TRAVEL GRANT REPORT:

NEW ZEALAND GRAZING SYSTEMS: ARE THEY RELEVANT TO NSW?

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INTRODUCTION

Exporting agricultural produce is an important part of the Australian and New Zealand economies, and in recent times both countries have experienced extreme hardship in maintaining market share in the highly subsidised world commodities markets. This has meant that agriculture has been squeezed by escalating costs of inputs and falling world prices.

In Australia, this has lead to a rapid deterioration of both our native and improved pastures from which most of our animal products are derived. This deterioration is evidenced in lower legume content and invasion by highly competitive but undesirable annual grasses and weeds (Archer *et al.*, 1993) many of which have limited value to livestock production (*eg.* vulpia). As a result pasture improvement has become unprofitable in many instances with the break-even point, calculated on current commodity prices, lying beyond the expected life of sown pastures or never being reached.

Although scientists and producers have been developing, modifying and refining pasture management techniques over many years, grazing management is still a developing science in Australia with many areas of limited knowledge. At a recent workshop sponsored by the Wool Research & Development Corporation [WRDC] (Kemp and Michalk, 1993), the need to develop innovative, strategic grazing practices to manipulate and improve pasture production, persistence, composition and quality was ranked as the number one priority for research activities in the annual and perennial pasture zones. Papers from research workers and producers from Western Australia and Tasmania highlighted the potential of the current New Zealand practices (commonly referred to as "Mob or ration grazing") to fulfill many of the goals listed in this priority.

Current research at Orange undertaken by the Pasture Development Group, is already showing that better strategic grazing practices can have a major impact on pasture composition and thus potential animal production without changing inputs. These results have independently supported the strategies used in the higher rainfall areas of New Zealand.

GRAZING MANAGEMENT STUDY TOUR OF NEW ZEALAND

While the grazing strategies employed in the high rainfall intensive regions of New Zealand have been subjected to scrutiny by Australians, the relevance of grazing practices used by producers in drier hill country of the South (*eg.* McKenzie Basin Country in Otago) and North (*eg.* Hawke's Bay area) Islands have not been assessed in relation to conditions in eastern Australia. Modification made by New Zealand producers to "mob grazing" strategies during drought are of particular interest to eastern Australia. In this region, subterranean clovers are widely grown and alternative pasture species have been selected for the drier conditions. Other species of interest to Australia such as chicory (*Cichorum intybus*) and serradella (*Ornithopus compressus* and *O.sativus*) have also been integrated into grazing systems.

The NSW Grassland Society provided travel grants to David Kemp ($500), David Michalk ($500) and John Read ($2000) to undertake a study tour of New Zealand in February 1993, to investigate the use of high intensity short duration grazing strategies (commonly known as "mob stocking or ration or block grazing") in sheep and beef enterprises (particularly in the hill country), and to assess the value of these techniques for maintaining or improving pasture productivity in NSW. Geoff Robards was funded by the University of New South Wales to take part in

the tour and to provide an animal perspective to the investigation. The scheduling of the XVII International Grassland Congress (IGC) (8-21 February, 1993) provided an ideal opportunity to economically undertake this study tour.

The study tour was divided into two parts - the south island (1-6 February) and the north island (17-20 February). A number of farms and research establishments were visited over the 10 days. Attendance at the IGC also provided an opportunity to liaise with a wide cross-section of leading New Zealand and world scientists. Several sessions of the conference program were devoted to managing grasslands for stability and productivity, the highlights of which are summarised in the conference report by Allan and Read (1993).

AIMS OF STUDY TOUR

The specific aims of the study tour were:

(1) To establish contact with scientists and farmers developing grazing systems for the drier hill country of New Zealand and to assess the applicability of research findings and accumulated experience to similar situations in southern Australia; and

(2) To obtain the latest information on chicory cultivars and grazing practices which can be incorporated into the NSW Agriculture "Chicory Project" recently funded by Meat Research Corporation [MRC].

NEW ZEALAND - SOME VITAL AGRICULTURAL STATISTICS

Agriculture and horticulture are vital to New Zealand, accounting for 60% of the country's export earnings. About half of New Zealand's total area (26 million ha) is used for pastoral production with about two-thirds of the livestock or stock units (SU)[1] being carried on the flat and rolling lands, one third on the hill country and <2% on the high country. Only 12% of New Zealand is arable which means that a large proportion of the pastoral area has been improved using aerial means.

