

Teagasc Annual Report 2000

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Milk Production

Farmers Benefit from Intensive Advice

Ireland's top performing dairy herds had milk production costs 3.3p per litre (15p per gallon) less than the average, according to analysis carried out by Teagasc specialists.

These farmers, who were involved in the 260 Teagasc-led discussion groups in 2000, have cut production costs by more than 1p per litre (5p per gallon) during the last three years.

The discussion groups are an integral part of the 13 joint development programmes which Teagasc operated with dairy processors in 2000 and have become a key mechanism for the adoption by farmers of new technology developed by Teagasc researchers.

An important component of the discussion group model is the establishment of 'Monitor Farms' in local areas, where the best and latest research findings are demonstrated in a commercial farming environment. These farms have become the benchmark for good farming practice and are the focus of an intensive advisory effort and in-depth financial analysis.

An analysis of 15 monitor farms established under the joint Teagasc/Glanbia Dairy Development Programme in 2000 showed a substantial improvement in milk protein levels and a reduction in costs during the previous two years.

Milk protein increased by 0.1%, worth almost £1,000 on average to each of the farmers. This resulted from the adoption of grassland production blueprints developed at Teagasc Moorepark, leading to earlier turnout to spring grass and increased autumn grass supply. On average, grass was included in the cow's diet from February 18th.

Production costs were also reduced in 1998 and 1999 bringing average 'common costs' on the 15 monitor farms down to the Teagasc target of 8.8p per litre (40p per gallon).

The combined benefit of increased protein and reduced costs averaged £2,500 per farm, which helped to counteract the effects of the downturn in dairy incomes, particularly in 1999.

The average milk protein level on monitor farms was 3.32%, compared to the national average of 3.23%. An indication of the scope to increase protein levels can be seen from the fact that the overall winner of the National Protein Award in 2000 achieved a remarkable 3.6% milk protein level and many of the finalists had levels in excess of 3.5%.

The Teagasc target is to achieve average milk protein levels of 3.35% in 2006 and 3.5% in 2010. This will have the effect of increasing profit at farm level and expanding the range of value-added products manufactured by the dairy industry.

Blueprint for Natural Irish Milk

Milk produced under the blueprint developed by Teagasc at Moorepark Research Centre, Co Cork has all the properties of organic milk as well as proven health benefits.

The milk is produced from a diet of 90% grazed grass and grass silage. The 10% of the cow's diet which comes from purchased off-farm feed does not contain any animal by-products. The production system also places great emphasis on animal comfort and welfare. The large grazing component ensures cleanliness and minimal disease.

This naturally produced Irish milk has also many health promoting properties. It contains significant amounts of monounsaturated fatty acids, which lower cholesterol, as well as calcium which protects against osteoporosis. It also contains much greater concentrations of healthy fatty acids, called CLAs (conjugated linoleic acids), which the medical profession now accepts will protect against cancer, obesity and heart disease.

The Teagasc blueprint, which involves February/March calving, can deliver milk yields of 5,900 litres (1,300 gallons) per cow at 3.4% protein and 3.9% fat and a production cost of 8.8p per litre (40p per gallon). Farmers adopting the blueprint can make a net income of £20,000 from a milk quota of 182,000 litres (40,000 gallons). This represents an increase of up to £6,000 on typical incomes at present.

New Dairy Breeding Policy

A major international research and development project aimed at developing a new breeding index for Irish dairy cows got underway at Moorepark Research Centre in 2000.

The project, which is being carried out jointly by Teagasc and scientists in Holland, is aimed at correcting the growing infertility problem in high yielding dairy cows and developing the cow which best meets the Irish climate and milk production system.

The results of the first phase of an intensive dairy fertility study were outlined by Moorepark researchers during the year. They show an average calving rate to first service of just 48%, with a variation of 26% to 70%. Infertility is also extremely high, averaging 14% compared with a Teagasc target of less than 10%. Infertility ranged from zero to 34% across the 76 farms which were surveyed.

The results confirm the huge drop in dairy cow reproductive performance, which was at 60% in the late 1970s. This is substantially increasing production costs and its correction is a top priority in the Teagasc research and advisory programme.

Another element of the Teagasc dairy breeding programme involves the assessment of new breeds for use on Irish dairy farms. Two breeds, Montbeliarde and Normande, were compared with the Holstein Friesian.

Results in 2000 again showed that the Holstein Friesian achieved the highest milk yield at 6,290 litres (1,380 gallons) per cow while the Normande gave the lowest yield of 4,960 litres (1,090 gallons) per cow.

The Holstein Friesian had the poorest reproductive performance, 74% pregnancy rate, compared to 91% for the Montbeliarde and Normande.

Further breeding research, involving collaboration with scientists in New Zealand, also got underway in 2000. This is aimed at developing a cow which performs best under Irish conditions.

New Zealand bred calves were born at Mooerpark Research Centre as a result of embryo transfer and their performance is being compared with that of pure Holstein Friesians from North America and native Holstein Friesians.

Confronting the Labour Shortage

New approaches at farm level to ensure more efficient use of scarce labour are being investigated in a major project which got underway at Moorepark Research Centre in 2000.

The pulling power of the buoyant Irish economy and the nature of farm work are resulting in falling levels of both hired and family labour. Action is now required to manage these changes and direct them in a way which fortifies the future of the industry as a vibrant and sustainable entity.

Initial results of detailed measurement by Teagasc of labour use and efficiency on a representative sample of 140 dairy farms show that the average labour input per day ranges from 10 hours in February to 12.5 hours in the peak labour month of March.

The aim of the three-year study is to highlight the key areas where dairy farmers can make changes in labour use and to establish best labour practices for dairy farmers in the future.

At advisory level, a substantial awareness campaign on labour efficiency was undertaken in 2000 and labour reduction plans were put in place by farmers who are members of a number of Teagasc-led discussion groups.

Reducing Nitrogen Levels

A large proportion of dairy farmers are now participating in REPS schemes. The research at Solohead is focused on assessing the effects of reduced stocking rates and nitrogen inputs on grass production and on animal performance. There was little difference in milk yield for the various treatments compared. The average yield was around 5,750 litres for the year 2000. The early results are indicating that it is possible to maintain milk yields in low input systems. This is very important if low input systems are to compete with high input systems. New guidelines are needed for low input farming systems so that grass supply can be geared to animal

requirements. Clover also makes an important contribution. The focus of the research at Solohead is on investigating strategies to reduce nitrogen use.

Meat Production

Blueprints for Profitable Beef

Beef blueprints developed by Teagasc can now deliver farm incomes of over £500 per hectare (£200/acre), ensuring that farmers with medium-sized farms can make an income equivalent to or better than the average industrial wage.

While the BSE outbreak in continental Europe in late 2000 will lead to volatility and difficulty in beef consumption, stocks and prices in the medium-term, increased direct payments to farmers under the EU Agenda 2000 agreement and the expanded Rural Environment Protection Scheme (REPS) will significantly cushion farmer margins.

The Teagasc blueprints on grass and quality beef were further developed in 2000 and a major research, advisory and training programme was undertaken to ensure uptake and adoption by the maximum number of farmers.

The number of joint Teagasc/industry Beef Development Programmes was expanded to seven. This involves collaboration between Teagasc, livestock marts and meat factories, ensuring that resources are deployed in the most efficient manner.

The focus on demonstration farms and discussion groups as a means of transferring critical information to farmers was further expanded during 2000. Analysis showed that farmers who participated in the intensive Teagasc beef advisory programme used proven technology which ensured more efficient production of beef suitable for the more lucrative export markets, leading to more than double the average income levels.

Ireland's Biggest Beef Event

The national beef open day at Grange Research Centre in May 2000 was the biggest practical farming event of the year, attracting an attendance of over 10,000.

