Research into the types of cows and systems required to utilise grazed pastures sustainably in 100 years from now

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Dairy farming has undergone rapid intensification in many countries over the past 60 years, as the result of technological developments, trade policies, and financial incentives. For example, the use of soluble fertilisers, irrigation and concentrated feeds have increased enormously, and antibiotics and hormone treatments did not even exist in 1940. However, the dramatic increases in milk yields per cow (e.g. in North America) and per hectare (e.g. in New Zealand) and in cows per person (in most countries) have been associated with growing concerns about the health and fertility of cows, and their metabolic stress and welfare and about the adverse effects of high stocking rates, plus related inputs, on soil water quality.

Pastoral dairy systems incorporate three key biological "subsystems", the soils, the pastures and the cows, which must be kept in balance, with each other and with the wider external environment.

Systems research, modelling, and intensive monitoring of farms are urgently required to ensure that these balances can be maintained within sustainable, profitable and acceptable limits. Two key aspects of the cows and the systems are outlined below.

Use of genetic information about the cows for the design and management of pastoral systems

Milk is produced by a wide variety of dairy systems in the world, with an enormous range in milk yields per cow (and presumably also in feed intakes per cow). It is now clear that there is no one type of cow that is best for all dairy systems.

In seasonal, pastoral dairy systems maximum daily feed intake capacity by grazing is lower (by 10 to 20%) than on other more concentrated, non-grazing diets, and the interval between successive calvings must average 365 days. Energy demand and fertility of the cow must therefore be compatible with these two essential requirements, and the cows' Genetic Values can be used for these purposes.

The cows' Genetic Feed Demand (GFD) can be calculated from their Genetic Values for liveweight and yields of milk, fat and protein, and used to estimate the optimum stocking rate for a particular type of cow and feed supply. In future, the GFD will be calibrated against the maximum daily intake per cow achievable from grazed pasture, in order to identify those cows that are able to eat enough by grazing to prevent unsustainable negative energy balances.

The cows' Genetic Values for Fertility can be used to identify those cows that are able to meet the dates of conception and calving required in the seasonal system; for example, for more than 90% of the herd to conceive in a 10 week mating period.

Logical use of Genetic Values for key traits in these and other ways in future will result in soundly based use of cows for particular systems.

Research into systems for sustainable, resource-efficient pastoral dairying This is essential when seen against the background of the recent, rapid intensification in dairying. Two New Zealand examples are described briefly below.

The current Resource Effluent Dairying study, with 6 separate farmlet systems at Dexcel, Hamilton, is a bold step to meet some of these needs. It will provide important information for systems operated at widely different stocking rates and levels of supplementary feeds, and will guide decisions about future research.

The philosophy behind organic methods, to improve the biological activity of soils, and to prevent stresses on cows and adverse effects on the environment, is generally compatible with the objectives of sustainable systems. But some organic "rules", for example prohibition of soluble fertilisers, antibiotics and some other conventional animal health remedies seem to run counter to pragmatic sustainability. Nevertheless, the present comparison between an organic and a conventional pastoral system, at Massey University, will help to reemphasize the benefits of "good biological husbandry" of soils, pastures and animals as effective methods to prevent problems and to reduce environmental and financial costs.

Conclusions

Recent research in dairying on pasture has explored the limits of technical possibilities, which may have enabled production to outstrip the biological limits within which these systems must operate. It must now refocus within these limits, to ensure mutual compatibility between the cows, the systems and the environment, and their ongoing sustainability.

Educational programmes in dairy production systems, and exchange programmes for postgraduate students between countries with pasture-based dairy industries, would make important contributions to increased international understanding of the main problems and their solutions.