Teagasc Annual Report 2001

Chairman's Statement

The year 2001 will be remembered for the major outbreak of foot and mouth disease in Britain, the emergence of BSE in mainland Europe and September 11th in the US.

The potential disaster of a major foot and mouth outbreak in Ireland was avoided, thanks to a great response from farmers, industry and the general public. Teagasc played its part in the national preventative campaign and in providing professional assistance to the agri-food sector in coping with the impact of the restrictions.

The foot and mouth emergency led to a necessary curtailment of research, advisory and training services for a lengthy period. However, through the adoption of information technology and innovative systems of communication, the impact on our work was minimised.

Teagasc's mission is to provide the innovation and technology transfer necessary for the sustainable development of agriculture, food processing and rural communities through integrated research, advisory and training programmes.

Highlights of the year included the implementation of our new nationally accredited training programme, the introduction of radical changes in our advisory services and further enhancement of facilities and expertise in research. These are detailed in the Director's review and in the main body of the report.

Notwithstanding the turmoil in European and third country beef markets, resulting from the BSE outbreaks in continental Europe and the foot and mouth emergency, it was a relatively satisfactory year in farming. Analysis of by the Central Statistics Office showed a 5.8% increase in aggregate farm incomes, to €2.45 billion. Estimated gross value-added in the agri-food sector increased by 4.7% to almost €9.5 billion. However, other sectors in the economy continued to grow faster. Consequently, the contribution of agriculture to GDP, at 9.2%, was down on the previous 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, Food and Rural Development, Joe Walsh and Ministers of State, Noel Davern and Eamon O Cuiv. We also record our appreciation to the Secretary General of the Department of Agriculture, Food and Rural Development, John Malone, and his officials for their continued commitment and assistance.

Many of our activities were run in partnership with public bodies in the agri-food, educational, environmental, heritage and food safety areas. We value greatly their support and collaboration during 2001.

We also value our linkages with our colleagues in universities and research institutes, at home and abroad. These were further enhanced in 2001, 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 2001.

During the year, our Director, Dr Liam Downey, announced he was retiring early in 2002. Liam served with distinction as Director of Teagasc since 1994. On my own behalf and on behalf of my colleagues on the Teagasc Authority, I wish to record my appreciation for his excellent and dedicated leadership. I welcome Jim Flanagan, formerly Chief Inspector in the Department of Agriculture, Food and Rural Development, who took up duty as Director in May 2002 and wish him every success.

Teagasc's greatest asset is its staff. I would like to record my appreciation to all our staff for their commitment, hard work and enthusiasm during the year.

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

I am pleased to report on another year of solid achievement for Teagasc's integrated research, advisory and training services.

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

Among the highlights of the year were the introduction of revolutionary changes in Teagasc training courses and the establishment of new advisory structures aimed at securing a strong commercial farming sector and maintaining the viability of rural areas. Considerable advances were made in enhancing our research expertise through the establishment of new laboratory facilities and the recruitment of highly skilled scientists in biotechnology.

Foot and Mouth

In the early months of the year, the full resources of Teagasc were mobilised in the national campaign against foot and mouth disease. Teagasc staff worked hand-in-hand with their colleagues in the Department of Agriculture, Food and Rural Development in mounting a major information and advisory campaign aimed at ensuring effective controls by farmers, industry and the general public. Our staff also played a central role in the implementation of animal movement controls during the critical risk period.

Following the single outbreak of foot and mouth in the Cooley Peninsula in Louth, an intensive advisory campaign was undertaken to help farm families come to terms with the impact of animal depopulation. This was followed by a prolonged expert advisory and counselling service aimed at regenerating farming in Cooley.

The full array of scientific, management and socio-economic services of Teagasc were committed to the 250 farmers affected by the total animal cull. The focus was on protecting incomes in the short-term and on implementing a phased farm and household income regeneration programme. This special service continued throughout 2001 and was maintained into 2002.

At national level, our advisory services provided important support to farmers in coping with the problem of additional animals due to movement restrictions. Expert nutritional, management and economic advice was available to help farmers manage their way through the problem.

The necessary restrictions resulted in a cessation of all Teagasc public activities, on-farm contact and the closure of colleges and training facilities. However, through the use of modern information technology and the support of national and local media, critical information was imparted to farmers and food processors.

Research

The research programme in livestock, crops, food processing, environmental control, economic analysis and rural development was conducted by 200 scientists at our nine research centres.

A total of 307 projects were undertaken during the year. Researchers published a total of 147 reports in international scientific journals, of which almost half emanated from our two food research centres. This demonstrates the international standing of the food research programme.

The number of other scientific and technical reports published by researchers was 640, of which 101 were end of project reports, detailing the outcome of research projects which were completed in 2001.

Among the highlights was the awarding of €9.5m under the Food Institutional Research Measure (FIRM) of the National Development Plan to our two food research centres – the National Food Centre and the Dairy Products Research Centre. This greatly enhanced our already extensive food research programme and involved an additional 35 projects at the two centres. The projects are concentrating on the key areas of food product innovation and food safety.

Important developments from our 2001 food research programme included the identification of new strains of *E.coli* 0157 which pose similar threats to humans as the lethal *E.coli* 0157. Our scientists also made important advances in risk assessment strategies for *E.coli* 0157. Progress was also made in the development of a new type of bio-cheese with potential health benefits and a new initiative got underway to provide scientific support to farmhouse cheese manufacturers. In food product development, a new consumer model aimed at developing a better understanding of consumer attitudes to food was established. It has the potential to assist food manufacturers in producing products to meet changing consumer demands.

In economic analysis and rural development, the analysis of the impact of possible EU and world food policy changes on the Irish agri-food sector continued. In this regard, important information was published on the impact on farm incomes of an elimination of EU export refunds.

The strength of our economic and rural development research programme was reflected in the awarding of four EU collaborative research projects. One of these projects, which is co-ordinated by the Teagasc Rural Economy Research Centre, involves the development of a modelling framework for the evaluation of policy changes in each of the EU member states. It involves partners in 14 member states.

In production research, the emphasis continued on the development of technologies for quality output, effective cost control and sustainable production systems. A major investment programme to upgrade facilities at our National Beef Research Centre at Grange was completed and construction of new biotechnology laboratories at Grange and Athenry research centres got underway. Plans were also advanced for the construction of major biotechnology facilities at our National Tillage Research Centre at Oak Park and at Moorepark Dairy Production and Dairy Products Research Centres.

Among the highlights of our production research programme was the further refinement of production blueprints for livestock and crop systems. Significant attention was also devoted to research on animal welfare and new information was produced on the role of nutrition and diet on fat colour in beef and on elevating the level of health enhancing fatty acids in beef and milk.

In tillage farming, the results of a comprehensive study on minimum cultivation, or 'eco-tillage' systems, were published. New research information was also developed on the production of beans and lupins as potential sources of home-grown protein feeds. In cereal growing, further advances were made in the development of disease control strategies which could lead to further yield increases in our major crops, wheat and barley. Our potato and grass breeding programmes at Oak Park Research Centre achieved further success during the year, with a number of new varieties included in Irish, UK and European recommended lists.

Our expanded environmental control programme concentrated on developing the scientific and technical basis for environmentally sustainable farming systems. Among the highlights was the application of geographic information systems (GIS) for maintaining and managing environmental data at farm level and the construction of an integrated wetland system (ICW) at Johnstown Castle Research Centre. Interim results indicate that an ICW can be an effective method of pollution control at farm level.

Advisory Services

The year 2002 saw the introduction of a new Teagasc advisory initiative aimed at securing a highly competitive Irish farming sector and maintaining and viability of rural areas.

It involves the provision of two specialised services – the Technology and Business Service and the Rural Viability Service – focused on the needs of two distinct groups of farmers. It involves a fundamental restructuring of Teagasc's advisory services and focusing of expertise towards the key challenges facing farmers and rural Ireland over the coming decade.

The Technology and Business Service 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 critical component is a specially developed 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 improve quality of life.

In addition to their involvement in the intensive national campaign during the foot and mouth disease emergency, Teagasc advisory staff also played an important role in helping beef farmers cope with the effects of BSE outbreaks in mainland Europe in November 2000. This resulted in a dramatic reduction in beef consumption and drastic changes in market destinations for Irish beef. The advisory programme was directly focused on immediate and long-term implications for production and income.

Our sheep advisory service was also centrally involved in the introduction of compulsory identification of sheep. An intensive information and awareness campaign was mounted on the operation of the new procedures.

The major thrust of our advisory programme continued to be on quality, low cost, sustainable production. Many of our activities are now operated as joint programmes with industry and I am pleased to report that the number of these joint programmes increased further in 2001. Also, the focus on discussion groups and monitor farms as key mechanisms for transferring new technology to farmers was further intensified. More than 400 discussion groups were serviced by advisory staff during the year.

Education and Training

The year under review marked the introduction of revolutionary changes in Teagasc training courses. Students had the opportunity, for the first time, to apply to the Central Applications Office (CAO) for new third level courses provided jointly by Teagasc colleges and institutes of technology. New nationally accredited vocational certificate courses were also provided.

I am happy to report that enrolments in third level and vocational courses for the 2001/2002 academic year, at just under 900, were marginally up on the previous year. This was a reversal of the downward trend in numbers which had taken place since the mid 1990s.

The new course structure was accompanied by a major capital investment programme in colleges, with €7.5m expenditure in 2001 and an allocation of a further €6.5m allocated in the capital budget for 2002. This unprecedented level of investment will ensure that college facilities are on a par with the best internationally.

Another innovation in our training programme in 2001 was the introduction of nationally accredited courses for mature students, over 23 years of age. These courses are specially constructed to meet the needs of the growing number of people who will be taking up farming on a part-time basis. Courses are provided at times which suit the work schedules of participants.

Pilot distance learning programmes also commenced during the year and we intend to make these an integral part of our training programme over the coming years.

A total of 5,500 farmers and rural dwellers participated in a comprehensive range of courses in all aspects of business management and rural enterprise. Adult courses are now nationally accredited by the Further Education and Training Awards Council (FETAC) and participants have the option of accumulating modules and progressing to FETAC awards.

