# THE CONTRIBUTION OF RESEARCH TO GRASSLAND FARMING SYSTEMS IN WESTERN EUROPE

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## INTRODUCTION

Ireland is a country that has drunk with profit and satisfaction at the pool of knowledge in grass farming — a pool that owes very much to New Zealand's science and practice.

As yet, Ireland has contributed too little to this store of knowledge. This may be a result of our late entry into effective grassland research; the 20 years since our Research Institute was established may not have been vintage years in the harvest of grassland research. Certainly Ireland has not produced a research leader comparable to Dr C. P. McMeekan, whose memory we recall today.

Mac was a penetrating, accurate observer in the many disciplines relevant to animal production from grass. He was the complete farmer who sought an effective service for his industry from every specialized field of science. He was impatient in applying established fact to farm practice. This honest, sensitive, eloquently expressed impatience was a stimulus to farmer and scientist alike.

I remember during his last visit to Ireland we discussed results of sheep crossing trials involving various fat lamb sires, including the Dutch Texel. He accepted that the Texel showed excellent performance in lean meat production, excellent eye muscle area, little fat; he saw variation between individual Texel rams in growth rate; some quite good, some less impressive. "Yes," he said, "use the Texel to build up your French lamb trade, but don't neglect a performance and progeny test programme." Then he contrasted the progeny of Texel sires with that of the Southdown, and he pondered on the economic consequences of New Zealand's complete commitment to an early maturing, rather fat sire line. He wanted decisions at farm level related to scientific logic and to economic reality.

But reminiscences of McMeekan, interesting though they be, will not provide us with a paper worthy of the man. He himself would join us in a glass this evening, and with energy would enter discussion on the serious question: what is the present state of progress in research on meat and milk production from grass?

Are we increasing the yield potential of pasture?

Have we resolved the balance betweeen fullest utilization of pasture by the grazing animal and any consequent depression in animal performance?

Are we making progress in increasing the efficiency of the grazing ruminant?

In brief, can we grow more grass, and can we utilize it more efficiently? In this discussion I will outline the major contribution of research to grass farming systems in western Europe over the past two decades. I will endeavour to identify our areas of success and of failure and will suggest possible avenues of future progress.

## FACTORS RESPONSIBLE FOR INCREASED OUTPUT FROM PASTURE

In the period since 1960 the application of knowledge of five factors has been responsible for the greatest part of growth output in meat and milk from pasture. These factors are: (1) increased stocking rates; (2) emphasis on highly digestible fodder, particularly in conserved grass; (3) maximizing the input of nutrients in the dairy cow in the first 60 days of lactation; (4) topdressing with fertilizer nitrogen at levels of 200 to 250 kg N/ha; (5) rotational grazing.

Let us briefly discuss each of these production inputs.

### Stocking Rate

This relates directly to McMeekan's observation that, without adequate grazing mouths, the full output of a pasture will not be consumed; as much as 30% of grass dry matter can just be wasted with little visible indication of the waste involved. There is of course a delicate balance between maximizing product output per unit area and minimizing depression in individual animal performance at high levels of stocking. As a generalization, output per hectare is highest when stocking rate slightly depresses animal performance, perhaps by not more than 15%. In Ireland, on well fertilized pasture, optimum stocking rates are in the region of 3 cows per hectare. With grazing beef cattle the optimum is about 3300 kg liveweight of grazing animals per hectare in late spring and early summer; this stocking level would decrease as the season advances.

To a limited degree the stocking rate picture is complicated by a factor identified in Irish research: there is a very definite depression in grass dry matter production on heavily stocked

pastures. The depression amounts to about 12% and it occurs on free-draining as well as on retentive soils. Let us accept, of course, that the greater capacity of livestock to utilize pasture output at high stocking rates is far bigger than the growth depression. Use of dense, high-tillering strains of ryegrass may help to overcome, at least partly, this phenomenon.

Not least among the bonuses arising from increased stocking rates is the fact that more critical and more effective examination of the factors influencing pasture output can only be done at high levels of stocking. This is a critical point in making further advances in grassland research.