Footnote 1: 1 stock unit (SU) = 1 breeding ewe

The mean rainfall ranges from <300 mm/yr in Central Otago to 8000 mm in the Southern Alps, but most of the reliable pasture areas are found in the 600 to 1500 mm zone. Rainfall distribution varies throughout the pastoral area with dominant winter rainfall in the North Island while in the South winter has the least rainfall.

Like Australia, New Zealand soils are inherently deficient in P. About half of the fertiliser used (about 2 million t/yr) is applied by air. Sulphur is also deficient, and trace elements are needed for pasture (molybdenum) and animal (copper, cobalt and selenium) production. The accumulation of cadmium as a result of high inputs of superphosphate over time is a recognised problem in animal product (*eg.* kidneys).

Due to slope, aspect and physical attributes of soils, problems of instability and erosion affects productivity on 2 million ha of grassland. New Zealand producers have developed many techniques to manage their flocks and herds on hill country, including special dogs.

PRODUCTION ZONES IN NEW ZEALAND

There are four main production zones for livestock production in New Zealand, the features of which are discussed below.

Hill country sheep and cattle farming

One-third of New Zealand's 21,000 sheep/beef farms are classified as "hill country", 85% of which are located in the North Island. Due to the short mild winter and even rainfall, properties in the North Island hill country are relatively small (400-700 ha). However, these farms are highly productive carrying 8-10 SU/ha with a cattle (mainly Angus and Herefords) to sheep (mainly Romney) ratio of 1 beast to 10 sheep. Cattle generate 30 to 60% of gross revenue of North Island hill farms.

In the South Island the topography is steep, the winters harsh and summer drought is common, hill country properties tend to be larger (up to 1700 ha) and less productive. Fine wool and cast-for-age ewes from sheep flocks stocked at 3-4 SU/ha are the major sources of farm income.

Pasture development commenced in the 1950's

when aerial topdressing was pioneered. By the 1970's, superphosphate was being applied at 350 kg/ha/yr to maintain stocking rates above 12 SU/ha. However, since 1984 when subsidies were removed and agricultural land effectively devalued by half, fertiliser application has been halved and stocking rates have decreased by about 16%.

High (tussock) Country

The South Island high country, which makes up 15% of New Zealand's farm land is situated at high altitude and is subjected to severe winters. Including the well known McKenzie Country, the 3.2 million ha of high country is divided into 300 runs with an average size of 11,000 ha and flock size of 8000 sheep. This represents about 5% of New Zealand's sheep, and about 4-8% of net farm income, depending on the price of fine wool. The current wool prices have meant that a lot of this country is now for sale.

The vegetation on the hills and steeplands was originally an association of short tussock grasses including: hard tussock (*Festuca novaezelandiae*) and blue tussock (*Poa colensoi*) or on the moister soil by silver tussock (*Poa laevis*). Above 1000 m, this grassland intergrades into snow tussock grassland dominated by *Chionocloa rigida* and *C.macra*. A recent and serious concern is the widespread establishment of *Hieracium* spp. (hawkweed) thought to be symptomatic of an overgrazed and degrading ecosystem.

Aspect and altitude determine the proportion of summer and winter country on a particular run. Summer country consists of the hardest and highest south facing slopes where livestock can only be grazed for 3-5 months in summer after the risk of snow has passed.

Carrying capacity of Merinos, Halfbreds and Corriedales varies from 1 sheep/1.5 ha to 1 sheep/4 ha. Over the past 30 years, about 20% of each run has been improved with legumes and fertiliser applied by air. White, red and alsike clovers are the common legumes, while cocksfoot is the only successful introduced grass.

With the present threat from rabbits and hawkweed, there is increasing economic pressure for high country runholders to increase pastoral efficiency while maintaining the productivity of their country (Allan, 1992). "Tara Hills" (near Omarama) is a 3340 ha research station where research to improve production on South Island high country is concentrated.

Finishing country for sheep and cattle

Fattening farms are located in the flat plain areas such as the Canterbury plains of the South Island. Farm size ranges from 80 to 300 ha and most are operated by family units. Stock are supplied to these farms from surplus young and cast-for-age sheep and cattle from the hill country, and Fresian and crossbred bulls from dairies. The contribution of sheep and cattle to farm income varies with locality.