The open day covered every aspect of breeding, feeding, management, economics and marketing of beef and, in addition to the full array of Teagasc expertise, also featured demonstrations and advice by all agencies servicing the beef sector.

It provided an opportunity for farmers to see the latest production technology and get clear signals on market requirements and trends.

- The high performing suckler herd at Grange was demonstrated, with male progeny being finished at 400kg carcass at 22-24 months and female progeny being finished at 300kg carcass at 16 months.
- Systems of bull beef production were on show, with Holstein calves achieving a 250kg carcass weight at 12 months. These are eminently suitable for the red veal markets of Spain, Portugal and Italy. In the suckler bull beef systems, continental cross bulls are finished at 12-16 months.

- Calves from top AI continental bulls give more than 10% higher carcass weight than those from early maturing breeds. This results in a difference of 22p/kg in meat value in favour of the continental breeds.
- New research on the impact of nutrition and handling on meat tenderness was unveiled. The new technologies aim to produce meat with guaranteed tenderness and colour characteristics, by manipulating the animals diet and using newly developed technologies at meat processing level. This provides the opportunity to 'design' beef with particular quality attributes for specific markets.

Focus on Improved Breeding

An intensive advisory and demonstration programme was undertaken aimed at dramatically improving beef breeding practices, thereby ensuring that Irish beef can command a greater share of the high priced European consumer markets.

The programme concentrated on increasing the level of 'continental blood' in the beef suckler herd and using stock and AI bulls with proven ability to lift beef merit.

To achieve access to high priced European markets, farmers must use a combination of the best continental bulls and cows with 75% continental blood.

A major study on the genetic make-up of the national beef herd showed that the level of continental beef crosses in the suckler herd has increased from 29% in 1992 to 52% in 1999. However, less than 20% of the progeny from the beef suckler herd are currently in the top U grade in the beef classification scheme. This contrasts with a figure of 60% of the progeny from the beef suckler herd at the Teagasc Grange Research Centre achieving the top U grade. The Teagasc target is to bring the national performance up to the Grange standard within the next five years.

Non-Antibiotic Treatment for Pneumonia

Initial results of a world leading research project involving the development of a non-antibiotic treatment of pneumonia in cattle were outlined by a team of researchers in Teagasc and the Northern Ireland Department of Agriculture.

The new treatment is at the cutting edge of world biotechnology research and is being used in field trials to combat one of the most debilitating conditions in young cattle.

The tiny microspheres used in the trials are administered by nasal spray to calves as a treatment for pneumonia. The aim is to develop this biotechnology approach so that farmers will be able to treat pneumonia in calves without having to use injections of antibiotics. In Ireland, young animal mortality from pneumonia is more than 10%, with treatment costs at farm level reaching £35m a year.

The microspheres attach themselves to the lung of the calf and deliver a vaccine to stimulate a localised immune response at the very seat of the respiratory system. The slow release treatment then protects the animal during the most vulnerable months of its life.

Landmark Trial on Mechanical Beef Grading

A Teagasc evaluation has shown that mechanical beef grading can be exploited by the beef industry as a means for paying for quality cattle. However, the mechanical systems available at present do not meet proposed EU standards for official beef classification purposes.

The evaluation which involved three systems that use computer vision technology, from Denmark, Germany and Australia, was carried out by the Teagasc National Food Centre and the Department of Agriculture, Food and Rural Development over a nine months period in 1999-2000. This was a landmark project as it was the first time anywhere that the best mechanical grading systems were compared head-to-head in a factory trial.

It arose from recommendations in the McKinsey Report on the beef industry and the Beef Task Force that a move from visual to mechanical grading of beef would be an important step in building partnership between beef producers and processors and would lead to better market signals being passed back to producers through payment based on lean meat yield.

The results showed that the three systems were able to predict saleable meat yield with an equally high degree of accuracy, clearing the way for the uptake of mechanical grading by the beef industry for trading purposes.

The primary aim of the trial was to assess how well the three systems could predict the conformation and fat class scores of a panel of classifiers. Here also, the results were promising. The machines could predict the score for conformation with an accuracy of 97%, 95% and 94% for the Danish, German and Australian systems respectively. For fat class prediction the accuracies were lower, at 80% for the Danish system, 76% for the Australian system and 74% for the German system.

None of the systems would meet the level of accuracy proposed by the EU as the required standard for authorisation of mechanical systems, particularly for fat class. However, the high accuracy achieved for saleable meat yield could be exploited by the industry as a means of paying for quality in the interim.

Meeting Grass Production Targets

The Teagasc 'Cash in on Grass Programme' is the cornerstone of more profitable production of quality Irish beef. It involves an integrated research and advisory programme involving leading researchers at the National Beef Research Centre at Grange, specialist beef advisers and the county advisory services all working in partnership with key sectors of the beef industry.

The critical targets in the programme are animals eating quality grass for 220 days a year and achieving an average liveweight gain of 0.9kg per day.

An added advantage of grass-based beef production is that beef has greater concentrations of the type of fatty acids which the medical profession now accepts

will protect against cancer, obesity and heart disease. These fatty acids, known as CLAs (conjugated linoleic acids) are now being strongly recommended as an essential part of the human diet.

The demonstration farms established under the Teagasc 'Cash in on Grass Programme' had cattle on grass for 208 days in 2001, marginally short of the Teagasc target, and achieved the recommended liveweight gain target of 0.9kg/day.

Financial analysis shows that average gross margin on the demonstration farms was over £700 per hectare (£280/acre) in 1999 compared to the national average of £310 per hectare (£125/acre). The top performing demonstration farms achieved a gross margin of £950 per hectare (£380/acre). These figures show that substantial income gains are achievable through adoption of the latest technology.

An indication of the importance of animal performance on beef profitability can be seen from the fact that a difference of just 3kg per month in liveweight gain of a beef animal is the equivalent of up to 13p/kg carcass weight in the price which farmers get for their beef.

Emphasis on Quality Assurance

The Teagasc programme to raise beef producer awareness of key food assurance issues was intensified. This was reflected in comprehensive training for trainee farmers, adult farmer participants in advanced certificate and diploma courses and for staff employed by meat processors. This was complemented with a range of information literature, special meetings and a media campaign on critical food assurance practices.

Teagasc also promoted the expansion of producer/processor partnership as the best route to ensuring a quality assured product. A benchmarking survey carried out by the Teagasc National Farm Survey unit showed that 85% of beef producers believe that participation in quality assurance schemes should be a necessary requirement. Almost 60% believe quality assurance schemes help market access while one-third of producers believe that these schemes help to increase the price for beef.

Income Boost from Sheep Technology

New Teagasc technology has the potential to lift income from sheep farming by up to £15m a year.

Farmers who follow the blueprints developed by Teagasc researchers on grass management, parasite control and strategic use of meal feeding can capture substantial income gains.

The critical target is to have twin lambs weighing 32kg at weaning at 12-14 weeks of age. The key to achieving this is quality grass, particularly in May and June. Farmers who manage grass in a manner which ensures a sward height of 6-9cm during these two critical months will reap the rewards in increases in lamb performance.

Creep grazing, where lambs are allowed to selectively graze ahead of their mothers, has the potential to add 2kg to weight at weaning. While feeding meal to lambs can further boost performance, meal as a substitute for poor grass management is bad economics.

Clover can also give a big boost to performance and profit. It is the route to excellent lamb growth rate from July onwards, which is regularly a 'black period' for performance on sheep farms. It also cuts fertiliser costs.

Sheep Breed Resistance to Stomach Worms

Further on-farm trials in 2000 confirmed that the Texel sheep breed has higher resistance than the Suffolk breed to stomach worm infection. The genetic transmission of resistance to cross-bred progeny was also confirmed.

