accident and two out of five accidents resulted in economic loss to the farm business.

The survey also assessed safety practices on farms. In spite of the proven dangers of power take-off (PTO) shafts three out of every 10 farms had tractors with uncovered PTO shafts in 2001. Also, there was no locked storage area for chemicals on one-third of farms.

While 90% of farmers said they are aware of their legal requirements to operate a safe farm, less than 10% had a safety statement. In the 1996 survey, just 2.5% of farmers had a safety statement.

Teagasc maintained an active farm safety advisory, training and awareness programme in 2002. All participants in Teagasc young farmer training courses completed a module on health and safety. A number of special events on farm safety were held, including two national demonstrations. Literature and posters were also published on a range of safety issues and these were widely disseminated. All courses run for participants in the Rural Environment Protection Scheme (REPS) included a module on health and safety and the topic was also put on the agenda at meetings of farmer discussion groups.

Many of the Teagasc activities were run in partnership with the Health and Safety Authority which also combined with Teagasc in the production of an awareness video on child safety.

The number of farm related fatalities in 2002 was 12, compared to 24 the previous year.

Events and Publications

Teagasc maintained an active programme of public events at local, county, regional and national level in 2002. These included demonstrations, farm walks, discussion group meetings, advisory clinics and a large schedule of conferences on every aspect of the organisation's work. Among the highlights were:

- A national dairy conference in Killarney which was attended by a record 1,500 farmers.
- The Teagasc National Tillage Conference together with a series of conferences in all tillage counties ensured that tillage farmers and industry personnel were kept abreast of all production and marketing information.
- The current situation and outlook for the agri-food sector was outlined at two national conferences run by economists. A national conference examined the prospects and policies for balanced regional development in Ireland.
- Over 100 meetings and clinics were held on beef production, including a series of regional meetings run in conjunction with An Bord Bia.
- A total of 16 conferences and workshops were held for food industry personnel on key aspects of food processing, safety and product innovation.
- Conferences were held in all counties on production and marketing of sheepmeat. A national open day was held at the Teagasc Hill Sheep Research Farm at Leenane, Co. Mayo.
- National forestry demonstrations were held in five locations as part of the intensive advisory campaign on forestry.
- In horticulture, national conferences were held on potatoes and nursery stock.
- In rural environment, the annual REPS conference provided up to date critical information for professionals involved in the scheme.
- Special meetings and seminars were held in late summer/autumn as part of the nationwide advisory programme aimed at helping farmers cope with the impact of the wet summer.

A comprehensive publications programme was maintained during the year. This included new manuals and workbooks for the training programme and handbooks/leaflets on production, quality management, financial analysis, farm safety and food safety to support all aspects of the advisory programme.

Two issues of the *Irish Journal of Agricultural and Food Research* were produced, together with a range of end of research project reports and other publications covering the entire area of the research programme.

Six issues of the magazine, *Today's Farm,* were published and distributed to over 35,000 clients of the advisory service and to key personnel in the agri-food sector.

Two issues of *Farm & Food,* the research and development digest, were produced.

Teagasc Today, which details innovations in the research, advisory and training services, was circulated to some 5,000 leading farmers, food industry personnel, government departments, Oireachtas members and other scientific and public sector organisations at home and abroad.

At the request of the Minister for Agriculture and Food, three reports were produced by Teagasc on the impact of the wet summer weather and on measures which farmers should adopt to minimise the impact on animal and crop performance.

The Teagasc website, www.teagasc.ie, was further developed, with the addition of a substantial new body of information. The website continued to gain in popularity as

a source of information for national and international visitors. An increasing number of candidates for posts in Teagasc are now applying on-line.