A typical lamb finishing operation would carry between 16 and 25 SU/ha. Romney ewes (4-5 year old) are purchased and crossed with Polled Dorsets, Southdowns or Texels to produce lambs. The lambing percentage is 100 to 140%. The objective of the fattening operation is to produce lambs with carcass weights of 12.5 to 14.5 kg at 14-18 weeks.

Most farms are subdivided into 20 to 30 paddocks and stock are rotated from mating until lambing in August, when the ewes and lambs are then set stocked. Ewes with older lambs are drifted off and are rotationally grazed until weaning.

Stocking rates for cattle vary from 3.5 to 5 weaners/ha to 2.5/ha for bigger animals. The goal is to finish weaners at about 20 months either as export steers, or heifers for the local trade. Cattle are rotated through the year using slow rotations (80 to 120 days) in winter and rapid movement (15 to 25 days) in spring. In dairy areas, bull calves are purchased as 4 to 7 days and reared on milk. At 20 months, such calves yield carcasses of >200 kg or 300 kg at 30 months. Bull calf farming can produce carcass beef outputs of 450-500 kg/ha/yr in good conditions with good management.

Pastures consist mainly of perennial ryegrass and white clover with areas of brown top, rat-tail and subclover found on low fertility or dry soils. Hay or wilted silages produced from spring surpluses to provide feed supplements when required. Fertiliser rates of 250 to 375 kg/ha/yr are recommended, but over the last 10 years many farmers have reduced fertiliser inputs to below maintenance requirements.

Dairy farms

Dairy farms are located on most fertile soils in the

better rainfall areas. In the North Island 93% of dairy herds are located in the South Auckland and Taranaki/Manawatu regions. The average farm of 70 ha produces 349 kg milkfat/ha from 2.4 cows/ha, but top production can exceed 700 kg milkfat/ha. Two thirds of the 2.4 million dairy herd are Fresian.

The production system is simple with cows rotationally grazed on ryegrass/white clover pastures throughout the year. The short rotations (<30 days) used in spring are gradually lengthened in autumn and reach a maximum of 100 days in winter. Hay or silage is provided at rates of 5 to 25 bale equivalents/cow depending on the season.

Annual fertiliser (phosphorus and potassium) rates of 500-600 kg/ha are common, and nitrogen is used to boost growth when winter/spring shortages are expected.

EAGER EXPORTERS

Unlike Australia which is endowed with mineral wealth and a relative large domestic market, the New Zealand economy depends heavily on agricultural exports to generate income. The need to secure and maintain export markets to survive has made New Zealand an eager and aggressive marketer of agricultural produce. While this has always been an essential part of New Zealand agribusiness, the removal of subsidies and the devaluation of land prices in 1984 only intensified efforts to develop new products and maintain market share by ensuring quality and of continuity supply. Efforts to market the invasive Australian possum as "Kiwi Bear" in Asia perhaps epitomises the New Zealand drive to export which is perhaps not as strong in Australian agriculture.

PRODUCT INNOVATION

Innovative strategic planning, brand labelling and total quality management have been used to advantage in the meat industries to enable New Zealand to maintain or increase exports in a very competitive international market place.

Deer Farming

Deer farming in New Zealand has developed from the opportunistic harvesting of feral deer to a highly organised industry which is expanding at an annual rate of 25%. In 1992, there were about 5,500 deer farms and a national herd of 1.4 million which generated $170 million through the export of venison ($100M) and velvet ($70M). In the next five years it is expected that deer numbers will exceed those of dairy cattle, an expanding industry. Venison is exported under the registered trade name "Savannah" which distinguishes it from inferior products in the European market. Europe is the main market for venison, but North America is an expanding market especially for the processed cuts exported as chilled rather than frozen products. Velvet which is collected annually from the antlers of stags (2-5 kg/head) is sold mainly to Korea where it is used extensively as a tonic medicine. Instability in the price of velvet (*eg.* $250/kg in 1992, $120 in 1993) has focused attention on the development of a wider range of gourmet venison products for export. Venison is even sold on the road-side.