Teagasc researchers have now firmly established a highly significant breed effect on stomach worm resistance, which operates at farm level.

A project is now underway with the Veterinary Faculty in University College, Dublin on DNA analysis to identify genes responsible for the differences. The objective is to develop a DNA-based test to enable selection for increased resistance.

Sheep Breeding Developments

Research work on sheep AI showed a big variation in pregnancy rates between rams, ranging from 12% to 50%. Pedigree sheep breeders involved in this on-farm study consider that a pregnancy rate of around 50% would be acceptable. On-farm evaluations are continuing in 2001.

In another experiment, researchers analysed DNA from sheep carrying a major gene with a recessive effect causing ovarian hypoplasia. An unexpected discovery was a significant mutation in an X-linked gene recently shown to play a central role in follicle maturation. Since breeding data have shown that an autosomal gene is involved in the ovarian hypoplasia in our populations the results to date suggest that our populations contain a novel gene involved in the control of ovarian function. This project involves direct collaboration with the AgResearch Unit of Molecular Biology in Dunedin, New Zealand and the Microbiology Department of NUI, Galway.

Framework for Sheep Technology Transfer

Teagasc researchers and advisers were involved in the development of an action plan aimed at ensuring more effective transfer of proven technologies to sheep farmers.

Following extended consultation with members of sheep discussion groups, four priority areas were identified: labour requirements, lameness, poor lamb growth and parasite control.

A number of progressive sheep farmers agreed to participate in studies on lameness, lamb growth and parasite control. Information was collected on these farms on parasite measurements using DIY technology recently developed in New Zealand. A programme involving fortnightly monitoring of grass supply and weekly monitoring of lamb growth and parasite control also got underway. This will generate unique information on the likely determinants of lamb growth at farm level and the role of parasite challenge.

Preliminary results of a Teagasc study on labour use on drystock farms show little difference between sheep and cattle - 26 hours versus 25 hours per livestock unit per annum. The results also highlight a major deficiency in facilities for routine sheep tasks.

Tillage and Horticulture

Research Delivers World Class Yields

New technology developed by Teagasc researchers together with international technology adapted to Irish conditions has resulted in Irish tillage yields being among the highest in the world.

The application of this new technology combined with good growing and harvesting conditions resulted in record tillage output in 2000, increasing by over 10% to 2.25 million tonnes.

Yields of winter wheat averaged 10 tonnes /hectare (4 tonnes/acre) while spring barley yields were 7 tonnes/hectare (2.8 tonnes/acre).

At research level, trials at the Teagasc National Tillage Research Centre at Oak Park demonstrated scope for even further expansion in yields. An experiment with early-sown winter wheat resulted in yields of up to 14 tonnes/hectare (5.6 tonnes/acre).

The intensive research programme on lower cost cereal production was further expanded. It shows that significant scope exists to reduce inputs especially where disease pressure is low. However, the researchers stress that a reliable disease prediction system must be developed before growers can adopt the reduced input system with confidence. This aspect is now being given priority in the Oak Park research programme.

At farm level, costs on farms availing of the intensive Teagasc advisory service continued to decline. Based on the results of the Teagasc Profit Monitor, these farms achieved winter wheat production costs of £70/tonne – just £5/tonne lower than the Teagasc target.

Breakthrough with New Leaf Disease

Researchers at Oak Park made further substantial progress in discovering the causes of a recently discovered leaf necrotic spotting disorder in barley.

They have found that the disorder, which significantly reduces barley yields, is due to the combined effects of a disease called Ramularia and some other factors, possibly involving light irradiance.

The research has found considerable variation in the susceptibility of varieties to the spotting. Fungicide treatment had a positive effect against the disorder and gave a significant yield response, which may be due to the control of the Ramularia disease.

Teagasc researchers are now involved in a major international collaborative programme aimed at solving this problem.

In a separate development, researchers at Oak Park found that a seed-applied insecticide effectively controlled Barley-Yellow-Dwarf Virus (BYDV) which can reduce yield of winter barley by up to 40%. The seed dressing was not as good as the

conventional practice of applying two aphicide sprays in autumn. However, as much less chemical is used, the seed treatment has considerable potential environmental benefits.

Spray drift, which is regarded as highly undesirable in respect of possible damage to human health and the environment was also the subject of research. In ongoing work at Oak Park, spray drift was substantially reduced by using specialised nozzles and manipulating spraying pressure. Some evidence obtained in 2000 trials indicated that the level of weed control obtained with the low drift nozzles may be lower than obtained with conventional nozzles, but differences were small.

Plant Breeding Success

In 2000, two new Teagasc-bred potato varieties, Banba and Emma, were added to the Irish National List and the EU Common Catalogue of potato varieties. Both varieties are now being multiplied for seed export, particularly to Mediterranean countries. Emma is also displaying considerable promise as a 'baking' variety in the UK.

Sixteen varieties bred by Teagasc at Oak Park are now in commercial production worldwide. The most successful is Cara which accounts for 10% of UK potato production and is also an important seed export variety to many Mediterranean and North African countries.

Rooster is the second most important variety in Ireland. It has also succeeded in replacing up to 15,000 tonnes of imported potatoes for frozen chip production. Other varieties, such as Burren and Slaney, have developed significant export outlets.

Substantial success was also achieved in the Oak Park grass breeding programme. Millennium, a new tetraploid ryegrass, was added to the British and Northern Ireland Recommended Lists. It has high yield coupled with good spring and autumn growth.

Cashel, a new diploid ryegrass, was added to the Scottish and Northern Ireland Recommended Lists. Both of these varieties are in the Irish Recommended List since 1999.

Inclusion on recommended lists means that the varieties are among a small group of superior strains recommended for use within each country or region and represents a very high level of success for the Teagasc breeding programme.

Mapping of Potato Blight Outbreaks

A recording system for potato blight outbreaks was introduced by Teagasc in 2000, with the purpose of providing information on infestation in the different potato growing areas throughout the country.

Each area was monitored by Teagasc potato specialists and by inspectors with the Department of Agriculture, Food and Rural Development. The first incidence of

blight in each area was entered on a map which was available on the Teagasc website and updated regularly.

This new service enabled growers to establish if blight had been reported in their area and to implement effective control programmes.

Meanwhile, research at Oak Park showed that new fungicides which are likely to be available to farmers in the coming years gave good control of potato blight. Natural plant products which enhance the resistance of the potato plant to blight infection continued to show promise and could replace, at least in part, conventional fungicides in the future.

Applying fungicides according to a decision support system (DSS) gave excellent control of potato blight in experiments and on farms, using about 30% less fungicide than conventional routine spraying. The DSS approach is being further refined and could be adopted by growers within a few years.

Forage Maize Increases

The area of forage maize has increased steadily in the past five years, reaching 13,000 hectares in 2000 and expected to expand further. Research at Oak Park and other sites has shown that growing under photo-degradable plastic can increase yield by an average of 4 tonnes of dry matter per hectare, increase starch content and bring forward harvest date by about 21 days. Total dry matter production can be as high as 17 tonnes of quality dry matter per hectare.

In 2000, a number of fully bio-degradable plastics were compared with the photo-degradable type presently used. Some starch-based bio-degradable plastics show excellent promise and, although more expensive, have considerable advantage from the environmental perspective. Work with these plastics will be continued.

Vegetable Production Becomes Specialised

The demand for strict crop production protocols by the major supermarkets and the introduction of centralised distribution centres is leading to a highly sophisticated and specialised vegetable production industry in Ireland.

The national output of vegetables of £32m per annum is now grown on just 380 farms. These growers supply 70% of Irish consumers' purchases of vegetables, which have a total retail value of almost £200m.