Teagasc continued its position as the major provider of food industry training in 2001, with almost 2,400 participants in courses provided by the National Food Centre. Courses were provided in food supply, innovation management, consumer foods and farmhouse/cottage foods production.

MILK PRODUCTION

The national research and advisory programme in dairying concentrated on the development and application of more efficient, low cost environmentally sustainable milk production systems, increased milk value and improved animal health and welfare. The research facilities at Moorepark were enhanced through the purchase of new laboratories from the Irish Dairy Board. Animal housing facilities were updated to international standards and the recruitment of new staff further improved our capacity to undertake high quality research. In the advisory area, the refocusing of services led to a greater emphasis on financial management and business planning by dairy farmers. the following were the main activities and achievements.

Results of Cow Fertility Study Published
The results of the first two years of a major study on dairy cow fertility were published. The study which is examining the genetic and management factors influencing fertility is taking place against the background of a drop in pregnancy rate to first service from 60% in the mid 1980s to 48% at present. Cows not in-calf have also risen from less than 10% to over 15%, representing an increase in costs of almost €90 per cow.

The genetic analysis has indicated that the reduced fertility is associated with increased selection for milk production and increased Holstein genes in the Irish dairy cow population. The results also highlight the importance of condition scoring as an aid to achieving good reproductive performance of spring-calving, grass-based production systems. The research team discovered that cows which lost greater than 0.5 units of body condition score between calving and first service resulted in a pregnancy rate of just 47% compared to 59% for cows that lost between 0.25 and 0.5 units. The study is continuing in 2002.

International Breeding Reputation Enhanced
The international reputation in dairy breeding earned by researchers at Teagasc Moorepark was further enhanced during the year. Our researchers formed part of a Dutch/Irish consortium which developed a new dairy breeding index. The index which was launched by the Irish Cattle Breeding Federation (ICBF) will guide dairy breeding decisions over the coming years.

The first full year of the Teagasc/New Zealand study on different strains of Holstein Friesians was also completed in 2001. New Zealand Holstein Friesians are being compared with European and North American Holstein Friesians in replicated trials at Moorepark and the Dexcel Research Institute in New Zealand. Aspects such as reproduction efficiency and feed efficiency are receiving particular attention.

Research on the suitability of different dairy breeds for Irish farming was further expanded. The breeds studied in 2001 included Holstein Friesians, Montbelliardes, Normandes and Norwegian Reds. The results to date show that the Montbelliardes improve farm margin by almost 3c/litre compared

with Holstein Friesians. The benefits arise mainly from the large difference in culling rate between the two breeds.

Strong Focus on Milk from Grass
Development of research blueprints for grass-based milk production continued to be a major focus of the Moorepark research programme. The Moorepark grassland research team established that late heading grass varieties resulted in a 9% higher milk yield than intermediate heading varieties. These results, combined with those of previous experiments at Moorepark, show that grazing swards should consist entirely of late heading varieties.

Blueprint for Wetland Dairying
Research by Teagasc on wetland farming at the Kilmaley farm in Clare led to the publication of a production blueprint with widespread potential application at farm level. The essential parameters involve:

- Compact spring calving with 90% of cows calved within a nine weeks period
- Well managed, productive ryegrass pastures
- Well-designed drainage programmes, implemented over a number of years
- Use of low ground pressure machinery in conserving quality winter feed.

The blueprint involves a mean variable cost of 8c/litre with a range of 6.7c-9.3c/litre depending on annual climatic conditions. This shows the huge variation in costs and risks associated with dairy farming in wetland areas.

The Moorepark team also initiated a dairy research programme in the north east in 2001 aimed at developing a blueprint geared towards these particular regional conditions. The programme is based mainly at Ballinamore Research Farm in Leitrim and Ballyhaise College in Cavan. It is focused on grass management and utilisation and environmental control.

Quantifying Labour Demand

The comprehensive labour efficiency study, involving detailed measurement on a representative sample of dairy farms, continued in 2001. Results show an average daily labour input of 10.1 hours, with a peak of 12.4 hours/day in March and a trough of 7.3 hours/day in December. Labour input increased substantially with the size of the dairy enterprise .

Milking is the most time consuming task, accounting for over 30% of labour demand, regardless of the size of the dairy enterprise.

At advisory level, substantial attention was given to time management and labour audits in dairying advisory activities. A comprehensive booklet on cow handling facilities was also produced and circulated to all dairy farmers.

Expansion in Monitor Farms

The number of 'Monitor Farms' operated by the Teagasc advisory service increased by over 20% in 2001 to a total of 120 nationwide. These farms are used to demonstrate the best and latest research findings in a commercial farming environment and are now an integral part of the intensive Teagasc advisory programme in dairy farming.

The 'Monitor Farms' are used as benchmarks for good farming practice and are a key resource for the 260 Teagasc-led discussion groups which operated in 2001.

Some 21,000 dairy farmers actively participated in the Teagasc intensive advisory programme during the year. Many of these benefited from the 12 joint Teagasc/dairy industry development programmes which are increasingly becoming a major vehicle for profit and practice improvement. A total of 16 staff are currently part-financed by the dairy industry on these programmes. A new programme with co-operatives in the north east was agreed during the year and a total of 24 monitor farms were established in early 2002.

The programme is aimed at 5,800 milk suppliers in 10 counties who supply a total of 270 million gallons per annum. The objective is to cut production costs from over 14c/litre at present to 11c/litre , a figure now being achieved by an increasing number of farmers.

Strong Focus on Profit

The launch of the new Teagasc Business and Technology Service in 2001 was accompanied by an increased focus by advisers on financial management and business planning on dairy farms. Among the highlights of the expanded programme were 30 special courses for farmers on financial management and the development of new online financial management packages.

Cost control and increased milk protein content remained the critical drivers of the dairying advisory campaign. Figures from the Teagasc National Farm Survey show that average milk production costs increased by 0.8c/litre in 2001. When adjusted for the change in input levels, costs remained close to 2000 levels. Given that extra stock had to be maintained on dairy farms due to foot and mouth restrictions, this was a reasonable performance.

An example of the impact of Teagasc's intensive advisory campaign can be seen from the results of the joint programme run by Teagasc and Carbery Milk Products in Cork. Monitor farms set up under this programme showed an increase in profit of €6,100 between 1998 and 2000.

Milk protein content on these monitor farms increased by .045% per annum during the three year period. This is three times the average increase on farms in the Carbery Milk Products area. Production costs were also reduced from 12.5c/litre to 11c/litre during the three year period.

MEAT PRODUCTION

The integrated research and advisory program on meat production concentrated on the development and dissemination of technologies for quality output, effective cost control and sustainable production systems.

In beef production, a major investment programme to upgrade facilities at Grange Research Centre was completed during the year. Construction of new biotechnology laboratories also got underway at Grange and Athenry Research Centres and these were commissioned in early 2002.

While foot and mouth disease restrictions curtailed research and advisory activities, important innovations emerged and significant achievements can be reported. The following are some of the highlights.

Coping with BSE Fall-out

Teagasc advisory staff played an important role in helping beef farmers cope with the effects of BSE outbreaks in mainland Europe in November 2001.

The dramatic reduction in EU beef consumption resulted in over 800,000 tonnes being taken of the market through a number of EU funded schemes. This led to drastic changes in market destinations for Irish beef. Exports to mainland Europe fell from 24% of production in 2000 to 13% in 2001 while exports to non EU markets fell from 45% to 11%. Exports to the UK rose from 21% in 2000 to 36% in 2001. Exports of live animals were back by over 300,000 head.

Almost 30% of Irish beef output was absorbed into the EU Purchase for Destruction, Special Purchase and intervention buying schemes.

The advisory programme was directly focussed on helping beef farmers to cope with the immediate and longer-term implications for production and income. Particular emphasis was given to switching production systems away form producing beef at over 30 months of age. In addition to intensive on-farm advice and discussion group activities, detailed advisory booklets were published and major demonstrations and conferences were held where production targets and feeding strategies for beef under 30 months were outlined.

At research level, work at Grange has shown that with attention to management details, steer progeny from the dairy herd can be produced as finished beef at 24-26 months of age. An analysis of consequences of under 30 months slaughter for carcass traits and grades of beef cattle showed that with animals heretofore finished off pasture at 30 months or over, but now finished indoors at around 24 months, kill-out will be higher and carcass conformation will be better and carcass fat score will be higher assuming similar carcass weights. Alternatively, for the same level of fatness as previously , animals can now be slaughtered at a lighter carcass weight.

The research and advisory campaign, aimed at developing the best beef breeding strategies which will ensure the maximum share of the high priced EU beef markets, was intensified in 2001.

There is evidence that the 'Breeding for Quality' programme is having an impact. At farm level, 70% of replacements for the suckler breeding herd were at least 50% continental breeding in 2001. At beef output level, around 25% of our national steer output was in the top grades in the EU classification scheme. This compared with 17% of steers in the top grades in 1998.

Beef breeding was a central feature of nine major beef advisory programmes run jointly by Teagasc and livestock marts/meat companies in 2001. Over 70 beef farmer discussion groups were serviced by Teagasc advisers and almost 200 public events were held covering all aspects of beef production.

A comprehensive programme got underway in Grange in 2001 on comparing the productivity of suckler cows as the proportion of continental breeding increases from 50% to 75% to 100%. The results will have important implications for beef production.

Producing Beef for Specific Markets

Teagasc scientists at Grange and the National Food Centre continued their research programme on the production of beef to meet the needs of specific consumer markets. One of the aspects examined further in 2001 was the role of nutrition and diet on fat colour in beef, which is an important factor in some EU consumer markets. They have found that concentrate feeding following a period on grass leads to a decrease in yellowness in beef fat. Grass-based diets result in more yellow beef fat. However, there is little effect on the characteristics of beef. The researchers have also found that the timing of concentrate feeding to animals can be used to manipulate fat deposition and colour.

Work on the production of beef with health enhancing fatty acids also continued at Grange Research Centre. Teagasc scientists have already found that Irish beef and milk produced from grass has helped levels of conjugated linoleic acids(CLAs) which the medical profession now accepts can protect against cancer, obesity and heart disease.

