70 years of grassland research in Ireland

TEAGASC grassland research has enabled the transformation of Irish agriculture since the 1950s.

Introduction

The importance of grassland to agriculture in Ireland is indicated by over 70 % of agricultural output (monetary terms) coming from grassland as cattle, milk, and sheep products. This paper gives a summary of the key developments in grassland research over the last 70 years. Initially, grassland research was led by the Department of Agriculture (Johnstown Castle) before the establishment of An Foras Taluntais (AFT) in 1959. Grassland research was transferred to AFT and then to Teagasc. Grassland research was carried out at AFT/Teagasc research centres, including Moorepark (dairy), Grange (beef/sheep), Creagh/Belclare/Athenry (sheep), Oak Park (grass and clover breeding), and Johnstown Castle (soils, agronomy and environment).

Evolution of grassland science

Increased production from grassland has arisen from improved understanding (research and practice) of soil and plant nutrition, plant physiology and cultivar improvement, while improved understanding of feed evaluation, ruminant nutrition, grazing management and silage technology has contributed to increased utilisation of grassland. Annual grass dry matter (DM) production varies from 12.7 to 15 t DM/ha based on Department of Agriculture, Food and the Marine (DAFM) variety trials. More recent data from PastureBase Ireland indicate that average annual grass production on efficient dairy and drystock farms is 13.5 and 10 t DM/ha, respectively.

In the early 1960s, national stocking rates were less than 0.8 LU/ha. The first experiments demonstrated that with some nitrogen (N) for silage, it was possible to stock at 2 LU/ha. Experimental design consisted of self-contained farmlets using rotational grazing. The use of these systems (blueprints) was of great benefit to both advisors and farmers on how best to manage both livestock and grassland at farm level. By the mid 1970s, 2.47 LU/ha or better became the norm on dry soils on commercial grassland farms. Over the next number of years other factors influencing output per hectare were investigated, e.g., soil type/drainage, level of N, genetic merit, concentrate supplementation, and grass species/variety.

Research in the 1990s highlighted the influence of grassland management on animal performance and the importance of grass budgeting using decision support tools to aid grassland management. Additionally, the benefits of extending the grazing season in both spring and autumn, matching feed demand to grass supply and the importance of pasture-based animal genetics were identified.

Forage legumes were highly regarded initially, and then declined (mainly due to the use of high levels of N), but are once again assuming much more importance. Recognition of the environmental implications of grassland management has increased, especially over the last two decades. This includes the need to reduce nutrient emissions from agriculture, improve water quality, and also the role of grassland in biodiversity protection, carbon sequestration and landscape quality.

Key developments from grassland research

The objective of all grassland research is to study the factors that can increase the output of animal production in a sustainable way and integrate this knowledge into a complete, integrated system.

Some key developments over the last 70 years include:

- Research at Johnstown Castle quantified the effect of N, phosphorus (P), potassium (K) and lime on grass production. The first soil survey in the 1970s mapped the soils of approximately half the country. This provided information on productivity of soils and showed that soil drainage was a significant determinant in the level of production achieved. It was estimated that over one million lowland hectares required drainage, which led to the development of both shallow and deep drainage systems. The knowledge gained from soils and environment research over many years is today captured in the 'Teagasc Green Book'.

- Much of the early work carried out at livestock centres (Moorepark, Grange and Creagh) quantified the effect of stocking rate on milk, beef and lamb growth rates. Additionally, the influence of the grassland system (rotational versus set stocking), soil type, drainage and N use were investigated. The application of this knowledge led to the development of blueprints of systems on animal production. In all these systems, the whole management programme for both animal and pasture was specified. These systems are now widely used on farm.

- A key challenge in the early years was the availability and quality of winter feed. There was a great dependence on hay. In 1958, only 160,000 tonnes of grass were conserved as silage, whereas by 1976 this had increased to 10 million tonnes. The reasons for this expansion included the development of simple unroofed silos in conjunction with polythene covering, use of the cold fermentation process, self-feeding systems, and the elimination of the risk in saving hay due to weather conditions. Key innovations (developed mainly at Grange) include knowledge on when and how to conserve grass silage, assessment of its feeding value and how it should be supplemented.

- Systems of grassland management evolved, which placed greater emphasis on grazed grass rather than grass silage or concentrates in animal production. Key livestock production decisions like calving date (dairy, beef) and lambing date for ewes were targeted to maximise use of grazed grass. However, this was only possible where grass-based animal genetics were used. Product quality also improved, and this gave Ireland a unique marketing advantage in the production of 'grass-fed' animal products.

- Grass and clover breeding was initiated at the early stages, so as to breed varieties more suited to the Irish environment. Initially, the focus was placed on yield, but this changed over the years to give greater emphasis on seasonality of yield and quality. Over the period 1973 to 2013, it is estimated that annual DM yield increased by 0.52 % under conservation and 0.35 % under simulated grazing. Over this period, there is no indication of any increase in herbage digestibility.

- Considerable resources were used over the years to strengthen capacity in grassland science. This facilitated a greater understanding of the influence of grazing management on animal performance. The importance of pre- and post-grazing height, as well as pasture allowance, were identified. The use of markers to measure herbage intake helped greatly to understand the interaction between grazing management and animal nutritional requirements. Knowledge gained from this work facilitated extending the grazing season (spring and autumn). These advancements in grassland science have led to the development of decision support tools for farmers (e.g., PastureBase Ireland).

- In the early 1980s, an annual target of 6,820 litres per dairy cow (3.5 % fat and 3.2 % protein) and a liveweight gain in beef production of 1,680 kg/ha, at a stocking rate of 2.47 LU/ha were identified. Using the current Teagasc Road Maps, dairy farming nationally is averaging 6,224 litres/cow at a stocking rate of 2.2 cows/ha (corrected for changes in milk composition), while current research performance is approximately 7,164 litres/cow at a stocking rate of 2.70 cows/ha. The corresponding national performance in suckler beef production is 446 kg/ha, while the current research performance is 983 kg/ha.

Challenges for grassland science in future

Over the past 70 years grassland research has contributed significantly to increasing animal production from grassland. The continued development of grazing technologies will be critical in increasing the future sustainability of grassland farming. Research programmes in the future will place greater emphasis on confronting challenges in relation to climate change, water quality, N-use efficiency, and ammonia emissions.

Authors

Pat Dillon
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork
Correspondence: pat.dillon@teagasc.ie

Seamus Crosse
Former staff member, Dairy Production Research Centre, Moorepark, Fermoy, Co. Cork

Edward O'Riordan
Teagasc, Animal & Grassland Research and Innovation Centre, Grange, Co. Meath