The vast bulk of vegetables are produced on farms adjacent to the major population centres of Dublin and Cork. Their major customers are the giant supermarket chains which control three-quarters of all vegetable purchases. The profile of growers ranges from small units of 4 hectares involved in the production of labour intensive crops to larger units of 80 hectares with highly mechanised systems for the production and storage of field vegetables.

Specialisation is a striking feature of vegetable production at present. In the past, many growers would have been involved in up to eight different types of vegetables.

Now, the majority of growers are producing no more than three vegetables. The key challenge facing growers is to guarantee consumers that vegetables are produced in the most environmentally friendly manner. This involves the use of minimal pesticides and nutrients and the utilisation of integrated crop management systems.

Production of new varieties which have high tolerance to a range of diseases is now the subject of extensive research internationally and has the capacity to revolutionise production.

In order to help growers meet the more stringent market requirements, Teagasc researchers are giving priority to the development of Integrated Crop Management (ICM) blueprints.

Growing Demand for Shrubs and Plants

Higher disposable incomes and increased home ownership are generating rapidly increasing demand for shrubs and flowers for home gardens. This has led to nursery stock production in Ireland almost trebling in the past decade. The industry is projected to grow by a further 50% between now and 2006.

In Ireland, 88% of households have gardens, compared with 90% in Finland and Spain and 40% in Germany. Gardening continues to grow in popularity as a leisure activity. Also, the higher number of people in older age groups is also fuelling demand for nursery production. Increased industrial development and road construction are also impacting on demand for landscaping products and services.

A solid export market for nursery stock has been developed to the UK and Northern Ireland. Irish suppliers have established an image of quality and competitiveness in export markets. The strength of sterling and the increase in demand for residential property and hence increased access to gardens has resulted in the UK becoming very attractive for exporting nurseries. However, the industry is now faced with serious production issues such as labour shortages, increased transport costs and a possible reduction in the number of pesticides available for crop management.

The Teagasc research and advisory programme concentrated on the development and adoption of sustainable production systems. New technologies investigated included the use of renewable growing media and cultural systems for disease control.

New Mushroom Technology

Output of mushrooms continued to grow in 2000 and comprehensive research, advisory and training service were provided to 550 mushroom growers.

The research programme at Kinsealy Research Centre focused on the testing of biodegradable plastic for use in growing bags, developing biological systems for pest and disease control and using evaporative control to improve quality.

A major three-year project on mushroom quality carried out in collaboration with researchers at Pennsylvania State University has been completed. The focus was on determining the main factors affecting mushroom quality and testing, in the Irish

growing system, using techniques developed in the United States. Work focused attention on water relations (irrigation and evaporation) as one of the most important influences on quality that can be regulated as part of the crop production process.

A joint project with UCD on the problems of managing spent mushroom compost (SMC), particularly in the Monaghan area, concluded during the year. The study concluded that the way forward was to establish centralised SMC handling facilities to enable efficient collection, temporary storage, further processing and transportation to end users. SMC used as an organic manure gave positive results in pot experiments and in field trials with wheat and potatoes.

Emphasis was continued on providing growers with the technology to increase mushroom yields. Each 5kgs of mushrooms/tonne of compost is worth an extra £2,500 per annum to growers. Thirty five per cent of growers are now achieving yields of 225kg/tonne of compost with a further 40% achieving 215kg. The remaining 25% are achieving 200kg.

Rural Environment

New Collaborative Research Project

Teagasc researchers at Johnstown Castle Research Centre, Wexford are co-ordinating a major international research project involving phosphorus and nitrogen eutrophication from agricultural sources.

The project was awarded by the Environmental Protection Agency (EPA) and is funded under the National Development Plan 2000-2006. It got underway in late 2000.

Participants in the project include scientists from other Teagasc research centres as well as Irish universities, University of Sheffield, Northern Ireland Department of Agriculture and Rural Development and the UK Institute of Grassland and Environmental Research.

The work is being carried out at laboratory, plot and field levels at both Johnstown Castle and Moorepark Research Centres and also at river catchment level.

This project will facilitate a major expansion in the research work being carried out by Teagasc on environmentally sustainable farming.

Researchers at Johnstown Castle are also participating in a major international project on greenhouse gas emissions which commenced in 2000. This is also funded by the National Development Plan.

Ammonia Emissions on the Increase

A study by Teagasc scientists at Johnstown Castle Research Centre has shown an upward trend in ammonia emissions from agriculture during the past decade.

In Ireland, agriculture accounts for virtually all ammonia emissions to the atmosphere which now total 120,000 tonnes. This represents the highest per capita emission levels in Europe.

Large quantities of animal manure combined with the application of 440,000 tonnes of inorganic nitrogen account for the current high level of emissions. International agreements, in particular the Gothenberg Ministerial Declaration, specify that Ireland must achieve a reduction in its national ammonia emissions by 2010, using 1990 levels as the standard.

Teagasc researchers have developed an inventory model in order to establish the magnitude of ammonia emissions. The model has shown that animal housing and manure spreading each account for 40% of total emissions with animal grazing accounting for 17%. The remaining 3% is attributable to manure storage.

Reduction targets may be met through the adoption of manure application-based abatement techniques. However, an integrated approach is necessary so that the abatement of one form of emission does not lead to increases in another.

REPS Boosts Buildings Investment

Investment in new buildings by farmers participating in the Rural Environment Protection Scheme (REPS) increased by 40% between 1994 and 1999. Investment in building maintenance increased by 70% during the same period.

In contrast, investment in buildings on intensively run non-REPS farms showed a drop of 17% during the same period. The figures are based on an analysis of the Teagasc National Farm Survey, which also shows a consistent income difference of 40% between REPS farms and similar non-REPS farms.

The analysis also shows that stock numbers and use of nitrogen on intensively run non-REPS farms increased by up to 16%, a trend which may not be sustainable in the long-term because of the introduction of new regulations and the Code of Good Farming Practice.

Almost 30,000 farmers availed of Teagasc's intensive REPS and environmental services during 2000. The organisation's expertise was also made available to companies, national agencies and local authorities in developing environmental control measures.

Emphasis on Environmental Sustainability

A growing proportion of Teagasc resources are now being devoted to specialised advisory programmes aimed at minimising nutrient loss from agriculture. The purpose is the adoption of more environmentally sustainable farming systems together with compliance by farmers with a battery of regulations which are now in the process of being introduced.

Bye-laws, some of which involve significant controls on farming practices, are likely to be operating in the majority of counties over the coming years. In 2000, two counties, Cork and Cavan, were already operating bye-laws in areas with a history of poor water quality and five other counties were advancing plans to have bye-laws in place by mid-2001.

The designation of some areas as Nitrate Vulnerable Zones is a further environmental pressure faced by agriculture. Up to 13 groundwaters in Carlow, Cork, Kerry, Louth and Waterford have been identified as being polluted or susceptible to pollution by nitrates. The catchments which contribute to these waters are now being identified and are expected to be formally designated as Nitrate Vulnerable Zones shortly. This designation could lead to the imposition of severe restrictions on farming practices, including stocking rate restrictions.

These new controls mark the beginning of a more proactive approach to water quality protection. The entire process is being policed by the Environmental Protection Agency (EPA) which is insisting on receiving reports from all local authorities every two years between now and 2006.

Also, up to 110,000 farmers who are in receipt of livestock headage and some other EU payments will be obliged to adhere to 'Good Farming Practice' from 2001 onwards. This involves strict adherence to good pollution control, animal welfare and hygiene regulations as well as the protection of designated habitats and archaeological sites.

Farmers who are participating in REPS are likely to be deemed to be fulfilling all these new regulations. This makes the new REPS hugely attractive for the existing 45,000 participants and the projected 25,000 new participants between now and 2006.