The scientists are now investigating ways of further increasing these beneficial acid through diet manipulation. They have found that the inclusion of plant oil in the diet of finishing cattle can increase the concentration of CLAs.

New Information on Grass and Silage Yields

On-going research at Grange on extending the grazing season has shown that autumn grown grass can be accumulated for grazing in situ during the winter. The potential to accumulate autumn grown grass is greater in

Grange than Moorepark. However, the rate of winter senescence is also higher in Grange. The results show that by mid-summer there were no residual effects on sward botanical composition arising from accumulating of up to 4,000 kg DM/ha of autumn grass.

In beef systems, grass supply and herd demand are not well matched and an ongoing study examining strategic application of fertiliser nitrogen to address the imbalance has shown that delaying nitrogen application from April-June until June-August, to coincide with peak growth, had no effect on total dry matter production. However, delaying nitrogen application changed the grass growth distribution pattern leading to higher late summer autumn growth.

Grange research has also that splitting the application of nitrogen fertiliser for first cut-silage gave a 7% increased dry matter yield but did not alter the indices of digestibility or ensilability. Earlier application of nitrogen favoured higher yields and better ensilability, but was associated with a lower digestibility. The potential of using new late-heading ryegrass varieties to optimise the yields of grass for spring grazing and the subsequent yield and quality of first-cut silage by delaying silage harvest date until mid-June, was also investigated. The conclusion from the fieldwork was that the late-heading swards could be managed to provide grass for spring grazing and good yields of high digestibility grass for silage in mid-June.

The Grange Research team also commenced a new EU-funded study on examining the role of high sugar grasses in Irish farming. The effects of factors such as fertiliser application rates, grazing and cutting will be examined and the carryover of elevated grass carbohydrate levels into the preserves silage and its effect on animal performance will be assessed.

Research on Animal Welfare

Significant attention was again given to research on animal welfare. In beef, Grange researchers have shown that beef cattle outwintered on wood mulch pads do not need shelter and do not suffer thermal stress. The research also shows that animal cleanliness is affected when individual space allowance is reduced from 18 square metres, to 12 square metres, to 6 square metres. However, reducing space allowance had no impact on animal production or health.

Scientists at Grange have already published the results of a study on the welfare impact of transporting weanlings to and from 30 livestock marts throughout Ireland. A total of 123,000 animals were involved in the study and the results show that the duration of the journeys either to or from the marts was not a welfare concern. In 2001, work commenced on a joint Teagasc/UK research project on monitoring the welfare effect on animals transported both within Ireland and on overseas journeys

In pig production, new EU regulations will involve the banning of individual penning of sows for the greater part of pregnancy and the elimination of sow tethering, over the next decade. Research staff in Moorepark are currently

examining stress and other aspects of different housing systems. Part of the research is taking place on commercial pig farms and also involves collaboration between Teagasc and the University of Limerick.

Research on Whole Crop Grains
As part of the Teagasc assessment on the role of forage grain crops as alternatives to grass silage, scientists at Grange monitored the conservation characteristics of whole crop wheat silage at a range of harvesting dates through July and August.

The consistently satisfactory preservation progressively changed from being due to a relatively high concentration of lactic acid and increasing dry matter concentrations. Both urea and proprionic acid based additives conferred some positive effect on aerobic stability, while the urea treatments increased crude protein concentration.

Breakthrough on Sheep Fertility Research

A new breakthrough on sheep fertility by scientists at the Teagasc research centre at Athenry, Co. Galway, could have major significance for research on control of fertility in women.
A team of researchers at Teagasc Athenry, has identified three new gene mutations which have a profound effect on ovarian function. As well as having significant potential benefits for sheep production, the discovery is likely to provide important insights for human fertility.

Using DNA technology, the scientists have found two distinct genes with a large effect on ovulation rate in sheep. Two different mutations have been found in one of these genes.
One of the genes is on the X-chromosome and therefore males can only inherit it from their mother. In the case of the second gene, individuals can inherit it from either parent

Ewes that inherit a single copy of any of the three mutations have a significantly higher ovulation rate. The effect could be an increase in litter size of between 0.5 and 1 lamb per ewe.

From a human perspective, the most significant discovery is that ewes which inherit two copies of any of these gene variants are sterile, because the normal development of the follicles in the ovary is blocked. This profound effect on ovarian function makes this discovery of major potential significance to medical research on fertility control in women.

This research project, which involved collaboration between Teagasc Athenry and scientists in NUI Galway, France and New Zealand, is part of the expanded Teagasc programme in biotechnology research. The results could also lead to new opportunities for the application of molecular genetic biotechnology to enhance the reproductive capacity of cattle.

Blueprint for All-Grass Sheep System
Work commenced at Knockbeg Sheep Research Farm in Carlow on an all-year-round grazing system for sheep. The first year results are very positive. Animal performance was as good as the conventional system where ewes are housed for the winter period and lambed indoors. Despite the high level of ewe productivity involved (1.8 lambs reared per ewe joined) the 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 examined. This involves measurement of nitrate leaching and soil run-off in the context of REPS and general sustainability requirements.

High Output Sheep Model
The three year research project at Athenry Research Centre on a high output sheep system was completed in 2001.

The objective was to produce 500kg of lamb meat per ha with modest inputs of nitrogen fertiliser by combining best breeding, feeding and management practices. The flock consisted of Belclare-type ewes crossed with Suffolk rams and was managed in a rotational grazing system after lambing in early March. The overall lamb meat output per acre was 490kg in 1999 and 503kg in 2000 and 500kg in 2001.

All lambs were sold for slaughter by mid September each year, with 75% drafted by mid August. The results from this project show the potential for well-managed grass based systems in terms of output per hectare and individual animal performance and provide an important benchmark for technology transfer and performance evaluation at farm level.

Campaign on Sheep Identification
The year 2001 marked the introduction of compulsory identification of all sheep. Teagasc advisory staff were centrally involved in an intensive information and awareness campaign on the operation of the new procedures. The campaign involved joint information meetings with the Department of Agriculture, Food and Rural Development in all counties combined with displays on the range of tags available and advice on registration requirements at all advisory offices. Over 10,000 sheep farmers attended the seminars and advisory displays while many others were dealt with in phone consultations and at other Teagasc sheep events.

Pay-Off from Intensive Sheep Advice
Information from the Sheep Technology Evaluation and Transfer Programme showed that farmers availing of Teagasc advisory services achieved lamb weaning rates which are 20% higher than the national average. This was worth an extra €19 in lamb sales and an extra €190 per hectare in margins.

Detailed information on performance and sheep health on a sample of leading sheep farms was assembled during the year and this formed an important component of the sheep advisory programme.

Emphasis on Pig Productivity

The pig research and advisory programme focused on cost monitoring and control, improved feed efficiency and increased average slaughter weight. Data from the Teagasc computerised management information system showed an improvement in feed conversion efficiency in finishing pigs. Average slaughter weight increased by 1.5% and lean meat yield also increased.

At research level, a new study on phase feeding, involving a sequence of diets each of lower nutrient content than the previous, commenced. Phase feeding offers the promise of cheaper feeds and reduced excretion of manure nutrients, provided pig performance is maintained.

Scientists at Moorepark also participated in an EU-wide project examining eating quality of pigmeat. They also commenced a study on the use of probiotcis in controlling Salmonella. This is being carried out in conjunction with the Teagasc Dairy Products Research Centre, UCC and UCD.

TILLAGE AND HORTICULTURE

The tillage programme continued the strong focus of developing, adapting and disseminating the technologies necessary to maintain yields and competitiveness. At research level, plans were progressed for the establishment of the new biotechnology facilities at Oak Park Research Centre and construction was scheduled to commence in 2002.

The recruitment of four new scientists in key areas of crop biotechnology was also undertaken and appointments were scheduled to take place in early 2002. A study on the environmental aspects of genetically modified crop species commenced in 2001. This involved the qualification of pollen drift as well as the risk of gene flow to native weed species prevalent in Ireland.

In horticulture, a comprehensive research and advisory programme was undertaken in mushrooms, nursery stock, soft fruit and vegetables. Both programmes were supported by a series of national conferences on tillage, potatoes, nursery stock and mushrooms in addition to regional, county and local conferences, demonstrations and farm walks.

The following are the main highlights.

Record Area of Winter Wheat
The impact of autumn weather on the area of winter cereals is exemplified from the winter wheat area planted in 2002 and 2001.

The difficult sowing conditions in autumn 2000 led to a significant drop in winter wheat area, which dropped to below 50,000 hectares. The superb sowing conditions in 2001 resulted in a record 90,000 hectares of winter wheat. The previous highest acreage was 73,000 hectares in 1992.

The trend towards larger, specialised tillage growers is continuing. The number of growers with more than 50 hectares has risen from 400 in 1985 to 1,500 in 2001.

In 2001, Irish growers were top of the league in cereal yields for the second year in a row. EU official statistics show that Irish wheat yields in 2001 were 8.4 tonnes per hectare, the highest in the EU. Spring barley yields, at 6.2 tonnes per hectare, also topped the EU table.

That our tillage farmers can out-perform those in the renowned tillage belts of Europe is testament to their skill and to the use of the latest technology developed by Teagasc at Oak Park and adapted from elsewhere. National grain output in 2001 was 2.133m tonnes, down 4.2% on the record harvest of 2000 but 11% over the average for the period 1991-2000.

New Cultivation Systems Assessed
Growing cereal crops without ploughing has become a feature on a small number of tillage farms in recent years. This new practice was the subject of

a comprehensive research programme by Teagasc at Oak Park, of which the initial results were published in 2001.

They show that 'eco-tillage' had up to 40% faster workrates with similar savings in labour requirements compared to conventional ploughing systems. Yields were similar for both systems. 'Eco-tillage' also uses less energy and offers the potential to reduce crop establishment costs by 30% - 45%. However, the story is not all plain sailing. The working window is much tighter than with ploughing systems.

The potential machinery benefits and initial crop results make the new system attractive to the larger grower. However, it will take a number of years to see how soil structure, weed population and other environmental indicators are affected.