## Forage Digestibility

High intake of conserved grass is an essential part of economic milk and beef production in Britain and Ireland during the winter period.

Following on U.S. nutritional work, Frank Raymond and his colleagues at the British Grassland Research Institute showed that the voluntary intake of forage nutrients is critically determined by digestibility. The higher the digestibility of grass, silage or hay, the more dry matter is consumed, and of course each unit of dry matter carries more energy.

For cows in full milk production and for fattening cattle, farmers are now aiming at a silage with a digestibility of 68 to 70%. With this feed, dry matter intake is 2% of body weight or better. Quality silage conservation is assured either by the use of formic acid or by wilting. In Ireland's damp climate, hay is not part of the winter feed programme on any commercially oriented milk or beef farm.

## Nutrition in Early Lactation

In the past 25 years, workers in Beltsville (U.S.A.), at the NIRD (U.K.), in Denmark and in Holland have clearly shown that nutrient intake in the first 60 days or so of lactation is the single most important factor determining lactation yield. In this period the cow is most efficient in her yield response to feed and there is a major carryover effect throughout lactation. Moreover, a cow calving down with body fat reserves can use this fat to enhance yield in early lactation and add to the carryover effect. Realization of the critical importance of early lactation yield has contributed substantially to the expansion of European milk output in the past 6 or 7 years.

commitments. An elaborate system exists within the EEC to test new varieties, using cutting techniques to compare yields. But the end result in terms of improved pasture performance is negligible. One Italian ryegrass produced by the Belgian State Breeding Organization is giving a 20% production boost over its contemporaries, and it combines this yield performance with a good working life — as much as 3 years where management is good. Such breeding performance is exceptional.With perennial ryegrass the yield increases offered by the best new varieties are less than 5% over a 15-year period. In this period there have been some improvements in factors such as longevity and tillering capacity; slight changes are noted in digestibility, but, in general, grass yield is not showing the response we have seen in other forage crops.

New grass-breeding techniques are obviously needed. One of these may be the use of artificially induced male-sterile lines of ryegrass. With these it is hoped to produce perennial hybrids with established hybrid vigour. A number of European countries, including Ireland, are now using this technique; already the Dutch, with an eye to early commercial advantage, have a hybrid variety under test at home and in neighbouring countries. Another breeding technique with promise is the use of tetraploid ryegrasses to replace the existing diploids. Tetraploids have been on the market for more than a decade and a half. Their cell structure is larger; moisture content is higher; digestibility is slightly better. However, total dry matter yield increase is not significant so far. Testing of tetraploids with grazing animals has been limited. One exception is a large-scale Irish trial. In this a tetraploid with early growth capacity is compared with known high merit diploids using grazing beef cattle. The trial is now entering its seventh year. In each year the tetraploid ryegrass has consistently outyielded its early-growing diploid counterpart by 8 to 10% of beef cattle liveweight. Superiority is being maintained despite the fact that the tetraploid pasture looks thin and miserable. The variety involved is not an outstanding pasture grass, but the leaf material it produces gives better animal performance. There is also evidence of superior animal performance with tetraploid silages. The breeder may have some hope of success along the line of improved tetraploids. Certainly he needs a break.

### Rotation Length

Another disappointing area in the development of grass output is our inability to exploit the principle that increased leaf area

will result in increased dry matter production. Irish workers have failed to increase animal output in any variable of grazing rotation length in the range of 10 to 30 days. Rotation length may be varied as a management device to control stem in early summer or to build up a reserve for use in a dry period, but it does not appear to increase total dry matter production. Am I correct in assuming that New Zealand has encountered a similar problem?

Theory would very much suggest a long rotation that offers a larger photosynthetic area and that provides greater harvesting ease for the grazing animal; this should result in higher milk and meat output. What is the key to linking theory to performance?

With slow progress in breeding and little success in manipulating grazing-management techniques, pasture yield under conditions of optimum husbandry appears to be at a plateau in western Europe. This is not a desirable situation for any country whose livestock economy is based on grassland.