In line with Teagasc recommendations, usage of phosphorus fertiliser fell by a further 1,000 tonnes in 2000. This, combined with a drop in the usage of nitrogen fertiliser, resulted in a saving of £6m nationally on fertiliser use.

Teagasc advisory staff played a critical role in preparing and supporting nutrient management plans for farmers in critical catchment areas. Staff were also involved in completing commonage plans on behalf of Duchas and the Department of Agriculture, Food and Rural Development.

Rural Enterprise

New Organic Training and Development Centre

A new national centre for organic training and development was established by Teagasc at Mellows College, Athenry, Co Galway during 2000.

Utilising the training facilities at Mellows College, introductory and up-dating courses will be provided for new and existing organic producers. Teagasc is also examining the provision of a full-time nationally accredited certificate course for young people interested in careers as organic farmers or in servicing the organic sector.

The new national training and development unit will adapt and disseminate the research information developed in Teagasc and elsewhere. The Teagasc research centre at Johnstown Castle, Wexford has already carried out extensive trials on organic meat and cereals and a major research project is currently underway at Johnstown Castle on organic milk production.

Organic production in Ireland has increased more than five-fold since the introduction of the Rural Environment Protection Scheme (REPS).

The area under organic production increased from 5,000 hectares in 1993 to up to 40,000 hectares in 2000, or about 1% of total farmland. The number of registered producers has increased four-fold to around 1,000 at present. Across Europe, the area devoted to organic farming is now approaching 5% and is predicted to reach 10% by 2007. In Sweden, Germany, Denmark and Austria, that 10% figure has already been reached.

Comprehensive Rural Enterprise Services

Almost 7,500 farmers and rural dwellers participated in Teagasc's integrated advisory and training programmes on rural enterprise. The largest number of clients was in rural tourism where 2,300 availed of specialist advisory and training services.

The demand for services in farmhouse/cottage food also remained strong with 850 individuals participating in a wide range of services. Around 40% of participants had already established a farmhouse/cottage foods enterprise.

Comprehensive services were also supplied for people involved in farm fresh and free range poultry, sport horse production and deer farming.

Almost 1,200 sport horse producers attended some 30 seminars and training courses were provided throughout the country on breeding and management, handling, schooling, judging and riding skills.

The programme on deer farming focused on lifting production efficiency and improving venison marketing from the country's 320 deer farms.

In poultry production, advisory and training services were directed towards promoting the opportunities for production of farm fresh and free range poultry and providing the skills for the expansion of existing enterprises and the establishment of new enterprises.

The production of outdoor cut foliage, which got underway in Kerry in 1993, increased further in 2000. A total of 225 acres of eight different lines of foliage was grown in Kerry, Waterford, Limerick, Wexford and Cork, with a sales value approaching £1m. A Teagasc adviser is working full-time on this project.

In floristry, the fifth annual course was held at Kinsealy Research Centre. Many of the participants have gone on to develop their own floristry businesses.

Economic Analysis /Rural Development

Impact of Policies Assessed

The impact of Agenda 2000 would lead to a drop of around 10% in the value of Irish agricultural output by 2007. However, this will be compensated by an increase of almost 25% in EU subsidies. In 2007, total subsidies will account for 72% of farm income compared with 56% in 1998.

This was one of the conclusions of the analysis carried out by Teagasc economists using the latest projections of the world and EU food sectors produced by the Food and Agricultural Policy Research Institute (FAPRI).

The analysis was based on the assumption that there will be no policy changes arising from the forthcoming World Trade Organisation (WTO) talks. The impact of different policy changes arising from WTO was the subject of an analysis in early 2001.

The economists also examined the impact of continuing parity of the euro and the dollar on farm incomes. This would have the effect of higher prices for farmers, resulting in an increase of around 6% in farm incomes by 2007.

The analysis also showed that farmers with a milk quota of 20,000-35,000 gallons in 2001 would need to increase quota size by up to 35% in order to maintain or modestly increase income by 2007. The most vulnerable group of dairy farmers is those with less than 20,000 gallons of milk quota, who accounted for almost 30% of total dairy farmers in 2000. The analysis shows that these farmers cannot profitably increase quota size and many are likely to exit dairy farming and avail of the more attractive off-farm opportunities.

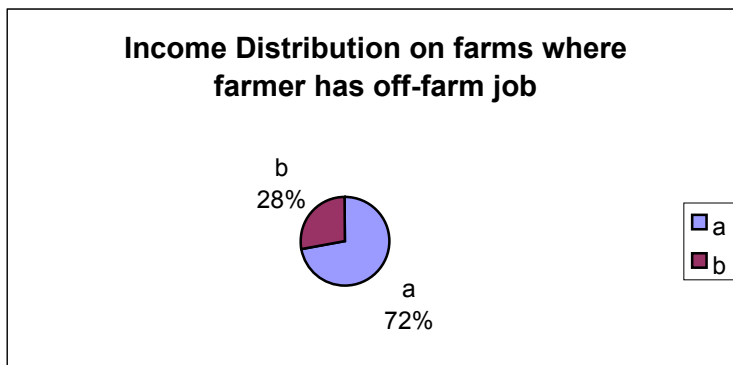
In relation to beef farming, the economists concluded that well-run beef farms, where the provisions of Agenda 2000 were fully availed of, could look forward to a net increase of up to 20% by 2007. This would bring incomes on these farms above the average industrial wage. However, there would also be a continuing increase in the number of part-time beef farmers. By 2004, two out of every three beef farmers are likely to have an off-farm job.

New Information on Off-Farm Income

The Teagasc National Farm Survey for 1999 contained, for the first time, estimates on the level of off-farm income.

Information was collected from two-thirds of the farms where the farmers had an off-farm job. This showed that the average off-farm income in 1999 was £10,900. The corresponding income from farming on these farms was £4,200, giving a combined income of £15,100 (Figure 1).

Figure 1

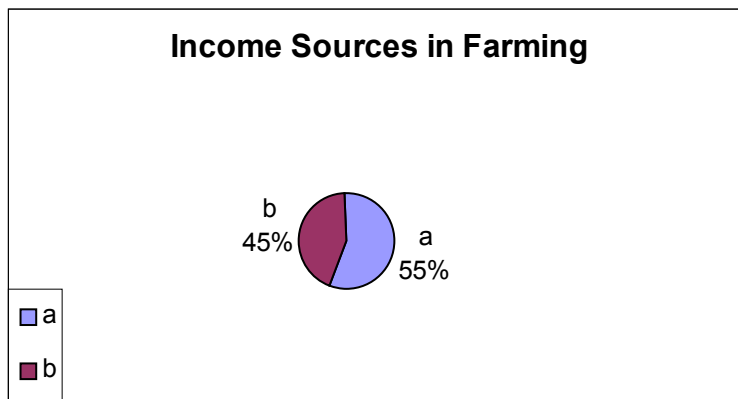


a = income from off-farm employment
b = income from farming

The authors stress that these estimates should be treated with caution because one-third of farmers with off-farm jobs did not give income data and also the fact that the information was received without documentary verification.

The 1999 National Farm Survey, which was based on an analysis of accounts kept-on a representative sample of 1,100 farms, showed a continuing increase in the number of farmers with off-farm sources of income. On 45% of all farms, the farmer and/or spouse had an off-farm job (Figure 2). On 32% of farms, the off-farm job was held by the farmer. The highest incidence of off-farm employment is on cattle and sheep farming.

Figure 2



a = no-off farm employment
b = farmer/spouse with off-farm job

The survey showed a drop of 18% in income from farming in 1999. Dairy farming had the highest average income, at £18,300 followed by tillage, at £16,600. The average on cattle farms was around £4,000, with larger farms (50-100 hectares) averaging just under £9,000. Sheep farmers averaged £6,000, with the larger farms making £11,000.