Examining Protein Crops

The Irish feed industry currently imports up to 1.5million tonnes of protein per annum. The ban on meat and bone meal and the increasing non-acceptability of genetically modified protein sources, such as soya bean, has led to an upsurge in demand for Irish-grown protein feeds.

Research by Teagasc has shown that field beans offer the best and most immediate opportunity to increase home-grown protein feed production. Irish weather conditions are ideal for bean production. A well-grown crop of beans will yield up to 6 tonnes per hectare. The crop can be effectively stored on-farm or can be sold to feed compounders for inclusion in animal feed.

Lupins are another potential protein source. Previous research at Oak Park demonstrated that white lupins will not mature in Ireland. The first evaluation of blue and yellow lupins was carried out in 2001, with encouraging results.

Yields were in the range 3.25 - 4.5 tonnes/ha, at 14% moisture. Variety and seeding rate were significant in determining yield. Sowing date had no significant effect on yield. Spring blue lupins can be sown from mid-March to May 1 without affecting yield potential. Harvest dates for 2001 were August 15 to September 4 depending on sowing date.

Lupins have the highest content of protein (30-40%) of the legume crops available . They could become a valuable source of home grown protein for both on-farm use and a source of traceable protein for the food industry.

New Disease Control Technology

Substantial yield responses were obtained from two new strobilurin fungicides tested at Oak Park in 2001 and due to become commercially available to growers in 2002.

As the new fungicides give greater and more consistent disease control than those previously used, they have the potential to lead to further cereal yield increases and improved producer margins especially in seasons when disease pressure is high.

Oak Park scientists also found that two fungicidal seed dressings reduced incidence of take-all in wheat by 50%, leading to a 21% increase in grain yield.

Take-all is a soil borne disease which attacks the roots of cereal, leading to a major drop in grain yield, especially in wheat. These fungicides enable producers to obtain acceptable grain yields in sites where previously take-all disease would make the growing of wheat uneconomic.

Varietal responses to the take-all control using the seed dressing, Latitude, were also determined for both winter barley and winter wheat. The trial results indicated that there was little response with any of the winter barley varieties examined and no difference between varieties in their response. Results were different with winter wheat where yield responses of over 10% were recorded, with some varieties, particularly Savannah, Madrigal and Rialto, giving no response to treatment. This suggests that varietal selection can be an effective tool in reducing losses from take-all as well as facilitating savings on seed treatment costs.

Another important discovery related to control of barley yellow dwarf virus (BYDV). Researchers found that an insecticide seed dressing, imidaclorpid, which can give good control of BYDV in winter barley gave unsatisfactory performance in spring barley. While giving poor control of the virus disease it prevented grain yield reduction due to kill of aphids feeding on plants during the growing season. However, it is unlikely that the yield response would justify the cost of the seed treatment.

Evaluating Plastic for Maize

Maize silage has expanded enormously, increasing from less than 1000 ha in 1990 to over 20,000 ha in 2001. Evaluation of the two plastic production systems has been the focus of the research effort over the last three years.

The 2001 results confirmed the emerging pattern. The French or Punch Plastic System has given consistent increases in dry matter yield of 30% over conventional sowing. Starch content was increased by 5 to 10 percentage points, depending on the season, while harvest dates have been brought forward by two weeks.

In contrast, the Complete Cover, commercially marketed as the X-Tend system, has produced inconsistent results. The plastic film used, which is manufactured in Ireland, has been variable in performance, in some cases resulting in excessive damage to the crop.

The 2001 results show no improvement over the yield of conventionally sown maize and, for some varieties, a significant reduction in dry matter yield. Starch levels and maturity date are improved by the X-Tend system, but with very significant variety x film interactions being recorded. More development work is required before the X-Tend system could be recommended to growers.

Further Plant Breeding Success
Plant breeders at Oak Park achieved continuing success in 2001. Two new potato varieties, Banba and Emma, were granted EU Plant Variety Rights and a seedling, T1399/17, was accepted for entry to the Irish National List. This seedling shows good potential as an early particoloured-type for seed export to Mediterranean markets, particularly the Canary Islands.

Chieftain, a new white clover variety, was added to the British and Scottish Recommended Lists. This is a medium large leafed variety which combines very high yield with improved persistence. Chieftain has also performed well in Irish National List Trials. Emeraude, a new tall fescue variety, which has given good establishment, high yields and persistency in French trials has been added to the French Recommended List.

Recommended listing, following extensive trialing and independent testing, means that selections are among a small group of superior varieties which are recommended for use within each country or region. Inclusion of these new Oak Park bred varieties represents a very high level of success for the breeding programme.

Studying Mycotoxins
A new study on the occurrence of mycotoxins in cereals, cereal-based animal feedstuffs and food commenced in 2001. Because mycotoxins can have an adverse effect on health and wellbeing of animals, they are of particular interest to the grain and animal feed processing sector.

Initial results from cereals harvested in 2001 show that the mycotoxin, ochratoxin A, was present in a low percentage of wheat samples at levels of 6-7 mg/kg. Those values are in excess of the proposed EU maximum permissible level of 5 mg/kg. The work is continuing and expanded to include animal feedstuffs and food in 2002.

Big Changes in Potato Production
Potato production in 2001 was dominated by a small number of highly sophisticated, mechanised and specialised growers. The number of growers declined from 1,700 in the mid 1990s to less than 950 in 2000. Seventy per cent of the 13,000 hectares grown nationally was controlled by 160 growers.

The Teagasc-bred variety Rooster, is now the leading variety accounting for 30% of total acreage. The traditional variety, Kerr's Pink, is in second place, followed by British Queen and Record.

The Teagasc advisory campaign was targeted towards increasing saleable yield from 32 tonnes to 40 tonnes per hectare, by concentrating on best husbandry practices and choice of variety. With the cost of growing and cold storing potatoes now running at €1,000/hectare, achieving a net margin of €200/hectare requires yields of 40 tonnes and management of the highest calibre.

The market for washed potatoes has now expanded to 20% of production. In 2001, a further 1,000 hectares were grown for this market, resulting in an additional €4m income for growers.

At research level, work aimed at improving potato blight control continued. Two new fungicides, Electus and Raimon, for the control of potato late blight have been identified as giving improved disease control. Both were scheduled to be released for commercial use in 2002 and have the potential to be of substantial benefit to growers. Analysis of the genomic DNA of the potato blight fungus has confirmed previous findings that the level of genetic variation in the Irish population of the fungus is relatively low. This suggests that the development of more aggressive strains of the pathogen is not an immediate threat to potato production in Ireland as is emerging in some other countries.

Teagasc Census of Mushroom Production

Over 400 Irish growers produced 68,000 tonnes of mushrooms in 2001 with a farmgate value of €130m, according to the Teagasc Census of Mushroom Production.

The census shows that while mushroom production continues to increase, the number of units has declined from 576 in 1997 to 465 in 2001. A significant number of smaller growers have ceased production or have leased their units to other growers. Also, a considerable number of committed growers have erected new production facilities and a number of new growers have entered the industry in recent years.

Monaghan is the largest producer, with 122 units, followed by Cavan, with 58 units. Roscommon has 38 units while Mayo and Tipperary have 36 and 33, respectively. Total employment in the sector is 4,400 full-time equivalents.

The census also shows a trend towards new production systems called Dutch Shelf Farms, where the compost is placed in steel shelves rather than in bags or blocks. This enables mechanical handling, thus significantly reducing labour requirements. A total of 20 Dutch Shelf Farms were established by the end of last year.

Capital costs in switching to the new system are in excess of €100,000 and growers need a minimum of five mushroom tunnels before considering this investment.

Growers now need to be selling a minimum of 4,500kgs of mushrooms a week in order to be viable and be in a position to withstand economic and market shocks. Five years ago, a weekly output of 2,250kgs was a viable level of production.

The Teagasc mushroom commodity team, comprising researchers and advisers, published a detailed booklet outlining alternative production systems available to growers. The booklet, Production Systems for the Irish

Mushroom Industry, was distributed to all Irish growers and has met with strong demand from abroad.

In 2001, mushroom output increased by €7.5m due to increased output from new systems of production.

Increasing Nursery Stock Sales

The objective of the programme operated by the Teagasc nursery stock commodity team was to increase efficiency by improving the saleable yield of plants from its 2000 level of 75%. Losses and wastage of plants are serious problems, with the percentage of saleable plants varying from 70% to 90%. At the lower levels, businesses will not survive. Each 5% increase in the saleable yield is worth close on €10,000 to the average nursery.

The research programme at Kinsealy was aimed at underpinning the continued development of the industry by improving the quality of nursery stock and reducing any negative effects on the environment. The programme included the use of biological control agents to replace chemical control of pests and the substitution of renewable materials, such as bark and green waste, for peat in growing media.

A new project got underway on the use of innovative plastic greenhouses to improve plant growth and reduce the incidence of diseases and pests.

ENVIRONMENTAL CONTROL

Nutrient management and water quality protection continued to be the major focus of the Teagasc environmental programme. At research level, the programme focused on developing the scientific and technical basis for environmentally sustainable farming systems. The refurbishment of laboratories at Johnstown Castle Research Centre commenced during the year and was due to be completed in March 2002.

New linkages were established with environmental research institutes in the US, UK, Netherlands and New Zealand, with the aim of strengthening the scientific base in environmental modelling, nutrient efficiencies and organic farming systems.

The programme also involved a continuation of the concentrated effort to provide information and raise environmental awareness among farmers and the food industry through public events, media and other information campaigns. In this context, new evidence that a small but important improvement in water quality has taken place is to be welcomed. The following were the major activities and achievements.

Research on Nutrients and Waste Management

A three year study on soil moisture tension concluded that the risk of overland flow on nutrients was most significant in gleys, which occupy 25% of the land area and was probably small or negligible on brown earths and analagous soils which comprise over 40% of the country and account for virtually all of the intensive agriculture.

A new way was developed to manage environmental data on large farms, through the application of geographic information systems (GIS) and related data base management systems. The system is capable of managing and monitoring the chemical and organic nutrients applied to land, the nutrient status of soils, their sensitivity to run-off and the possibility of ground-water contamination.