## A COMPARISON OF EUROPEAN GRASS- AND GRAIN-GROWING TECHNOLOGY

A yield of 5 t/ha has been accepted by the National Institute of Agricultural Botany in Cambridge as a norm for wheat grown under good conditions of husbandry. This yield figure has actually been doubled by large numbers of grain growers in Belgium, north-west Germany, and now in Britain and Ireland. These high-flying growers obtaining wheat yields of 10 t/ha have adopted sophisticated production techniques developed by McMeekan-type research leaders. Here I include Dr Laloux in Belgium and Professor Effland in Schleswig-Holstein, north-west Germany. These men have developed, separately, a grain-growing technology that uses responsive varieties, very accurate seeding rates, and high levels of nutrients, particularly nitrogen, applied in precise quantities and with exact timing; they use growth regulators to control lodging, and there is meticulous spraying against fungus and insect diseases. This method of grain growing demands a high level of management skill, but it also leaves high profits — so high that in Schleswig-Holstein today grain farming has replaced grassland in the programme of every commercially oriented farmer.

This technological breakthrough has come entirely from multidisciplinary research, well co-ordinated and intelligently led. It owes more to the manner in which research resources have been harnessed than to the magnitude of these resources. Also in both Belgium and North Germany a tremendous symbiotic relationship

has developed between grain growers and the research organizations. As I mentioned, the spark of McMeekan exists in both Laloux and Effland.

At this moment we do not see the same single-mindedness in European grassland research. It is true that grassland work is far more difficult. The intermediate product, grass dry matter, is more difficult to measure than grain. In assessing the end product, meat or milk, the animal introduces many complications. Hence, all the more reason for greater teamwork in grassland research; we need more precise definition of objectives and more accurate analyses of the barriers to increased pasture output.

Research bureaucracy will not provide the necessary cutting edge in clearing the undergrowth of confusion. I hope I am not unfair in saying that the British Grassland Research Institute has adequately demonstrated this. Nor in Ireland can we be too complacent; progress has been made, but our work is all too fragmented.

What then can be done about stimulating fresh progress in grassland research? We cannot await another McMeekan or another Stapleton. Personally, I would suggest that a number of alert minds from interested countries should come together to tease out the problem. A brainstorming session involving active workers from New Zealand, Ireland, Britain, Holland and Belgium might help to clear the air and lay plans for the future. The areas of the world dependent on intensively managed temperate grassland are all too few. They should be working more closely together.

## THE CONTRIBUTION OF ANIMAL BREEDING

If we now move from agronomy to examine the animal breeding contribution in milk and beef outputs, we see the New Zealand Dairy Board's record of success. Its dairy bull selection programme and its organization of artificial breeding have applied knowledge to the fullest.

A large-scale detailed comparison of Friesian strains from New Zealand, Canada and Ireland has just been concluded in our country. The daughters of New Zealand bulls were about 12% above the Irish breed average in butterfat yield; they were about 3% better than the progeny of the best Irish AB bulls. The results indicated that the Canadian Holstein population is superior to that of New Zealand in fat yield, but this may be counterbalanced by weakness in feet and in infertility observed in Holstein progeny both in Ireland and in Holland.

One observation I would make: the Irish analysis of this trial suggests that, on average, young bulls entering the progeny test programme in Ireland are slightly better genetically than young bulls entering the New Zealand test programme. The ultimate superiority of New Zealand AB bulls comes from the greater number tested and the higher selection intensity. But knowing the efforts put into young bull selection in our two countries, and particularly recognizing Irish limitations, I would have expected a much higher level of relative performance from the New Zealand young bulls. Perhaps the Dairy Board has scope for a new leap forward.

In beef qualities the male progeny of New Zealand AB bulls were quite inferior to their Irish contemporaries; their average carcass weights were 9 kg lower and there was a further reduction in the unit value of the carcass. Total carcass value of the New Zealand progeny was about 4% below that of the Irish. This difference is not sufficient to justify any swing in selection pressure towards beef in black and white AB bulls.