New Payments System Proposed

A move from the current animal-based system of direct EU payments to farmers to an area-based system could have considerable advantages for Irish farmers, according to an analysis by Teagasc.

The existing EU payments, based on animal numbers and stocking densities, are due to run until 2006. The proposed new system, outlined at the 2000 Teagasc Agri-Food Economics Conference, would involve paying farmers on an acreage basis with a bias towards small-medium sized farms and residency on the farm. Such a system is already in operation for REPS and comes into effect in 2001 for payments under the Disadvantaged Areas Scheme.

The new system would result in a significant improvement in the stewardship of the natural resources and would make a major contribution to the Kyoto emission targets. It would also shift payments to farmers into the more acceptable 'green' box, which is regarded by non-EU states involved in the WTO talks as production neutral.

It would mean that the EU taxpayer was funding a system which led to the production of public goods rather than just compensating farmers for price reductions. Most importantly, it would lead to a significant restoration of the economic link between the farmer and the consumer.

Survey of Farmers' Intentions

A Teagasc survey of farmers' plans for 2001 showed an increasing number intending to opt for forestry, reflecting the more attractive planting grants and premium payments introduced in 2000.

The survey was conducted among the representative sample of 1,100 participants in the Teagasc National Farm Survey.

It indicated that farmers planned to invest £270m in their farms, a 5% decline in their investment intentions a year earlier. Dairy farmers accounted for 50% of the planned investment with cattle farmers accounting for a further 33%.

The survey revealed no change in dairy cow numbers while beef cow numbers were planned to decline slightly. Sheep farmers were planning a reduction of 10% in the breeding flock.

Tillage farmers expected a big reduction in winter cereals acreage due to the very wet autumn planting season. Overall cereals acreage in 2001 was expected to be down by 2%.

New Regional Strategy Proposed

The selection of 12 strategically located centres outside of Dublin would bring most of the rural population within an hour's drive of a main centre of employment.

This was proposed by Patrick Commins, Head of Rural Development Research with Teagasc, at the 2000 Teagasc Agri-Food Economics Conference.

The development of key regional centres would have to be complemented by definite policies to improve the attractiveness of rural towns and villages for small-scale enterprises and as locations to live.

He said the continuing growth in the economy, even at half the 2000 rate, and a sustained expansion in employment will lead to the re-population of many rural areas. Around half of the country's 155 rural districts lost population between 1991 and 1996.

He predicted a continuing fall in the numbers working in agriculture, possibly to 4% of the national workforce by 2015, compared to 8% at present. However, there are optimistic prospects that the expansion in non-farm employment in rural areas will be more than sufficient to compensate for labour losses in farming.

He warned that by 2010 the Irish rural economy would operate in a much more different context than at any time since EU membership.

Enlargement of the EU to up to 30 member states, free trade, considerably reduced funding and increased competition are the main challenges. The settled policy environment between now and 2006 should be used to prepare for the more difficult years to follow.

The prospects for employment expansion and renewed population growth in rural areas depend considerably on the National Development Plan and especially on its capacity to achieve more balanced regional development. In this regard, the National Spatial Strategy, now being drawn up, must distribute the benefits of economic progress to more extensive parts of the country.

Study on Rural Poverty

Up to 30,000 farm households, half of which depend mainly on farming for their livelihoods, are living below the poverty line, according to the results of a report prepared by Teagasc in association with the ESRI for the Combat Poverty Agency.

Overall, farm poverty fell in the late 1990s, reflecting a growth in off-farm employment and a long-term decline in the number of farm households.

Low-income farm households are distributed throughout the country and are associated with small farms and drystock farming systems.

The report made a number of recommendations on changes to EU and national policy measures in order to alleviate rural poverty.

Forestry

Progress on Forest Soils Study

Under the major forestry soil mapping study being undertaken by Teagasc, parent materials have been mapped using soft copy photogrammetry for Mayo, Cork, Donegal and Roscommon with validatory field-work carried out in each of the four counties. Thematic maps of land cover have also been produced for these counties.

Topographical work has produced maps including, slope, landscape curvature and wetness index for Mayo and counties in Munster. A landscape classification map of Mayo has also been completed.

The study, which is continuing in 2001, is being funded by the Forest Service of the Department of Marine and Natural Resources. It will develop a national soils classification for forestry and a productivity ranking for all soils using the latest techniques in remote sensing and digital photogrammetry. It will be a critical support for professional decision making in forestry planning and development.

Forestry Will Boost Overall Farm Income

Over 30,000 farmers could significantly boost income by converting part of their farms to forestry, according to a Teagasc analysis of the new forestry grant and premium payments, introduced in spring 2000.

The Teagasc National Farm Survey shows that the average income on 35,000 cattle and sheep farms is just £200/hectare. This compares with the new annual tax-free premium of £300/hectare for forestry. The reality is that the majority of cattle/sheep farmers can convert part of their farms to forestry with no impact on the level of livestock premia they receive or on their overall income from livestock. Therefore, every extra hectare planted on these farms will mean a net increase in income of £300.

Over 10,000 farmers are currently receiving £20m per annum in tax-free forest premium payments. This could be more than doubled over the coming years without any impact on income from conventional agriculture.

A new forestry manual, produced by Teagasc and the Forest Service, was launched in 2000. Titled 'The Farm Forest', it is a step by step guide on planning, planting and managing a forestry enterprise. It was circulated to over 40,000 farmers. An expanded national advisory and demonstration campaign was also run outlining critical economic and management issues in forestry.

Food Research and Development

New Beef Safety Blueprint

A blueprint aimed at eliminating food safety hazards in beef slaughtering plant, was published during Meat Week 2000.

The new plan, compiled by food safety experts at the Teagasc National Food Centre, is aimed at ensuring consistently high standards across the entire beef processing sector.

Called the 'HACCP (Hazard Analysis Critical Control Point) for Irish Beef Slaughter', it details the critical safety practices which must be undertaken from the time the animal reaches the meat factory or abattoir until the carcass enters the chill room. It is based on the best food safety scientific knowledge available nationally and internationally.

While there are many publications on HACCP already available, none have the level of operational and scientific detail and the vital step by step approach contained in this plan.

Implementation of the new plan will shortly become a legal requirement for the beef sector. The EU is now in the process of enacting a new food hygiene regulation, which will replace 16 different hygiene directives and will legally mandate HACCP in all food processing operations, including beef plants.

In addition to the legal requirements, there are overwhelming food safety and consumer assurance reasons why this new plan must be implemented. There have been over 150 Ecoli 0157 confirmed cases in Ireland in the last three years with one death in 1996. Also, Teagasc studies have shown that over 3% of beef carcasses were Ecoli 0157 positive and 8% were salmonella positive.

It is vital for the beef industry to implement systematic, rigid practices in order to give consumers total assurance on the safety of Irish beef. This new plan offers the ideal vehicle to do this.

Cheese as a Health Food

New research findings by the Teagasc Dairy Products Research Centre at Moorepark and University College, Cork (UCC) on the production of low-fat and probiotic cheeses could revolutionise the role of cheese in the diet.

A Teagasc survey has shown that 65% of Irish consumers have a strong interest in cheese with particular health benefits. Women in the 18-34 age bracket are particularly health conscious and actively seek nutritional and health promoting information on food product labels.

Teagasc researchers have now developed new technology for producing low-fat cheese. Up to now, low-fat cheese had major problems with texture and flavour. The researchers believe they have now overcome these problems and are working

with a major manufacturer on the commercialisation of a low-fat cheese with excellent texture and flavour characteristics. This has very exciting possibilities.