An integrated constructed wetland system (ICW) was installed at Johnstown Castle in order to evaluate its effectiveness for farmyard dirty water pollution control. The system was established on a soil of clay loam texture to treat dirty water from a 43 cow dairy unit with an open yard catchment area of 2000m^2. Interim results suggest that ICWs can be successfully applied at farm level.

A new field experiment, part funded by the Environmental Protection Agency, is studying nitrate leaching under intensive dairying on one of the Teagasc farms at Moorepark Research Centre. The objective is to partition leaching from grazed land receiving nitrogen fertiliser plus slurry. The results will provide data essential to the development of nitrogen management practices.

A new overland flow site was constructed at the National Tillage Research Centre at OakPark in 2001 to measure nutrient loss from tillage soil. Initially three plots, each one hectare in size, will be used to monitor losses of phosphorus and nitrogen from a tillage location. A new mini-flow meter, which indicates the start and duration of overland flow, will also be tested.

Teagasc is represented in an EU Concerted Action research programme addressing soil quality and in particular heavy metals in soils. Aerial inputs of heavy metals and especially cadmium appear to be lower in Ireland than in most EU countries. Inputs of zinc and copper via feed concentrates are high and may become the subject of scrutiny. Findings from the study could contribute to policy development at EU level.

New Fertiliser Recommendations Published

During the year, new fertiliser recommendations were published aimed at ensuring the most cost-effective production of milk, meat and tillage crops while also maintaining risks to the environment.

Compiled by a team at Johnstown Castle Research Centre, the new recommendations reflect the changing farm production systems and the increased awareness of damage to water from nutrient run-off.

They involve a refocusing of the Teagasc advice on nitrogen application levels to grassland taking into account aspects such as high yielding dairy cows and the low levels of clover on most Irish farms. Advice on phosphorus levels for grassland and tillage crops has also been updated to reflect new Teagasc research information and also the importance of balancing agricultural production with environmental risk. They represent an important foundation stone in ensuring the sustainable development of Irish agriculture and environmental protection.

The implementation by farmers of Teagasc advice in reducing levels of phosphorus fertiliser resulted in a drop of 20% in the usage of phosphorus over the previous three years, with no impact on agricultural output. Farmers are now applying 10,000 tonnes less of phosphorus fertiliser which has led to a saving of €12m. This will also reduce the potential losses of phosphorus from agriculture to water. The drop in fertiliser nitrogen use in 2001 alone was almost 10%, reflecting the growing trend among farmers to follow scientific advice.

Fertiliser Saving on REPS Farms

Farmers who are participating in the Rural Environmental Protection Scheme (REPS) spent 30% less on fertilisers than extensively run non-REPS farms, according to an analysis carried out by Teagasc. The analysis of the Teagasc farm income survey for 2000 showed that despite lower fertiliser costs REPS participants had almost 10% more stock than their non-REPS counterparts.

The results, which were presented to the Teagasc National REPS Conference in November, show that REPS farmers used almost 30kg less nitrogen and 5kg less phosphorus per hectare than their non-REPS participants.

In addition to more cost-efficient farming, REPS is also contributing to improvement in water quality. For example, up to 60% of the improvement in water quality in Lough Allen and Lough Derg took place in areas where REPS uptake exceeded 30% of the land farmed. The delivery of REPS services continued to be a major focus of the Teagasc advisory programme. The REPS planning service continued to hold a 40% share of the national REPS market.

Over 5,200 new REPS plans were prepared during the year and over 10,000 existing plans were reviewed. REPS advisers made 18,400 advisory visits to farms.

Servicing Environmental Schemes
Teagasc advisory staff played an important role in providing professional support to a number of pollution control, nutrient management planning and natural heritage protection schemes.

Staff processed almost 1,000 applications by farmers for grant-aid under the Farm Waste Management Scheme. This involved assessment of eligibility and planning exemption. Over 500 nutrient management plans were supported to meet the requirement of lake water schemes, agricultural bye-laws and pollution control tax break. Advisers involved in this work benefited from further development of nutrient management planning software.

In the area of natural heritage protection, Teagasc staff played an important role in providing specialist services to targeted areas, including blanket bogs, coastal sand dunes, machairs and the Burren and Shannon callows.

Among the services provided were the completion of framework plans for commonage and non-commonage target areas, demonstrations on habitat protection, hedgerow maintenance and planting and specialist support on the development of management prescriptions for farming in callows.

'Good Farming Practice' was a new requirement which came into effect in 2001. It demands that farmers act responsibly, preventing pollution and protecting valued national and cultural heritage, in return for direct payments and grant assistance. Practically all farmers are affected by this new requirement.

Teagasc responded by providing information on good farming practice to all farmers, through a range of public information campaigns and as part of its intensive advice to farmers.

RURAL ENTERPRISE

The Rural enterprise programme involved research and specialist advisory services in forestry, sport horses, deer framing, farm fresh poultry, organic farming, tourism and farmhouse/cottage foods. The following are some of the highlights.

New Factsheets on Income Opportunities
A new series of factsheets on alternative income earning opportunities for farmers and rural dwellers was produced during the year.

Aimed at stimulating income-earning ideas among rural families, they contain information on the potential markets for a diverse range of products and services, as well as advice on set-up costs and expected returns. They also provide guidance on the skills needed to run each enterprise and an outline of the production system.

The latest series brings to 32 the number of enterprises on which rural people can get easily readable information. They meet an ever-increasing demand for objective information on new income sources on farms and in rural areas.

The following is a flavour of some of the income earning possibilities which are covered:

- Farm based production such as organic meat and potatoes, dairy goats, sport horses, free-range geese, free range eggs and farm fresh turkeys.

- Cottage food enterprises, including home cooked ham, chocolate, chutney, ice cream and lactic butter.

- Tourism enterprises such as trekking, local visitor attractions and bed & breakfast.

- Niche fruit and plant production such as strawberries, blackcurrants, tulips and forestry.

Each factsheet has a contact number for a Teagasc specialist or adviser who will provide additional information.

Teagasc Forestry Service Expands
The year under review saw a substantial increase in the advisory resources devoted by Teagasc to forestry, reflecting the growing importance of this enterprise. Nine specialist forestry advisers and 27 local land use advisers provided advice on economics, planting and management of forestry.

The service highlighted the opportunities which the increased forestry premium payments offered to farmers. With farm income figures showing over 35,000 drystock farmers making less than €250 per hectare, the

opportunity to convert a portion of these farms to forestry, thereby substantially boosting income, was emphasised in individual farmer contact, at public events and in public information campaigns.

Research on Forestry

The application of a root pruning method (RPM) for broad leaf tree production in Ireland was undertaken at Kinsealy Research Centre. This method, developed in the USA is a multi-step production system which ultimately determines the trees' survival and performance when planted out. Its main interest in Ireland would be to speed up the growth of high value trees such as oak and ash.

Oak and ash trees produced by this method were compared with normal growing methods at Warrenstown College during the year. There was a very significant increase in the rate of development using the RPM method with a significantly larger root ball, height and girth. A new study, using collaboration between researchers at Kinsealy, Johnstown Castle and the University of Missouri, is being set up to study the field performance of these trees.

The project on forest soils classification was continued in 2001. The grounding of staff during the foot and mouth crisis caused considerable delay in progress, as they were unable to do necessary field verification work. This project will now extend beyond the scheduled finishing date of June 2002.

The projects on molecular characterisation of ash and oak provenances and establishment of elite clones continued. The Gaelic Athlete Association (GAA) is interested in this work because of its importance for hurley production.

Mellows College Goes Organic

The conversion of the 110-hectare farm at Mellows College, Athenry commenced in 2001. The farm will receive full organic symbol status in 2003.

Mellows College has been designated by Teagasc as the national organic training and development centre. Utilising the training facilities at Mellows and the organic milk and meat production systems now being developed, the college will provide a vocational certificate course and adult introductory and updating courses for existing and new organic producers and for those interested in careers servicing the organic sector.

The new organic unit will adapt and disseminate the research information which has been generated by Teagasc and internationally.

Meanwhile, the organic milk production project at Johnstown Castle Research Centre completed its second year and reported an organic milk output of 7,000 litres/hectare. When payments under the Rural Environmental Protection Scheme (REPS) and a 20% price premium are included, gross margins for organic are similar to those for conventional dairying.

In the longer term, a price premium of this level may not be sustainable. Therefore, research is being challenged to achieve further efficiencies. This is now being addressed where the aim to achieve stocking targets of 1.7 cows per hectare and milk yields of 5,500 litres per cow, or 9,000 litres per hectare.

Servicing Rural Tourism

Teagasc staff continued to work in partnership with other agencies to guide the development of rural tourism marketing structures in counties Carlow, Clare, Donegal, Galway, Kildare, Kilkenny, Laois, Limerick, Longford, Mayo and Wicklow. Seven of the rural tourism marketing groups, established by Teagasc in the last 10 years, were granted substantial grant aid last year to support their further development.

Five of the groups (Carlow, Longford, Roscommon, Kerry and Mayo) each received €317,500 from the FAS Social Inclusion Programme. Four groups (East Galway, Mayo, Carlow and Offaly) each received a €63,500 grant from the Bord Failte SME Programme.

Foliage Production Increases

The production of outdoor cut foliage for the floristry industry reached almost 100 hectares in 2001. Production is now taking place in Kerry, Waterford, Limerick, Wexford and Cork and accounts for 18 full-time and over 50 part-time jobs. The target is to almost double acreage over the next five years.

A specialist Teagasc advisor is assigned full-time in providing consultancy and training to growers and in liasing with Teagasc research staff at Kinsealy Research Centre, Tralee Institutes of Technology and UCD on the identification of new species and improved husbandry practices.

Three quarters of current output is exported to the UK, mainland Europe and the US.

Progress of Deer Farming

There were 320 deer farmers in Ireland in 2001. The majority of the larger farms are in the Rural Environmental Protection Scheme (REPS) and an increasing number are converting to organic production.

The majority of deer farmers have now adopted the earlier finishing system, as advised by Teagasc. This delivers an additional €1.30 per kilo of venison sold, which is worth around €0.65m nationally.