Red deer is the predominant breed, but there is some interest in wapiti (elk), fallow deer and some cross-bred types. Since deer do not perform well on standard perennial ryegrass/white clover pastures, pastures have been developed which are both palatable to deer and improve summer and winter production. Unlike sheep and goats, it is difficult to force deer to eat forage which they do not like. Deer show a preference for red clover, chicory and fescue, and an aversion to ryegrass especially during summer. Chicory/fescue/red clover pastures increase weaning weight by 10% over ryegrass-based pastures, and lead to a 15% (hines) to 25% (stags) increase in liveweight after 12 months grazing.

Rotational grazing strategies based on "feed-on-offer" (FOO) are used for deer production. In good deer pastures, a five day grazing period is common where the initial FOO is about 2.5 t DM/ha. Daily gains of 200 to 320 g/day are expected on red clover-based pastures, depending on season. Cattle follow deer in the rotation to remove uneaten forage.

Lamb and live sheep market

New Zealand's sheep meat production of 3-400,000 t/yr from 27 million lambs represents only 10% of the world's sheep meat, but accounts for 50% of the world's traded sheep meat. Europe consumes 49% of New Zealand's exported lamb (60% by value)

and 43% of mutton (59% by value). While Europe remains New Zealand's biggest market, the level of price support for local products combined with protectionism through quotas and non-tariff barriers continue to hamper an expansion of New Zealand's sheep meat market in the EC.

Live sheep exports coupled with credibility of New Zealand's Halal slaughter system has enabled markets to be developed in the Middle East, particularly a specialised market for fat ram lambs for the religious festivals. Particular attention has been given to health and disease protocols to avoid the costly delays which seem to plague the Australian live sheep trade to the Middle East.

Bull beef

New Zealand's current beef and veal production is about 455,000 t/yr (bone in), but it is estimated that output will exceed 600,000 t by the year 2000. At present 75% of total beef production is exported, mainly to North America as frozen grass-fed manufacturing grade. More recently, however, the volume of chilled beef has increased to 4% with good potential to increase further, while the amount of prime beef cuts exported to supply the table market has also increased significantly.

Bull beef production which fits the requirements of these new markets is being expanded rapidly and in 1990/91 accounted for 32% of New Zealand's total beef export. In this production system, bull calves are purchased from dairy farms at about 4 months of age for about $300. They are grazed on well fertilised (20 kg P, 20 kg S and 60 kg N/ha) perennial ryegrass/white clover pastures in small herds (about 20) at stocking rates of 2-3 bulls/ha. Growth rates average 0.9 kg/day for the full year with a low (0.75 kg/day) in winter and a high (1.18 kg/day) in summer. Animals are sold under contract for about $2.5/kg at a minimum carcass weight of 220 kg.

Changes to bull beef reflects shifts in the market demands for products with specific characteristics such as meat colour, fat colour and marbling on which consumers in the expanding North Asian market place great emphasis. In contrast, the North American market is increasingly putting a premium on lean manufacturing quality beef.

Message to Australia

The key message from these observations is that Australian producers must recognise the multiplicity of the world's meat market and respond to their varying needs in a more specialised and organised way. No longer can we afford to rely on the domestic market to bale us out by absorbing livestock produce of a type and quality for which there is no world demand. Unless producers in Australia work with processors to establish procurement and payment methods which recognise the extra effort and cost involved in producing livestock products for specialised high value markets, and can maintain a consistent high quality supply, the lucrative opportunities in the meat markets developing in the North Asian region will be lost to the more innovative New Zealanders. Australians must look beyond the domestic market if the livestock industries are to be both profitable and sustainable.

GRAZING MANAGEMENT - THE KEY TO SUCCESSFUL ANIMAL PRODUCTION

The objective of grazing management is to ensure that livestock harvest forage and convert it into saleable products in the most efficient and sustainable way possible. The key to achieving this goal is to accurately define the system to identify the weak points and then devise management strategies to overcome them. An analysis of the New Zealand livestock industries showed that the winter feed deficit was the major constraint to the production of all products. This is also a major problem for the grazing industries of temperate Australia.

However, unlike Australia the autumn break in New Zealand is earlier and more reliable which means that significant pasture growth from perennial based pastures occurs before low temperatures limit growth. It was found that by using rotational grazing systems not only was the evenness of utilisation improved within paddocks, but that feed banks were created ahead of stock thereby helping the annual feed supply to meet annual feed demands. In short, the system has enabled producers to raise and market traditional and new livestock products at competitive prices.