A joint Teagasc/UCC team have also successfully developed novel probiotic cheeses. These deliver a high level of health-promoting organisms to the digestive system, resulting in protection against cancer and other disease. A major achievement of the project was the manufacture at industrial scale of 40 tonnes of probiotic cheese, which is now being test marketed.

Other highlights of the cheese programme at the Dairy Products Research Centre include:

- The development of novel varieties which will enable diversification by the Irish cheese industry. The new technology is now being transferred to a number of commercial companies.
- New technology, which provides cheese manufacturers with the potential to slow down the rate of maturation and thus extend the shelf life of cheese.
- Work continued on the role of non-starter lactic acid bacteria in cheese flavour.
- A culture production unit was developed at Moorepark Technology, the joint Teagasc/industry pilot plant. The primary objective of the unit is to transfer cultures developed by Teagasc researchers to industry.

Consumer Lifestyles Model

A new Consumer Lifestyles Model, aimed at developing a better understanding of consumer behaviour and attitudes to food purchase and consumption, has been established at the Teagasc National Food Centre.

It is based on a model developed in Denmark and has the potential to assist food manufacturers in developing products to meet changing consumer demands. The object is to build a Centre of Excellence in food market research.

The initial emphasis will be on building a consumer database for the prepared consumer foods sector. As the model is developed further, it can be applied to the dairy and meat sectors.

New Product Development Service

To address the perceived weakness in managing the innovation process in Irish food companies a new product development and innovation service has been established at the National Food Centre.

It provides established businesses and new start-ups with technical, marketing and business expertise, so new products can be launched more quickly and efficiently. The new service integrates all aspects of product development from idea generation and screening to consumer testing of the end product. The end result is greater efficiency and focus on current market needs.

In 2000 the new service ran in five companies with a total of 30 workshops and 30 consultancy visits. The participants included senior managers of companies with national and international brands.

Entrepreneurs working at the National Food Centre pilot plant also benefited from the new service. A highlight of this was the successful transfer of a new bread-based products company to a greenfield site at Longford. Other projects included ready meals, snackfood, petfood, fresh juices, the latter project also resulted in a small scale start-up.

As the new service grows it will benefit from the consumer lifestyle model which will provide manufacturers with state-of-the-art forecasts of consumers' needs and feed into the innovation process. Work also started in 2000 on a market study of innovation in rural based SMEs.

Intensive Research on Healthy CLAs

The Teagasc research programme on the positive human health effects of grass-based beef and milk production was expanded further in 2000.

It is now scientifically proven that milk and beef produced from grass contains greater amounts of healthy fatty acids, known as CLAs (conjugated linoleic acids), which the medical profession now accepts protect against cancer and heart disease. This offers an excellent marketing opportunity for Irish beef and dairy products.

The research is being carried out on milk at the Dairy Products Research Centre and on beef by the National Beef Research Centre at Grange and the National Food Centre.

The work in 2000 concentrated on elevating the level of CLAs. Using selected grass varieties and adding dietary supplements of pulp 'n' brew increased milk fat CLA levels. Researchers are also using microbiology where microbes can synthesise these beneficial fatty acids.

Research also progressed at the National Dairy Products Research Centre on the role of dairy flavour ingredients, which can be used in a range of snack foods and ready meals in promoting better health. Some of these new products contain high levels of butyric acid, which has been shown to have anti-cancer properties.

Focus on Quality and Safety

The emphasis on food safety and quality was maintained during the year. Among the highlights were:

- The major international research project on E.coli O157 co-ordinated by scientists at the National Food Centre and involving 31 European food and medical research institutes continued during the year. A study undertaken by Teagasc showed that over 3% of Irish beef carcasses are infected with E.coli O157, with incidence highest in the spring and early summer. This confirms the results of previous Teagasc studies.
- New systems for the detection of E.coli O157 in cheese were developed by researchers at the Dairy Products Research Centre.
- Further progress was made with the bacteriocin, Lacticin 3147, which is the subject of one of a world-level discovery by Irish researchers. The lacticin

research group at the Dairy Products Research Centre and UCC has become one of the foremost groups internationally in this area in recent years.

In 2000, the Teagasc/UCC team produced a number of pilot scale preparations of Lacticin 3147 and these have been successfully evaluated as a bio-protectant in a variety of food products, including infant formula, powdered soup, cottage cheese and natural yoghurt and have been shown to improve food safety. A major international food company which has now licensed the lacticin technology.

Another major development during the year indicated that Lacticin 3147 may have significant potential for human disease treatment and prevention.

- The Food Residue Database was further expanded and nine reports were issued to the food industry contain the results of comprehensive residue analysis in a range of products. The database will be developed further in 2001 through the incorporation of results from other sources in Ireland, including the regulatory laboratories.

The database is used primarily as a marketing tool to demonstrate the safety of Irish foods. It can be used to demonstrate compliance of Irish products with regulations and with customer specifications. It may also be used to identify problems in food production and processing, enabling early corrective action to be taken.

Consumers Want Independent Information

A Teagasc study of consumer attitudes to animal welfare shows a need for reliable information from independent sources on animal production systems.

The study, carried out by food marketing specialists at the Teagasc National Food Centre, reveals that while the media is the main source of information on animal welfare, consumers regard information from independent sources, such as government and retailers, as more reliable.

Based on in-depth discussions with consumer focus groups, it shows that food safety is the primary concern. Aspects such as type of feed used by farmers, growth promoters and the use of genetically modified organisms (GMOs) are top of their list of concerns. Also, the traditional grass-based system of beef production in Ireland is seen by consumers as the ideal system.

Consumer groups were shown a video of a range of production systems for eggs, poultry, pigmeat, beef and veal. While participants opted for free-range systems as the ideal, they were conscious that these may not be economically viable for both farmers and consumers.

Growing Demand for Ready Meals

Market research by Teagasc has shown that growing consumer demand for ready meals in Ireland and the UK offers significant opportunities for Irish food

manufacturers. While per capita consumption of ready meals in Ireland is only about one-third that in the UK, the market is growing rapidly, especially for chilled products.

Expansion in the number of women working, loss of cooking skills, reduced household size and increased disposable income are certain to lead to an expansion in the market for ready meals. Enhanced awareness of health and diet, the growing number of vegetarians as well as increased interest in ethnic and international foods will further drive demand.

A study by the Teagasc National Food Centre has shown that microwaveability is the single biggest factor affecting consumers' decisions to purchase ready meals. While consumers viewed these meals as expensive, the majority of the participants purchased them on a weekly basis. While chilled products were seen to be of better quality, frozen products were purchased in greater quantities due to their prolonged shelf life. Also 'own' supermarket brands were viewed in a similar light to branded ready meals.

The survey showed that women working in the home regard ready meals as snack foods - a meal for one for lunch or late in the evening. Women working outside the home place high importance on ready meals as a main meal. The results were outlined at a National Conference on Ready Meals run by Teagasc in June.

The key Irish manufacturer of frozen ready meals is Heinz, with an almost 30% share of the market. The 'Weight Watchers' range of low calorie, single portion recipe meals manufactured by Heinz in Dundalk are the single biggest sellers. The number of smaller companies producing meat and fish-based ready meals is also increasing.

The chilled ready meal sector is dominated by retailers' own brand products, most of which are imported at present. For example, Marks and Spencers carry up to 140 chilled meal products with Tesco offering about 30 own brand varieties. However, at least six Irish manufacturers are acquiring growing market share for a range of niche branded products and opportunities exist for import substitution.

Immobilising the Free Radicals

Vitamins A, C and E have a crucial role in neutralising free radicals, which attack the DNA system leading to a predisposition to cancer and heart disease.