Ninety per cent of venison produced in 2001 was exported to the UK, Denmark, France and Germany. The number of plants slaughtering deer increased during the year, with two new plants at Claremorris, Co Mayo and Downpatrick, Co Down, entering the business.

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, continued to focus on the development of new technologies and support for the Irish food industry.

The expanded programme, resulting from increased funding since the mid-1990s, has resulted in significant advances in innovation in beef quality, food ingredients, cheese, consumer foods, functional foods and food safety.

Due to additional funding under the National Development Plan, the programme was expanded further in 2001. The following are some of the main highlights.

New Funding for Research
In January 2001, the two food centres were awarded €9.5m for the period 2001-2003, under the Food Institutional Research Measure of the National Development Plan.

The funding means an enhancement of Teagasc's already extensive food research programme and will support an additional 35 research projects at the two centres. The projects are concentrating on the two key areas of food product innovation and food safety. In a number of the projects, Teagasc researchers are collaborating with colleagues in the universities.

A number of new scientists were recruited during the year to underpin the new projects.

New Strains of E.coli Identified
Scientists at the National Food Centre identified new strains of *E.coli* which pose similar risks to humans as the lethal *E.coli* O157. The new strains can cause equally severe and potentially fatal consequences as *E.coli* O157. Two outbreaks of a new strain, called *E.coli* 026, were reported in Ireland in 1999/2000. Research got underway on developing techniques for detecting these new strains.

E.coli O157 has emerged as a serious public health hazard, resulting in a number of severe and fatal illnesses across Europe in recent years. It is located in the intestines of cattle and sheep and can be spread through water, food, person to person, animal to person or during the animal slaughtering process.

An international research project on *E.coli* O157, which was co-ordinated by the National Food Centre, ended in 2001. It involved participation by scientists in 31 European food and medical research institutions and the results were outlined at a three-day conference run by Teagasc in Dublin in February, 2001.

About 10% of people infected with *E.coli* O157 develop kidney failure or other serious complications. Research has shown that, in 0.6 per cent of cases, infection results in death. Young children and the elderly are most at risk.

The first reported outbreak of *E.coli* O157 in Ireland was in a children's developmental centre in 1995. Between 1996 and 2000 there were a total of 203 reported cases. The peak year was 1998 with 76 cases, while the number of reported cases dropped to 51 in 1999 and to 37 in 2000. The pathogen has resulted in the death of one child.

The highest number of cases occurred in late summer. This mirrors research results for the pattern of *E.coli* 0157 infection in cattle.

A major Teagasc study showed that over 3% of Irish beef carcasses are infected with *E.coli* O157. The study was carried out by scientists at the National Food Centre at a major meat plant over a 12 month period. It shows that incidence of *E.coli* O157 is highest in cattle in the spring and early summer, confirming results of previous Teagasc studies.

The results of the study were presented to the three-day international conference in Dublin in February 2001. The conference was also told that a major study in Scotland found that 8% of animals carry the pathogen while in England a similar study showed that 13%of cattle and 7.5% of sheep were infected.

The English study also investigated the level of *E.coli* O157 infection in meat in butchers' shops. It showed that 0.8% of lamb was infected and 0.4% of beef. Both UK studies showed that the incidence of infection is highest in the summer months.

The control of this lethal pathogen is a major priority for Teagasc and other research organisations world-wide. Research at the National Food Centre is focused on finding ways to treat the animal's hide which will remove this dangerous pathogen and other strains of *E.coli* which are now emerging. The implementation by all meat plants and abattoirs of the new beef safety blueprint launched by Teagasc in 2000 would help to control *E.coli* O157.

In 2001, scientists at the National Food Centre started a quantitative assessment of the risk posed by *E.coli* O157 in Irish minced beef. This risk assessment will also determine the effectiveness of strategic intervention measures in reducing the risk posed by *E.coli* O157 and will establish the stages in the beef chain which contribute most to risk and, as such, can be used to facilitate future risk management policy decisions. This is the first quantitative risk assessment to be carried out in Ireland on a food pathogen and will serve as a model for quantitative risk assessments on other food pathogens.

Also in 2001, the National Food Centre developed the first reported method for isolating and detecting the pathogen *cryptosporidium parvum* in beef. The technology will be used to establish if this pathogen poses a risk to beef.

Guiding Small Food Companies
Small and speciality food business grew their sales at an average rate of 36% between 1996 and 1999. Many are performing well in response to an increased demand for artisan and speciality foods. Growth potential is estimated at 40 % over the next five years.

Research suggests that, rather than achieving growth by moving a product into the mainstream, producers should consider developing new speciality food products. The basis of this recommendation is that speciality food producers know their sector best and that their expertise is not in the mainstream. They should be constantly planning for the development of new products.

However, small enterprises lag behind in technology and innovation. A comprehensive database of all Irish food companies with less than 50 employees was prepared. Thirty companies from the north-west and 30 from the south-west regions were interviewed. The analysis showed significant variations between the two regions in employment, skills, qualifications and earnings, which impacted on the development of food companies within each region. Guidelines are being prepared on the determinants of innovation and growth in microfood companies, on which policies can be based to further develop the sector.

Consumer Food Model
Work commenced at the National Food Centre on adapting the Danish 'food-related lifestyle (FRL) consumer model' for market segmentation and predicting consumer demand. Six FRL consumer segments were identified in the Irish market for convenience foods. Three of these market segments were particularly convenience-orientated and represented 52 per cent of the entire sample.

A food industry workshop identified the UK as the priority export market. Initial results indicate that the FRL Irish data are cross-culturally valid with the UK data. The National Food Centre is working in partnership with An Bord Bia in this project.

Meanwhile, a number of companies with prominent food and drink brands participated in training on new product development. All aspects, ranging from idea generation to consumer testing of the final product, were covered.

The participating companies now have fully operational new product development systems, resulting in greater efficiency and focus on market needs. The training programme has now been modified for delivering to eight small food companies, with support from the West Cork Enterprise Board.

Bio-Cheese for Dental Care
Researchers at the Dairy Products Research Centre have discovered two new applications for the antimicrobial agent, lacticin. It has been found that

lacticin is effective in the suppression of growth of milk spoilage organisms and has potential for production of extended shelf-life milk. Funding was recently obtained under Enterprise Ireland's Advanced Technology Programme to develop the concept further.

Lacticin was also demonstrated to be very effective against pathogens that cause dental caries. It was found that the concentration of lacticin required for effective action is easily achieved in cheese by using a lacticin-producing culture in cheese manufacture. This opens the possibility of developing a new type of bio-cheese, which could be specifically marketed as being beneficial for dental health. This concept is now being explored further in a collaborative study with Cork University Dental Hospital.

Supporting Farmhouse Cheese

The farmhouse cheese segment, while small in volume, makes an important contribution to the variety of Irish food. A new initiative has been taken by the Dairy Product Research Centre to provide better scientific support to farmhouse cheese manufacturers.

In a joint programme with CAIS, the farmhouse cheese manufacturing group, Enterprise Ireland and the Food Safety Authority, funding has been agreed for a microbiologist to be located at Moorepark, whose sole responsibility will be to support this sector. This is an important new initiative for support of small companies and may be a model to be extended to other small companies in the future.

Cheese technologists at the Dairy Products Research Centre have also undertaken a major new initiative on efficiency in cheddar cheese manufacture. An efficiency audit of the Irish cheese industry was commenced in 2001 and technical trials were undertaken in Moorepark Technology, the joint Teagasc/industry pilot plant, to establish the effects of all stages and inputs into cheese manufacturing efficiency.

The project will run for three years and will provide a database that will enable manufacturers to make decisions on efficiency improvement and benchmark efficiency against the best standards internationally.

In a separate development, cheese technologists, in association with industry partners, have developed new technology for increasing the efficiency and yield of Mozzarella production. This is considered an important development for the competitiveness of Irish manufacturers in competing in international Mozzarella markets.

Work on Healthy Fatty Acids

Scientists at the Dairy Products Research Centre have identified food microbes that can produce conjugated linoleic acid (CLA). CLA is regarded as a healthy fatty acid which the medical profession now accepts can protect against cancer, obesity and heart disease.

Work by Teagasc researchers has already shown that animals fed on grass produce milk and beef with higher levels of these beneficial fatty acids.

The identification of microbes that can produce CLA has important potential significance. These CLA-producing microbes are now being further developed as potential probiotics for use in bio-foods. A patent has been taken out, in association with an international pharmaceutical company, and a joint strategy has been agreed for future development.

Scientific Reputations Recognised

The Dairy Products Research Centre was invited to become a founder member of the International Confectionery Research Network (ICRN). An Australian initiative, the ICRN will be the applied research resource for the international confectionery industry, particularly SMEs.

The invitation to joint what is a select group is based on the Dairy Product Centre's growing reputation as a centre of excellence in ingredient powders and the recognition of Moorepark Technology, the joint Teagasc industry facility, as a quality pilot plant. Participation in the consortium will bring benefits to the Irish dairy industry as it should increase access to confectionery manufacturers and open up opportunities for ingredient customisation.

The Dairy Products Centre is also a partner in an EU-framework funded network on spray drying, which was announced during the year. This will facilitate information exchange on new developments in drying technology and provide a good platform for Teagasc scientists to extend their contacts with EU research institutes and equipment manufacturers.

Leading Scientist Honoured

Dr Catherine Stanton, one of the leading scientists at the Dairy Products Research Centre, was honoured by an invitation to join an FAO/WHO expert group on probiotics. Dr Stanton was elected as co-rapporteur of the group which met in Argentina. In that capacity, Dr Stanton had joint responsibility for preparing a prestigious document on evaluation of health and nutritional properties of probiotics in food, which will be a reference source for commercial companies involved in the marketing of probiotic products with associated health claims.

AGRI-FOOD ECONOMICS

The agri-food economics and rural development programme was focused on projecting the impact of policies on the agri-food sector and rural areas and assessing the performance of farm enterprises and changes in market demand for food products.

During 2001, there was a substantial increase in the volume of collaborative research carried out, in partnership with institutions in other European countries, following the awarding of four new contracts under the EU Fifth Framework Programme. In one of these cases, the Rural Economy Research Centre is the co-ordinator. This project, which sets out to provide a modelling framework by which the impact of policy changes may be evaluated in each of the EU member states, has partners in 14 of the member states and an overall budget in excess of €2m.

