TRAVEL GRANT REPORT:

INTERNATIONAL GRASSLAND CONGRESS: PALMERSTON NORTH AND HAMILTON, NEW ZEALAND

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The Seventeenth International Grassland Congress was held in New Zealand and Australia from the 8th to 21st February, 1993. The Congress theme *Grasslands for our world* attracted some 1500 delegates from 92 countries, with over 200 delegates from Australia.

The opening session was held in Palmerston North at Massey University (8-12 February) where the plenary papers were delivered. The Congress then divided into three groups, each of which toured for two days (13th and 14th) visiting farms, research stations and places of interest. These groups then resumed formal sessions for two days (15th and 16th) at either Hamilton, Christchurch or Palmerston North. The closing session of the Congress was held in Rockhampton where discussions focused on tropical aspects of grassland development and management.

The underlying purpose of these sessions was to deal with the major issues confronting grassland farmers and scientists such as:

- managing the pasture resource to maximise livestock production with minimal inputs;
- sustainable management of the pasture resource; and
- technology transfer.

These issues were dealt with in sessions considering: Plant Growth, Plant Communities, Foraging strategy, Forage management, Technology transfer and education, and Grassland systems development.

A combined understanding of each subject area contributes towards achieving the objective of matching animal requirements to pasture production and understanding the response of plants to defoliation at an individual plant, and community level which in turn influences the stability and sustainability of the pasture resource.

The realisation of the dynamic nature of the grassland ecosystem is fundamental to applying enhanced grazing management practices. Grazing management of the pasture resource concerns regulating the intensity and frequency of defoliation. Scientists and farmers are required to understand the resultant effects of grazing management. The problem to date is that we have not defined the thresholds of how far we can push a pasture without compromising pasture or animal production. The issue of maximising animal production may well be achieved in the short term by testing the thresholds. However, once the concept of making our grazing management practices "sustainable"is accepted, current recommendations and attitudes will have to be reviewed.

PLANT COMMUNITIES

An understanding of both the plant and animal systems is required before grazing strategies can be developed that will satisfy goals of pasture longevity and animal production.

By defoliating a plant, grazing animals cause physiological and morphological changes to the individual plant and the community as a whole. These changes may be beneficial, such as causing the plant to tiller and becoming more dense, or detrimental by causing plant mortality, thereby leading to erosion through exposure of bare ground to wind and water. In addition to defoliation, an understanding of the effect of nutrient cycling on recovery and subsequent plant community response enhances the predictive capabilities for grazing management.

A conceptual model was presented on the stability of pastures. The model consisted of a balance between competition (neighbouring plants utilising the same resources), stress (external constraints which may limit production) and disturbance (any mechanism which destroys biomass). These three are generally in balance, each changing within and between seasons.

The number of species in a community is highest at intermediate levels of disturbance. At low disturbance, greater competitive effects are present. When a pasture is degrading, perennial species are in decline, competition increases from annual species and weeds with forage cover is decreasing. Species composition may be changed by increasing the "disturbance" (*ie.* grazing) and species can be changed by different "stresses" (fertiliser and drought). Ingression of weeds is due to a change in stress. As a result we can either accept changes that do occur or we can change the causal mechanisms. An appreciation of the conceptual model of pasture stability will assist in understanding cause and effect.

FORAGING STRATEGIES

Decline in pasture quality (including weed ingression) has arisen from instability induced by incorrect grazing management. Herbicide partially corrects this imbalance but with the same grazing management the imbalance arises again. The remedy comes from a change in grazing philosophy, rather than looking for more grazing tolerant plants (from the breeders).

To efficiently utilise the herbage resource, scientists and farmers need to accept that foraging strategies differ between animal species and across a paddock (as soil changes). Stock avoid and prefer differing areas in a paddock and utilise the pasture resource accordingly. In mixed aged pastures presenting "DM/ha" is an illusion for single species grazing.

Overseas research results clearly acknowledge the benefits of grazing mixed animal species:

- New Zealand work indicates that growth rates of lambs are higher when grazing pastures previously grazed by goats (rather than those previously grazed by sheep);
- Studies in Northern Africa (semi-arid, heterogeneous pasture) and UK indicate far greater production (per/ha) from sheep, cattle and goats grazing together than mono species. This indicates the potential to improve utilisation of the herbage base (including browse/weeds);
- More of the pasture is utilised when sheep and cattle graze together as sheep eat clover growing adjacent dung pats which is usually refused by cattle;
- New Zealand work indicates the different components of the sward grazed by sheep, cattle and goats (for white clover and ryegrass swards). For example, for our pasture species, do we stock with goats to eat growth points, (causing tillering, clover proliferating at the lower part of the sward) follow with cattle again eating the taller part of the sward which is growing rapidly and sheep utilising the high protein available lowering the sward.

