Presidential Address

RESEARCH IN DAIRY COW NUTRITION

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It is probable that 1978 will be a year of some significance to those of us concerned with agricultural research. Within the Ministry of Agriculture and Fisheries, the retirements of the Director of Agricultural Research, and the Director of the Ruakura Animal Research Station are, in themselves, events of some consequence.

Winds of change will be generated during implementation of the policies of their successors. I expect these to be increased to a gale as they and other directors struggle with the problem of financial constraints on agricultural research and the increasing need to keep, if not get, animal production moving. We are also reminded at intervals that agricultural research is not held in awe by all. As one critic wrote recently, "One must seriously ask whether the sluggish state of agriculture in recent years has been due to ineffective extension of research findings, or whether research is being misdirected and concentrating on the wrong priorities" (Pinney, 1978).

It is therefore an appropriate time for all members of this Society to review their contributions to animal production. This address attempts to do so for one field of research, dairy cow management and nutrition. It briefly surveys recent research within the Research Division, draws attention to some deficiencies of knowledge in applied dairy cow nutrition, and very briefly comments on the requirements for correcting these deficiencies. A restricted view is adopted partly because of limited competence outside my speciality, but also because, if there are deficiencies in what is a traditional field of research for at least the Ruakura Animal Research Station, then how much greater the deficiencies must be in other areas.

One measure of the Research Division's research activities is provided by the number of approved research projects. These have been classified in Table 1 by a subjective and perhaps questionable appraisal into major fields. The scope of the project is ignored, with equal weight being given to one of 10 years dealing with the introduction of exotic sheep breeds and one of three weeks concerned with the germination of beans. Some of these approved projects were probably not implemented, whereas others were implemented but not approved. Similar information for the years preceding 1968 was not readily obtainable.

TABLE 1: APPROVED PROJECTS IN THE RESEARCH DIVISION, MAF, 1968-77

Subject	*No.*	*%*
Sheep	456	16
Dairy	202	7
Beef	147	5
Pigs	24	< 1
Deer	23	< 1
Pasture	506	18
Crops	377	13
Horticultural crops	348	12
Fertilizer	262	9
Insects and pests	205	7
Protein extraction	17	< 1
Miscellaneous	312	11
Total	2879	

During the period surveyed, sheep generated more research proposals than all other animal species combined, exceeded only by the number classified under pasture. Non-horticultural crops, insects and pests have generated 3 and 4 times the number of projects concerning dairy and beef, respectively.

Of the number of projects associated with sheep, beef and dairy cattle in Table 1, those concerned with the management and nutrition of dairy cows were fewer than similar trials with either sheep or beef cattle (Table 2). Other dairy topics that have received considerable attention are reproduction and health, with only 7 projects being concerned with milking machine design, performance or milking techniques.

The subjects covered by the 79 dairy nutrition projects are indicated in Table 3. Twenty-three projects have been concerned with young stock. Nearly all of these were devoted to calves up to about three months of age and examine various aspects of

TABLE 2: PROJECT TOPICS WITHIN SHEEP, DAIRY AND BEEF CATTLE, RESEARCH DIVISION, MAF, 1968-77

Topic	*Dairy*	*Beef*	*Sheep*
Total	202	147	456
Nutrition	79	98	172
Other	123	49	284
Reproduction	23		
Health	40		
Milking	7		
Miscellaneous	53		

TABLE 3: PROJECT TOPICS IN DAIRY NUTRITION AND MANAGEMENT, RESEARCH DIVISION. MAF, 1968-77

Topic	*No.*
Young stock	23
Maize silage	14
Pasture silage and hay	6
Levels of pasture	5
Other feeds	13
Small farm experiments	5
Total	79

early weaning, and the feeding of milk replacers and meals. Silage, hay and feeds other than pasture accounted for 33 projects. Thus, only 10 projects were concerned with a major interest of dairy farmers, the pasture-fed cow. These were divided equally between management studies invoving small farms and short-term trials described here as levels of pasture.

This apparent inactivity in the field of dairy cow nutrition and management would be excusable if its problems were already resolved. I believe that this is not the case, and many unknowns are as yet unexplored. Some of the more important are considered below.