In Ireland, beef does come from the dairy herd. It comes not only from the male Fresians but also from all calves that result from the mating of half the national Friesian herd with beef bulls. Until recently the Hereford breed has dominated the beef crossing scene. Now there is a swing towards Charolais and similar highly muscled breeds. The Hereford carcass is too fat for the better-paying Italian, French and German markets. The Charolais offers a faster growth rate and a higher level of carcass acceptability because of its lower fat and superior muscling. Meat factories now pay a premium of 6% for Charolais-Friesian crosses over pure Friesian or Hereford crosses. However, the threat of calving difficulties has limited the level of Charolais use to about 10% of total inseminations. Difficult calvings are not acceptable in the dairy herd. The AB organization is identifying Charolais sires whose progeny have few calving difficulties. Such bulls exist and their semen is now available from AB services.

Largely with ease of calving in mind, a programme has been initiated in Ireland to establish a new synthetic breed of highly muscled fast-growing beef cattle. The components of the new line will be mainly Charolais, Limousin and Blond d'Aquitaine. The work is being done by the Agricultural Institute with finance from the farming industry, and it is following the lines of a similar programme that has been successfully operating in France for some years. Semen from high-quality Charolais bulls, proven

for growth rate and ease of calving in Sweden, Canada, Britain and Ireland, is being used.

Holland also seeks a better beef carcass from the progeny of its Friesian cows. Having rejected the French breeds because of calving difficlties, it tested the large Italian breeds and is now using Piedmont bulls in AB. Calving performances are similar to those of the black and white, and carcasses are comparable with the Charolais in musculature.

## TRADE IN ANIMAL PRODUCTS

In his later years McMeekan devoted himself to world agriculture, participating in the World Bank programme to increase the amount and quality of food available to humanity. In this programme he was not unaware of market inhibitions operating to the disadvantage of both food producers and food consumers.

In this context, Ireland's experience may be of interest. In the 1930s, some time after Independence, Ireland initiated a policy of industrial protection. Industry was built almost from scratch behind tariff barriers that effectively kept out competition. During this period Irish agriculture, never very strong, stagnated.

In the post-war years, industrial protection continued while agriculture competed, as best it could, against the highly protected food producers of Britain and Europe. It was not until the Anglo-Irish free trade agreement of 1965, and more particularly Ireland's entry into the EEC on January 1, 1973, that major policy changes occurred. Industrial tariffs were dismantled and Irish meat and milk products obtained entry to large and profitable food markets. With tariffs gone, many of the older, less competitive Irish industries languished; newer competitive ones are coming to take their place. But with free trade Irish farming has profited handsomely. Prices are attractive, production is growing. In the past year the increase in milk output over the previous year was as great as the total output of factory milk in 1947.

Is there any parallel in this for New Zealand? Can New Zealand establish a reciprocal trading arrangement or even a free trade area with any of the fast-growing industrial countries of the East?

Japan obviously comes to mind. Its population, increasingly affluent, is now over 115 million; its spending power is increasing at 6½ to 7% per annum, and yet an introverted food policy confines Japanese meat consumption to 18 kg per head per annum.

That figure is the current Irish level, and history shows that the Irish are t always heavy meat eaters.

South Korea is also interesting as a very rapidly growing industrial country; the population is approaching 40 million; GNP is maintaining a steady growth of 10 to 12% per annum. Again meat consumption is miserably low at 12 kg per head. A potential market certainly exists in this region, and the Korean peasant is in no way geared to satisfy it at present. Perhaps New Zealand should endeavour to pre-empt the growth of strong local vested interests in meat production. As in Ireland, some understanding of industry may be needed.

## CONCLUDING REMARKS

In covering the broad canvas of the link between research, production and markets I have omitted discussion on the important minor details that combine to make an efficient grass livestock industry. Here I should include the well-managed milking shed, the machine inflations that give top milking performance and minimum mastitis, fertility, parasite control, indeed the entire animal disease complex.

McMeekan's energy and vision embraced all. May his inspiration remain in grass farming both in your country and in mine. I have been honoured to give his Memorial Address.