We do not have such data for our temperature pastures.

Some results are immediately applicable from overseas data. However, some data associated with plant growth, sward structure and the grazing behaviour of livestock may be quite different between Australia and New Zealand due to differences in rainfall patterns and soil types.

However, the benefits from mixed grazing would probably remain the same:

- higher utilisation of total herbage on offer
- stability of pasture in a variable environment

FORAGE MANAGEMENT

Management of the pasture resource is in managing a major contributor to disturbance of the pasture equilibrium: livestock. The fact that different animal species select between pasture species and plant parts indicates that grazing pressure will be different between pasture species. The grazing intensity will be influenced by the temporal and spatial distribution of kinds/classes and numbers of livestock. Notwithstanding pasture species preference, grazing intensity is a viable tool for both scientists and farmers for pasture management.

Response of pasture species to infrequent grazing:

- Increase in growth, leaf area, low pasture density.

Response to increases in frequency of grazing:

- Decrease in leaf area, growth, and higher pasture density (smaller plants).

Plant communities can be manipulated in both quality and quantity of species by using mixed animal grazing and differential preferences of species within a pasture.

Grazing management in Australia will need to address pasture (herbage) species, growth/dormancy periods, pasture rationing/conservation, livestock classes, preferences, pasture species and market requirements (timeliness of being able to match pasture production and animal demand).

The integration of these factors is best done in modelling of grassland systems to determine the potential consequence of grazing management decisions.

SUSTAINABLE SYSTEMS

E*ternally sustainable* grassland systems perhaps are not achievable. However, the imbalance between inputs and outputs could be minimised. Pasture production is assisted by non-sustainable methods; herbicide to minimise weed ingression, fertiliser to replace nutrients removed in production. Grazing management to optimise pasture productivity (with minimal inputs) and satisfy animal requirements was viewed as being more sustainable.

Radiata pine plantations with pasture sown underneath was seen as being an integral part of New Zealand's sustainable grassland systems. The trees assisted in stabilising soil and reducing wind-run; while the organic matter and soil phosphorus levels were higher after the end of a rotation (of about 25 years). Pasture could be utilised in the forest until canopy closure at around 18 years after planting.

IMPLICATIONS FOR GRASSLAND FARMERS AND SCIENTISTS

The Congress presented options and aims to grassland farmers and scientists. Grassland systems need to be developed by incorporating all facets of grassland farming, both inputs and outputs. Costs of grassland farming to maintain production meant least cost systems need to be devised, incorporating the value of grazing management to utilise pasture production and the importance of the stocking policy in optimising plant growth (pasture longevity) and satisfying animal requirements.

The areas of research which are needed to achieve a sustainable system includes definition of the rules which grazing herbivores use in pasture selection. The resultant stocking strategies may include:

- Stock pastures according to plant species on offer for animal use/ pasture benefit. Sustainability: fit animal requirements with feed offering across animal species. Determine fractions of species grazed by fractions of the livestock present. By definition of grazing behaviour, plant growth and utilisation may be optimised.
- Thresholds have not been defined of how far we can push a pasture out of equilibrium without compromising pasture of animal production. These limits can be defined by developing conceptual models. Grazing management is a function of *intensity* and *frequency* of plant defoliation, where intensity is associated with kind/class and numbers of livestock.

On-farm research which involves farmers from the onset will increase awareness of a complex interrelated system such as grazing management was recommended. The low uptake of technology was caused by poor farmer perception of the value of the technology. Thus, understanding was required before they adopt and receive the benefits of any change in a production system.