FEED PRODUCTON

Without question a major factor limiting substantial increases in the productivity of the best farmers is feed production. Results indicate that combinations of summer crops, such as maize, used in conjunction with winter crops, such as oats, can yield more than twice the dry matter production of pasture. Work in this area has intensified in recent years and there has been a pronounced swing away from the plot trial mentality to a more meaningful paddock and farm scale approach. Even so it will be many years at the present rate of activity before it will be known:

(a) Whether the yields of maize of about 20 t DM/ha can be sustained.

(b) Whether those of the winter crop can be lifted from their present levels of 2 to 5 t DM/ha to their immediate potential of 10 to 20 t DM/ha (Eagles and Taylor, 1976).

(c) What are the optimum systems of crop usage, and the effect of these on the profitability of dairy farming relative to the more traditional grassland systems.

It may yet be possible to obtain worthwhile increases in dairy cow production from the use of improved strains of pasture species. These are released in a steady if unspectacular flow but few attempts have been made to examine whether their introduction into existing dairy pastures is accompanied by improved animal performance. The beliefs surrounding the contribution of these "improved" strains in dairy pastures are therefore largely hypothetical. The inferred asumption that the technology is available to ensure the establishment and maintenance of these strains in existing pasture is, in my judgement, incorrect.

The chances of converting any increase in feed production into extra animal production will depend in part on developing a profitable system of overcoming summer feed shortages. These shortages account for much of the between-year variation in production of individual herds and are the main reason why average lactation length is closer to 250 than 300 days.

STOCKING RATE

McMeekan at Ruakura was among the first to demonstrate the pre-eminence of stocking rate in determining output per hectare. Now, about 20 years later, farmers and advisers are still awaiting a definition of the relationship between stocking rate and the performance of pastures and animals. What happens to milk yields, length of lactation, herd wastage, cow fertility and health, pasture composition, yield and quality if cows of this breed or that are farmed at, say, 5 cows/ha rather than 0.5, 0.75 or 1.25 times this rate? How are profitability, managerial outlook and labour affected? What for each stocking rate are the targets or decision rules on which rational management decisions should be based? When these and similar questions are answered, there will be some justification for talking of optimum stocking rates.

YOUNG STOCK

Each year some 400 000 heifers enter the national milking herd. Yet the relationship between the treatment of these animals during their two years of carefree consumption and their milk-producing ability, longevity and reproductive performance at the various stocking rates they will experience is steeped in mystery. As a consequence any recommendations as to target liveweights, growth rates or size during those two years are speculative.

CONSERVATION

Pasture harvested as hay and silage is, in terms of area, the largest crop harvested by mechanical means in this country. Yet a systematic study of the relationships between stocking rate and the extent, form, and timing of conservation has never been undertaken with sheep, beef or dairy cattle. This state of affairs is made even more incomprehensible with the realization that, in at least some very high producing systems, the best may be one of no conservation (Brougham, 1975). A further dimension of unreality arises from the contrast between the ready acceptance by farmers of modern conservation technology from overseas and the hesitant activity in this area by our own scientists. For example, the wilting of pasture for silage is being adopted by dairy farmers but information to assist them in deciding on the type of machine, fineness of chop and degree of wilt must be sought in the talk of salesmen rather than the work of scientists.

USE OF SUPPLEMENTS

The worst effects of summer feed shortages may be avoided either by feeding supplements in summer or by calving early. A probable outcome of the latter is that the feed deficit is transferred from summer to late pregnancy-early lactation. Establishing which is the most effective of these two alternatives is a prerequisite for designing efficient systems involving both high producing crops like maize and grazed pastures.

GRAZING MANAGEMENT

Deeply entrenched in grazing management lore for the dairy farm is the sacred tenet of rotational grazing. Certainly it is a system of management that has the attribute of generating endless debate on the merits and demerits of various rotational lengths. This is despite evidence that animal performance is not greatly affected by rotation length, at least during the most of spring, summer and autumn. It is probably the most complicated to manage and expensive to establish system yet devised. In a recent review of systems of grazing management for dairy cattle, Campling (1974) concluded that

> None of the recent experiments with milking cows has shown that one grazing system was markedly superior, and there has been a lack of rigorous comparisons using more than one stocking rate. There is no unequivocal evidence contradicting McMeekan and Walshe's report, that at high stocking rates rotational grazing was

superior to continuous grazing. With intensively grazed stock, rotational grazing systems are easier to operate because they facilitate assessment of the quantity and quality of herbage on offer.