Free radicals are grown naturally in the human body and are increased through exposure to sunlight, ozone, air pollutants, certain drugs and cigarette smoke. They lead to a cascade reaction resulting in damage to DNA, proteins and fats. There is now strong evidence that high levels of vitamins A, C and E can 'quench' these damaging free radicals.

Fruit and vegetables are powerful sources of vitamins A and C while vegetable oil is the best source of vitamin E. Five servings of fruit/vegetables/salads per day are recommended in order to deliver an adequate supply of vitamins A and C and food should be garnished with vegetable oils in order to get the required amount of vitamin E.

The topic was the subject of an international conference run by Teagasc in May. It heard that over one-third of Irish people consumed less than the recommended intake of fruit and vegetables.

The conference was also told that many newly developed convenience foods contain only small amounts of fruit and vegetables. A challenge for the food industry is to develop new products that combine wholesomeness and convenience.

Education and Training

Training Courses Updated

The year 2000 marked a watershed in agricultural education and training in Ireland. All Teagasc courses were upgraded and, for the first time, agricultural education and training was brought into the mainstream education system, with certification under the National Qualifications Authority of Ireland.

The historic changes involve upgrading of agricultural and horticultural training courses to third level status with applications through the Central Applications Office (CAO) from January 2001. The new third level courses are being provided by Teagasc college/institute of technology partnerships.

- A new two-year National Certificate in Agriculture is being provided by three agricultural college/ institute of technology partnerships.
- A new three-year National Diploma in Horticulture is also being provided by three horticultural college/institute of technology partnerships.

A key element of the new courses will be the option to progress to degree level, thereby opening up exciting possibilities for many participants.

Another key element of the new courses is the introduction of nationally accredited Vocational Certificate courses. Two-year Vocational Certificate courses in agriculture, horticulture, horse breeding and training and forestry are being introduced in 2001 at colleges and Teagasc local training centres.

The introduction of the new courses is being accompanied by a major refurbishment programme in agriculture and horticulture colleges. A total of £10m is being spent on bringing facilities in the colleges up to the standard of institutes of technology.

Over 1,800 Students Graduate

In 2000, a total of 5,000 young people participated in Teagasc training at 14 colleges, local Teagasc training centres and the Farm Apprenticeship Board. Just over 1,800 were awarded certificates and diplomas on successful completion of training.

Details of training courses and participation levels are given in Table 1.

Table 1: Training Courses and Participation Levels

<i>Courses</i>	<i>Completed 2000</i>	<i>Commenced 2000</i>
Certificate in Agriculture (1 year)	598	593
Certificate in Horticulture (1 year)	111	151
Certificate in Rural Enterprise (2 Years)	66	120
Certificate in Farming - Agriculture (3 years) College Option ¹	375	567
District Option	259	432
Diploma in Horticulture(3 years) Year 2 ²	107	111
Year 3	109	107
Diploma in Agriculture (Dairying)	30	34
Diploma in Agriculture (Machinery & Arable Crops)	0	15
Diploma in Agriculture (Farm Machinery)	18	20
Certificate in Farming - Pig Production ³	9	9
Certificate in Farming - Poultry Production ³	0	0
Certificate in Horse Breeding & Training ⁴	10	21
Certificate in Forestry	6	13
Horticultural Skills - Multyfarnham	4	5
Farm Apprenticeship Apprenticeship Scheme (3 years)	146	170
Trainee Farmer Scheme (3 years)	13	11
Diploma in Farm Management	18	20
National Certificate in Agricultural Science (2 yrs) ⁵	22	29
National Certificate in Business Studies ⁶	44	38
National Cert in Business Studies in Equine Studies ⁷	0	7
Adult Courses		
Advanced Cert in Dairy Herd Management	52	158
Advanced Cert in Tillage Crop Management	49	17
Advanced Cert in Drystock Management	17	0
Advanced Certificate in Business Management	0	11
Courses in Rural Business	1,261	1,261
Short Agricultural Courses	3,044	3,044
(1) Year one is spent doing the one-year Certificate in Agriculture Course (2) Year 1 is spent doing the one-year Certificate in Commercial Horticulture Course (3) Entrants must have Cert in Agriculture or Leaving Cert and satisfactorily experience (4) Conducted by Kildalton Agricultural College in co-operation with Thomastown Vocational School (5) Conducted jointly by Kildalton Agricultural College and WIT (6) Conducted jointly by Mountbellew Agricultural College and GMT (7) Conducted jointly by Gurteen Agricultural College and Athlone IT		

In spite of the difficult year in farming, the numbers enrolling in agriculture colleges in September 2000, at 700, was only marginally down on the previous year.

Over 7,000 farmers and rural dwellers participated in a comprehensive range of courses on all aspects of farming and rural enterprise. As in previous years, women accounted for a significant number of participants.

Training Part-time Farmers

New nationally accredited courses were introduced for mature students who currently have a job and will be taking over the management of a farm on a part-time basis. The continuing growth in part-time farming has created special training needs for an increasing number of people. The new courses are being provided at times which suit the work schedules of the participants. A number of courses got underway in 2000 and substantial expansion is expected over the coming years.

Growth in Food Training

Teagasc maintained its position as the major provider of training for the food industry. Almost 2,500 food industry personnel participated in courses provided by the National Food Centre. Specialised courses were also provided for the dairy processing sector by the Dairy Products Research Centre.

As in previous years, food safety dominated the training schedule with over 1,000 Irish food industry personnel participating. Special courses were also provided for almost 300 personnel from the Department of Agriculture, Food and Rural Development and Environmental Health Offices.

A new feature of the food training programme was the introduction of training for over 500 personnel from the Czech Republic. The courses concentrated on equipping the participants with knowledge on food safety requirements in preparation for the accession of the Czech Republic to the EU.

Other highlights of the food industry programme included courses on food product innovation and on the establishment of small food enterprises in rural areas. A full outline of the National Food Centre training programme is given in Table 2.

Table 2: National Food Centre Training Courses 2000

Course	No. of courses	No. of participants
Foundation course for food handlers	37	876
HACCP	28	376
HACCP for DAFRD	10	200
Internal auditing	1	10
Food safety auditing for EHOs	6	72
Introduction to food safety auditing	1	6
Food safety training for West Cork cluster group	2	30
Laboratory auditing	6	53
IBEC Train the Trainers	1	14
Food legislation/legal labels	3	55
Food safety legislation for Czech Authorities	14	520
Managing innovation	6	45
Sensory analysis	2	33
Grain testing	2	6
Rural enterprise micro companies	4 topics x 5 courses	58

The establishment of a Centre of Excellence in Food Industry Training at the National Food Centre, under the new £25m investment programme in Teagasc research facilities, will ensure that training programmes are delivered to the highest international standards. The close linkage between the new national training centre and the National Food Centre research programme will greatly enhance the quality of training by ensuring that courses are continuously updated by emerging technological developments.

The new training initiative will be developed in close collaboration with the Food Safety Authority of Ireland, thereby ensuring that a food safety culture will be inculcated at all levels within the industry.

Big Focus on IT Training

A significant feature of the Teagasc training programme in 2000 was the provision of training courses in IT for over 2,500 farmers.

A total of 250 courses were held covering the entire country. The courses involved partnerships between Teagasc, second level schools, institutes of technology and private trainers. They were aimed at giving farmers the competence in IT and in the use of various software packages which are a growing feature in farm business management.

Two levels of training were provided. The Beginners Course involved an introduction to computers and a familiarisation with the software packages available. The Advanced Course concentrated on providing the expertise in using packages, such as breeding charts, farm account keeping and VAT recording and returns.

The IT training programme is being expanded further in 2001 with the development of standard support materials for tutors and trainees and the introduction of an online evaluation for participants. These initiatives are being funded by the Information Society.