The other three projects are all in the area of rural development, involving research in rural tourism, the supply chain for small food firms and aspatial peripherality, in at least five member states. As each of these projects began in spring 2001, there are as yet no research results. However, each project is progressing satisfactorily. This increased level of externally funded work led to an increase of four in staff numbers in the centre over the year.

The following are the main highlights of the Research Programme:

World Food Policy Options Assessed

The Irish agriculture and food industry would suffer most from a complete elimination of EU export refunds under the next World Trade Organisation (WTO) agreement, according to an analysis by Teagasc economists published in April.

The analysis found that Irish farm incomes would drop by 15% by 2010 if EU export refunds were eliminated. The beef and dairy sectors, which account for over 70 per cent of Irish agricultural output, would be the biggest casualties as they are the largest beneficiaries of the export refund regime.

The economists concluded that a reduction in export refunds similar to that in the last Uruguay Round, which saw a cut of 21% and 36% respectively in the volume and value of export refunds, would have much less impact on prices and incomes. The dairy sector would suffer most from a further reduction with relatively minor impact on other sectors.

These results were contained in the Teagasc Outlook 2001 report which provided analysis of the prospects for the agriculture and food sector from 2000 to 2010. It used the latest projections of the world and EU food sectors produced by the Food and Agriculture Policy Research Institute (FAPRI) in the USA and included the possible impact of BSE, the UK foot and mouth outbreak and the forthcoming WTO negotiations.

The report showed that BSE remains the main long-term problem for the Irish beef sector. Even with no further BSE setbacks in the EU, the beef market is likely to remain difficult and volatile for the next three years, with consumption depressed and pressure on prices together with significant build-up of intervention stocks. The economists forecast a return to more stability in beef consumption and prices from 2004 onwards.

However, beef margins at farm level would be significantly cushioned by an increase in direct payments and by increased participation in the Rural Environmental Protection Scheme (REPS).

The economists stated that steady growth in real incomes in Europe should provide a strong basis for domestic food demand. Also, solid growth projected for Russia and much of the developing world should provide increased food trade opportunities. Rapid growth in consumer incomes in China could provide a boost in world cereal markets.

Survey Showed Recovery in Farm Incomes

The Teagasc National Farm Survey for 2000 showed a recovery in farm incomes. Average farm income, at €14,600, was up by 27% on 1999. The income rise followed a drop of 19% since 1995. Therefore, incomes in 2000 have now recovered to around the levels achieved by farmers in 1995.

The improved position was due mainly to higher output from the cattle sector resulting from higher prices plus increased direct payments. Overall farm output increased by 12% in 2000 while farm production costs increased by just 5%. Direct payments to farmers increased by 16%.

The annual survey is based on an analysis of accounts on a representative sample of 1,100 farms and provides details of incomes on a wide range of farm sizes and farming systems. The total number of farmers represented by the survey is 124,000.

It showed that just under 40% of farmers, or a total of 47,000, had an income from farming of more than €12,700 in 2000. There were 11,000 with incomes in excess of £30,000 and a further 11,000 between €25,400 and €38,000. Over 70% of farmers with incomes in excess of €25,400 were involved in dairy farming.

While almost 50,000 farmers had an income from farming of less than £5,000, the vast bulk of these had other sources of income in the farm of an off-farm job, social welfare or pension. There was an estimated 37,000 full-time farms where the farmer had no off-farm job. The average income on these farms in 2000 was €28,700, an increase of just over 20% on 1999.

Enterprises

- Tillage overtook dairying as the highest income earner in 2000. Average income on tillage farms was €30,000, an increase of over 43% on 1999, reflecting the record yields achieved in the 2000 harvest. The value of tillage output was up by 28% and direct payments increased by 15%.

- Average income on dairy farms was almost €28,000, an increase of 20%, due mainly to increased output from milk plus a 19% increase in direct payments.

- Sheep incomes increased by 24% to an average of €9,440 per farm, due mainly to higher lamb prices.

- Beef farming was again the lowest income earner, with average incomes of €7,600. These were over 40% higher than the 1999 income levels, due mainly to increased cattle prices and a return to a full level of direct payments.

Off-Farm Income

On 45% of all farms, the farmer and/or spouse had an off-farm job. This showed no change since 1999. On 33% of farms, the job was held by the farmer, an increase of one percentage point on 1999. Farmers with off-farm employment are predominantly involved in cattle and sheep farming.

When other sources of income, such as pensions and social welfare, are included, the survey shows that just 29% of farmers are now relying on farming as their sole source of income.

Farm Investment Higher Than Planned

Farmers invested €472m in machinery, buildings, land and quota in 2001, according to the results of a Teagasc survey published in December.

The survey, conducted among 1,100 farmers, showed that investment in machinery was more than three times greater than indicated by farmers in a similar survey 12 months earlier. Investment in buildings, quota and land purchase was close to that planned at the end of 2000.

The survey showed that farmers planned to invest a further €340m in 2002. This included €70m in machinery. However, based on past trends, actual machinery investment in 2002 could be over €130m. Also, the reintroduction of grant-aid for farm buildings could see actual investment in 2002 exceeding the figure of €180m planned by farmers.

The survey also showed that, in spite of the increased profitability of sheep production in 2001, farmers intended to reduce the sheep breeding flock by a further 3% in 2002. If these intentions were implemented, it would be the ninth consecutive year of decline in the sheep breeding flock.

Dairy farmers intended to increase cow numbers by around 2%, while a small increase in beef cow numbers, particularly on farms in western counties, was planned.

Assessing Policies and Productivity

An analysis of the attractiveness of the EU extensification payments for beef farmers showed that some farmers could afford to pay considerably in excess of current "con-acre" prices for extra land to gain access to extensification. Rental rates of several hundred Euro could be justified for the extra land required to make small stocking rate adjustments. The financial attractiveness of extensification will precipitate the capitalisation of part of the payments into land charges and rental values, thereby increasing beef production costs and reducing margins.

A long term analysis of productivity change in Irish agriculture showed that the rate of productivity growth on the best farms averaged 0.9% per annum over the period 1984 to 1998 but the rate was slower in the 1990s than in the 1980s. Productivity growth was significantly higher on dairy and cereal farms, while there appeared to be regress on cattle and sheep farms.

An analysis of cereal production costs in a number of EU member states showed that total costs per tonne of barley in 1998 were €138 in Ireland compared with €197 in the UK, €218 in Denmark and €133 in Italy. The pattern for wheat was broadly similar. Wheat margins per hectare in Ireland (including subsidies) were €254, compared with €359 in Italy, €161 in the UK and a substantial loss in Denmark.

An analysis of the economics of afforestation showed that in a situation where off-farm jobs are not available, forestry is not competitive with cattle enterprises, as extensification payments and REPS enable efficient cattle producers to compete with forestry. Where off-farm jobs are available, the economic picture changes. If off-farm employment earns the average industrial wage, it may be economic to increase forestry area, to the exclusion of cattle enterprises.

EDUCATION AND TRAINING

The year under review marked the introduction of revolutionary changes in Teagasc training courses. All Teagasc courses were upgraded and nationally accredited. For the first time, agricultural and horticultural training was brought into the mainstream education system.

In January 2001, students had the opportunity to apply to the Central Applications Office (CAO) for third level courses offered jointly by Teagasc colleges and institutes of technology. Nationally accredited vocational certificate courses were also provided in agriculture, horticulture, horse production, pigs and forestry. An exciting component of the new courses is that participants can progress right up to university degree level.

The new course structure was accompanied by a substantial capital investment in facilities in agricultural and horticultural colleges. In 2001, a total of €7.5m was invested in college facilities and a further €6.5m was allocated in the capital budget for 2002. This unprecedented level of investment will ensure that college facilities are on a par with the best internationally.

The consolidation of college facilities continued during the year with two agricultural colleges, Warrenstown and Rockwell, ceasing to provide courses. Multyfarnham Agricultural College announced that it would cease to provide courses at the end of the 2001/2002 academic year.

An intensive information and marketing campaign on the new courses was carried out during 2001. This involved open days at all colleges, visits by education and training staff to schools, participation at national and local careers events and substantial advertising and publicity in targeted media. A prospectus was also produced giving detailed information on all courses, career opportunities and profiles of former participants.

Enrolments in third level and vocational certificate courses for the 2001/2002 academic year, at just over 900, were marginally up on the figure for the previous year. This was a reversal of the downward trend in numbers which had taken place since the mid-1990s.

The foot and mouth restrictions necessitated the closure of all agricultural and horticultural colleges for a lengthy period in spring/early summer. However, through distance learning arrangements and the availability of the extensive range of workbooks now available to students, together with an extension of the college year beyond the normal June closing date, all courses were fully completed and the quality of training was not affected.

The restrictions also had an impact on Teagasc's comprehensive training programme for adult farmers, with all courses scheduled for March/April suspended. While many of these courses were held in autumn/winter, total participation in adult training was somewhat below target. Details of

participation levels in third level, vocational and adult programmes are given in Table 1.

Table 1: Participation levels in third level, vocational and adult programmes

Courses	Completed 2001	Commenced 2001
Certificate in Agriculture/Vocational Certificate in Agriculture	587	461
Certificate in Horticulture/Vocational Certificate in Horticulture	118	84
Certificate in Rural Enterprise	61	0
Certificate in Farming College Option District Option	 395 186	 0 0
Diploma in Horticulture/National Diploma in Horticulture Year 2 Year 3	 106 101	 127 106
Advanced Certificate/Diploma in Dairy Herd Management	17	30
Advanced Certificate/Diploma in Farm Machinery and Arable Crops	0	10
Diploma in Agriculture – Machinery	19	27
Farm Apprenticeship Apprenticeship Scheme (3 years) Trainee Farmer Scheme (3 years)	 48 5	 99 6
Certificate in Horticultural Skills	4	7
Certificate in Horse Breeding/Vocational Certificate in Horse Breeding	27	29
Certificate in Forestry/Vocational Certificate in Forestry	9	23
Vocational Certificate in Greenkeeping	33	38
National Certificate in Agriculture	0	54
National Certificate in Agricultural Science	25	36
National Certificate in Agri-Business	47	33
National Certificate in Equine Studies	4	16
Short Agricultural Courses	5470	5470

Nine Third Level Courses on Offer

Nine third level diploma and certificate courses in agriculture and horticulture were on offer on the Central Applications Office (CAO) list in January 2001. The courses were provided jointly by Teagasc colleges and institutes of technology partnerships. All courses are certified by the Higher Education and Training Awards Council (HETAC).