If this is a true summary of knowledge, and I believe it is, then the experimental evidence justifying the widespread use of rotational grazing is weak indeed. How much simpler would be a system involving set stocking, or, say, at the most, four paddocks (Marsh *et al.*, 1971), with strategic use of the electric fence during winter. Such systems would greatly relieve the farmer of largely unproductive worries concerning his grazing management. This is not denying the possibility that were the necessary research undertaken, our confidence that rotational grazing is the best for our conditions may be justified.

COW EFFICIENCY

Considerable resources are devoted to genetic improvement of the dairy herd. Even so, it is not known whether the resultant production advantages are because of increased efficiency of conversion of the pasture eaten into milk, or whether the extra milk is because of higher food intake. It is possible that cows identified as genetically superior by the Dairy Board are those best able to cope with a feed supply that varies in quantity and quality. New Zealand cows may therefore have a resilience that is neither present nor necessary in their more carefully rationed counterparts elsewhere. Quantifying the major components of cow efficiency is essential for the further exploitation of our cows yet it is an almost virgin field for research.

These, then, are some important areas in dairy cow nutrition and management that have not been investigated systematically by the Research Division. I believe it is because of this that many advisers and farmers are critical of or dissatisfied with parts of the Division. A further consequence is that present dairy farming technology is in part based on myths and calculated guesses rather than a firm foundation of knowledge. Had this foundation been formed during the previous 10 to 20 years, then there would be almost none of the present debate surrounding the splendid performance of the Jersey herd at Ruakura's No. 2 Dairy (Campbell *et al.*, 1977; Karlovsky, 1977; Middleton, 1977; Jury, 1977; Campbell, 1977).

That the listed deficiencies exist emphasizes that scientists are not always able to recognize what is important to the industry, or, if they can, they are unable or unwilling to undertake the necessary research.

Agricutural research is far too expensive to tolerate anything but a most rigorous determination of priorities. The operating costs of the Research Division for the last five years amounted to about $57 000 000 including salaries. If this is divided by 1440, the number of research proposals approved during that time, the result is an average cost of $40 000 for each proposal.

Admittedly the resources devoted to dairy nutrition research by the Division are small compared with those made available by two of New Zealand's chief competitors. The input in this field by the Ellinbank Dairy Research Station in Australia is seven research officers with university degrees and 350 milking cows. At Moorepark Research Centre in Ireland the equivalent figures are 800 milking cows and 8 scientists. In both countries there are inputs at other stations. For example, in Ireland, at Johnstown Castle Research Centre which is concerned mainly with soil and plant nutrition, a comparison of clover and fertilizer nitrogen involves 8 treatments and up to 180 milking cows.

The Research Division's involvement amounts to 170 and 140 cows at Ruakura's No. 2 and 5 Dairies, respectively, with a further 150 at the newly established Taranaki Research Farm. Two scientists are wholly involved, with part involvement by others equivalent to about one additional scientist.

For the Research Division to meet the challenge I am offering, greater inputs than these will be required. Even now our commitment is being reduced as an increasing proportion of No. 5 Dairy's activity becomes concerned with protein extraction. Some indication of that Dairy's involvement is in the 400 to 500 tonnes of pasture that will have been either processed or fed to cows in protein extraction trials during September 1977 to April 1978.

A reassessment of resource use is required. In so far as the Ruakura Animal Research Station is concerned, this applies not only to the five dairies on that station and the 570 cows they are currently milking. It applies to the whole of the station's 600 ha. It might be argued, for instance, that the needs of the sheep farmer are not being met by carrying out sheep management studies on flat land producing annually 18 to 20 t DM/ha. Would not this work be better situated at the Whatawhata and Invermay stations? But above all there is a need for a more effective system than has existed in the past for identifying the needs of the industry and ensuring that the appropriate research is undertaken.

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