Another component discussed was the determination of research priorities. With respect to grazing management, research should be oriented towards the market place. Figure 1 demonstrates future grassland systems where the market demands

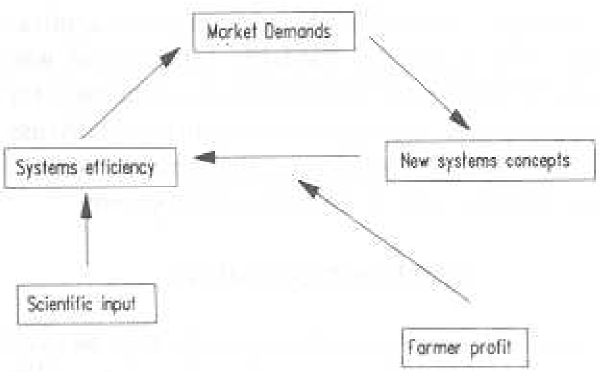

Figure 1: Grassland systems, cycle of development.

will determine the goals of a production system and the interrelated uptake of technology.

In the near future, environmental concerns will be just as important to farmers as current economic constraints. Grassland production systems today are very complex including economic, environmental, social and production constraints. The success of any production system involves a rapid adoption of the system, which in turn requires more efficient information gathering and synthesis with computer modelling to integrate all components.

SUMMARY OF MEETINGS

Greg Lambert/Keith Betteridge AgResearch Grasslands.

Topic: The role of goats in pasture management and weed control in New Zealand today.

Research by G. Lambert in the mid 1980's indicated a potential role for goats as biological weed control agents. The work at Ballantrae complemented the early work in Australia by Holst and Campbell. At that stage goats were relatively well received as commodity prices were attractive. However, commodity prices have dropped, difficulties were experienced in managing goats on hill farms, treelots used for soil stabilisation were eaten and the goats were associated with increasing soil erosion. As a result goats are not seen on hill farms. However, goats were being successfully used in the south island for scrub control. The low density of weeds on pasture in the areas visited on this tour was indicative of the value of strong pasture growth for controlling weeds.

Peter McGregor, Entomologist, Landcare Research

Topic: Biological control of Scotch Broom.

Scotch Broom occupies up to 30,000 ha in south eastern Australia and its control by grazing with sheep and goats is under examination by NSW Agriculture. Dr McGregor said the effectiveness of biological control of broom was a difficult task to assess because of the huge biomass of the broom plant. Several agents were being evaluated each with a different mode of action. The potential for integrated control with grazing management options may assist in the action of the control agents. A biological control agent has just been released in Australia.

Thomas Nolan, Teagasc, Ireland

Topic: Mixed grazing of sheep, cattle and goats.

Dr Nolan has documented the benefits of mixed species grazing in the United Kingdom and in Northern Africa. Greater output per unit area resulted from improved utilisation of all the herbage on offer rather than preferential grazing of specific species which leads to more rapid decline in pasture quality. Dr Nolan was interested in the Australian goat work currently underway in NSW which is examining the role of mixed grazing for weed control and maintenance of pasture quality.

Iain Gordon, Ecologist, Macaulay Landuse Research Institute, Scotland

Topic: Mixed grazing of animals on pasture; grazing behaviour.

Factors influencing grazing behaviour of sheep, cattle, goats, deer and alpaca were discussed including: pasture based factors, bite sizes, bite frequency, preference, mobility, energy requirements. From details of pasture quality and quantity, feed requirements and grazing action, grazing behaviour could be modelled and be used for predictions of animal performance. Predictions were relatively simple for stock grazing homogenous pastures and the precision of the performance predictions decreased rapidly with variability within a pasture, as would be seen in many Australian pastures.

Norman Owen-Smith, Ecologist, Uni. of Witwatersrand, South Africa

Topic: The ecology of mixed species grazing.

Dr Owen-smith has published many papers on grazing preferences/behaviour of ungulates. In the grasslands of Africa, multi-species grazing has been advocated to assist stability and this same principle may be implemented to an extent on Australian farms.

The issue of modelling grazing behaviour to predict production was complicated by the variability of the forage resource in a variable environment. However, it was essential to use conceptual models as a basis for understanding ecological interactions from animals on pasture.

CONCLUSION

All objectives outlined in our travel grant applications were achieved. Valuable information was gained for both a theoretrical and practical basis for future research. The opportunity to meet and discuss results, techniques and ideas with scientists was of great benefit to our professional development.

ACKNOWLEDGMENT

We are grateful to the Grassland Society of NSW for the travel grants provided which allowed us to attend this conference. The XVII International Grassland Congress was outstanding in its relevance to the research program of CM and to the overall research and advisory administration functions of JR.