The courses were in the following areas:

- Three National Certificate in Agriculture courses provided jointly by Teagasc college and institutes of technology partnerships.

- Three National Diploma in Horticulture courses provided jointly by Teagasc college and institutes of technology partnerships.

- National Certificate in Business Studies in Agribusiness, provided jointly by Mountbellow Agricultural College and Galway/Mayo Institutes of Technology.

- National Certificate in Business Studies in Equine Studies provided jointly by Gurteen Agricultural College and Athlone Institutes of Technology.

- National Certificate in Science in Agricultural Science provided jointly by Kildalton Agricultural College and Waterford Institute of Technology.

  A total of 220 students accepted offers for these courses and commenced their studies in September

New Vocational Certificate Courses

The new upgraded vocational certificate courses were provided by 11 agricultural and horticultural colleges in 2001. All courses are certified by the Further Education and Training Awards Council (FETAC) and are benchmarked to the best international standards.

The courses are geared to the needs of young people interested in careers in farming, food horticulture, landscape horticulture, forestry, horses, pigs and in all aspects of the services and processing sector of the agri-food industry. A key advantage is that participants can progress from these courses to third level Teagasc/institutes of technology courses and from there to university degree level.

In addition to the vital career benefits which these courses confer, training is also a requirement for crucial financial and business developments in farming. For example, young people born after January 1 1968 must have completed the two-year Vocational Certificate in Agriculture in order to qualify for stamp duty exemption, stock relief and additional milk and suckler cow quota.

Around 700 students enrolled in these vocational courses in September 2001.

Training Mature Students

Courses, accredited by the Further Education and Training Awards Council (FETAC), aimed at mature students, over 23 years of age, got underway in 2001.

The courses have been specially constructed to meet the training needs of the growing number of people who currently have a job and will be taking up farming on a part-time basis. A total of four courses commenced in 2001. They are being provided at night, weekends and during annual holiday periods.

Two distance learning programmes also got underway and, pending their success, it is planned to make distance learning more widely available over the coming years.

A pilot 100 hour training programme will be run in 2003 in conjunction with e-learning support.

Strong Focus on Adult Training

During 2001 a comprehensive range of courses was provided by Teagasc to adult farmers and rural dwellers in all aspects of business management and rural enterprise. A total of 5,500 participated in these courses.

Some of the courses provided, such as under the Rural Environmental Protection Scheme (REPS) are a requirement for participation in the scheme. Others, such as training in the safe use of pesticides, are a requirement of supermarket buyers of horticultural and other produce.

Typically, the courses are delivered in modules of 12.5 or 25 hours duration. They are now all nationally accredited by the Further Education and Training Awards Council (FETAC) and participants have the option of accumulating modules and progressing to FETAC awards.

Comprehensive Rural Enterprise Training

A comprehensive training programme was run for farmers and rural dwellers in supplementary farm and rural-based enterprises. It included the following:

- Some 50 short forestry training courses were delivered, half were introductory courses and rest were on the management of older plantations including skills courses.

- Fifteen breeding and management 20-hour courses were provided for horse producers. Also, three 20-hour skills courses were run covering showing, lunging and loose schooling. A total of 500 horse producers attended these courses.

- Two courses of 25 hours duration were run on free range/fresh farm poultry. Many of the participants are now committed to establishing an enterprise.

- Eight Certificate in Rural Business courses were provided in partnership with CERT and the institutes of technology. The courses extended over 150 hours. They had a total of 140 participants with two thirds of these achieving National Tourism Certification Board (NTCB) certification.

Some 1800 rural tourism product providers have now attended this course since it started in 1994.

- In farmhouse/cottage food, a range of courses were held, covering food production, packaging, marketing, business management and hygiene. These were delivered by staff from the two Teagasc food centres, institutes of technology, environmental health officers and Teagasc rural enterprise advisors.

- A 25 hours husbandry course on dairy goat farming was run at Ballyhaise College, Co Cavan.

Emphasis on IT Training

Over 50 training courses on information technology, were run by Teagasc nationwide in 2001. They were aimed at giving farmers the competence in IT and in the use of the various software packages which are a growing feature of farm business management.

Courses were held in response to a huge demand from farm families who which to acquire computer skills and involved partnerships between Teagasc, second level schools, third level institutes and private trainers. Two levels of training were provided – a Beginners Course and an Advanced Course.

The Beginners Course involved an introduction to computers and familiarisation with the software packages available. The Advanced Course was aimed at providing farmers with the expertise in using packages such as breeding charts, farm account keeping and VAT recording and returns.

Active Food Training Programme

There was further expansion in food industry training provided by the two Teagasc food centres in 2001. There were almost 2,400 participants in training courses provided by the National Food Centre in food safety, innovation management, consumer foods and in farmhouse/cottage foods production. Details of the courses and participation levels are given in Table 2.

Among the new initiatives undertaken at the National Food Centre were:

- Ninety environmental health officers (EHOs) were awarded the postgraduate certificate in food safety auditing, the first of its kind in Ireland. A further 150 EHOs underwent training in 2001. Training was also provided to the Department of the Marine.
- The national skills certified training for beef abattoir staff was launched by FAS during the year. The National Food Centre developed the curriculum and the assessment criteria, piloted the training in four

factories and formally evaluated 10 beef industry trainers and eight assessors for certification. The training is now in use in all major beef export plants.

- Training in the new Egg Quality Scheme was developed and delivered to 80 participants representing most of the 55 egg producers/packers in Ireland. This work was done for Bord Bia to aid the launch and implementation of the new scheme.
- The food safety and hygiene course was modified and translated for delivery to Portuguese and Brazilian meat processing staff. This FETAC certified course was developed at the National Food Centre for IBEC under the EU Skillnets programme.

A new 4-module course 'Technologies in Meat Manufacturing' was delivered to staff from 20 meat processing companies. A new module inmeat hygienewas also developed for Department of Agriculture, Food and Rural Development staff.

Staff at the Dairy Products Research Centre also focused on the needs of senior executives and technologists in the dairy foods sector. High-level workshops and training course were run on evaporation, drying, milk powder technology, cheese and dairy foods quality.

The Teagasc Authority sanctioned the building of a new €4.5m state-of-the-art training facility at the National Food Centre. Two new trainers were appointed to develop certified curricula. A five-year business plan for the centre was also approved by the Authority.

Plans for the construction of the new training facility are being advanced. It will provide a range of nationally accredited courses in food safety and food technology which will be benchmarked against best international practice and delivered to the food sector by Teagasc and approved external providers.

Table 2: Food Training Courses in 2001

Course	No. Courses	No. Participants
Food Safety		
Hygiene	60	1168
HACCP	29	365
Food Safety Auditing (Dept Health)	13	155
Laboratory Auditing	4	52
Introduction to Food Safety Auditing	1	8
Food Safety Training	1	48
Refresher Training in Internal & Supplier Auditing	1	11
Food Safety Auditing and HACCP (Czech Officials)	1	7
Food Law Update/Legal Labels	2	52
Food Safety & Hygiene Level 1 (Skillnets/IBEC)	4	46
Train the Trainers in Food Safety and Hygiene (Skillnets/IBEC)	1	15
Bord Bia Egg Quality Assurance Scheme	2	80
Innovation Management		
Sensory Panels	4	30
Innovation/NPD	5	41
Training by the Meat Technology Department		
Meat Assessors training (FAS abattoir skills)	1	4
Technologies in meat manufacturing	4	50
DAFRD – Animal Welfare	7	144
DAFRD – Basic Hygiene	1	25
Training by the Consumer Foods Department		
Testing for Grain Quality at Intake Points	2	30
Rural Enterprise Training		
HACCP	1	30
Sensory Analysis	1	7
TOTAL	**145**	**2368**

Events and Publications

While all public events run by Teagasc were cancelled between February and late summer due to the foot and mouth emergency, the organisation maintained contact with its key clients through all modern and conventional communications systems.

An intensive schedule of public events was run in the early and later parts of the year. This included seminars, demonstrations and open days at local, county, regional and national level. Among the highlights were:

- A national dairy conference in Killarney which attracted a record attendance of 1,350 dairy farmers.
- The Teagasc National Tillage Conference in January continued to be the biggest annual indoor event for the tillage sector.
- National conferences on the Rural Environmental Protection Scheme (REPS), on nursery stock, and potatoes were attended by the majority of professionals and growers involved in these areas.
- In the food area, major conferences included an international conference on food safety run by the National Food Centre and an international food ingredients conference run by the Dairy Products Research Centre.
- Ten major demonstrations on beef breeding were held in September and seven regional beef conferences were run in association with Bord Bia in October/November.
- A total of 26 special sheep seminars were run in October/November. September meetings on the new sheep identification regulations were run in every county in July.
- Our pig research and advisory service ran the annual series of three conferences which were attended by the vast majority of pig producers.

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 and financial analysis 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 reports covering all aspects of the research programme. An additional 10 end of project reports were published during the year, covering all areas of the research programme.

Six issues of the Teagasc magazine, *Today's Farm*, were produced and distributed to almost 35,000 clients of the advisory service and to key personnel in the agriculture and food industry. Two issues of *Farm & Food*, the research and development digest were produced.

Teagasc Today, the quarterly publication which details innovations and developments in the research, advisory and training services, was circulated to some 5,000 farmers, food industry personnel, government departments,

Oireachtas members and other scientific and public sector organisations at home and abroad.

Website

Information and services on the Teagasc website www.teagasc.ie were further expanded during the year. The website has become a very important source of information for national and international visitors and is also becoming an important vehicle for recruitment of new staff, especially in the scientific area.