The use of ration grazing with only slight variation across all livestock production systems and

climatic zones in New Zealand suggests that this system may be easily transferable to other environments and production systems. The fact that comparisons of grazing systems in Australian failed to show a clear advantage of rotation grazing over set stocking should not deter us from seriously considering the potential of the New Zealand system for use under Australian conditions. In New Zealand, early comparisons of continuous and rotational grazing showed that while rotational grazing allowed greater management flexibility, it did not enhance animal performance (Suckling, 1975). It was reasoned that from subsequent experiments at Ballantrae Hill County Research Station that although rotational grazing gave greater leaf extension rates, set stocking compensated by inducing greater tiller numbers (Clark *et al.*, 1982). Studies on dairy pastures showed that the *combined* practice of heavy stocking and rotational grazing were required to lift animal production.

Base on these studies, it follows that the lack of response in Australian comparisons was probably due to the use of only moderate stocking rates, the long grazing periods, and the use of year-long rotations rather than combining ration grazing in late autumn winter with continuous grazing for the rest of the year.

Basic requirements

The three basic essentials for the system to work are: fencing, fertiliser and flexibility in livestock movement.

Subdivision is essential

With only minimal subdivision, the producer has little flexibility and control which means that the property tends to be heavily grazed in dry year and under-utilised in wet years. As a consequence the stocking rate for much of New Zealand was geared to suit drier years. In turn, this tended to cause deterioration in pasture composition and productivity (particularly of improved pasture).

Good fences and electric fence subdivision to divide farm into at least 30 paddocks are first priority for controlling grazing to benefit both pastures and livestock. Subdividing large paddocks gives flexibility in grazing. Careful thought is given to fence location in New Zealand to ensure that paddocks have similar slope and aspect for grazing to suit the slope. This is particularly important in the high country where shady faces should be utilised during the growing season.

Fertiliser

The success of ration grazing also depends on soil fertility. Fertiliser is important to maintain high levels of ryegrass and white clover which require moderate to high soil fertility levels. Typical farmer practice is to apply: phosphorus once/2 years; sulphur every four years; molybdenum every five years; and lime as determined by soil test. On all farms visited, soil testing on a paddock basis was regarded as normal monitoring of farm resources.

Nitrogen is used to boost yield of hay and silage crops, and to increase pasture production when required. In a dry season, for example, urea may be applied in the first week of March to boost pasture production before the onset of low temperatures in May. Unused nitrogen has a beneficial effect on spring growth advancing production levels by about 3 weeks.

Fertiliser use in New Zealand has declined by >50% since 1984/85 when the subsidies were removed, and pasture production is declining accordingly. Where fertiliser inputs are withheld, it is essential that grazing management maintains a legume component in the pasture so that the pasture has the greatest chance of responding when fertiliser inputs are re-applied.

Flexible grazing

Environmental factors (climate, soils) set the limit to pasture production and composition within and between years, but grazing management determines whether or not that potential is realised. The key to grazing management is to keep the pasture in the vegetative state by grazing to avoid build-up of seedheads and dead material.. Grazing management must be correct to maintain stable and productive pastures, particularly on the hill country. Pasture must be well utilised to keep pasture highly productive and to avoid extremes of pasture mass. Controlling pastures over the late spring-summer period will avoid a build-up of low quality stem and dead material.

Strategic use of rest and pressure is used to balance composition. Hard set stocking with sheep during spring, for example, actively promotes ryegrass tiller-

ing, whereas lax grazing in autumn and hard grazing in winter discourages the growth of browntop (*Agrostis capillaris*).

White clover content will be increased by hard grazing to about 3 cm during November-December within a rotation. This is a period of active white clover growth and when competition from grasses is reduced.

The integration of stock classes provides the best means to achieve good control and still be sustainable. Alternating sheep with cattle will increase the ryegrass content. The use of mixed classes has the greatest impact when the livestock demands are not well matched with pasture supply.

The adoption of mod grazing has resulted in more productive pastures whereas under continuous grazing the content of clover and ryegrass are reduced and weeds and annual grasses invade the spaces opened up in the pasture when density of desirable plants decline.

The summary, the following check list is recommended procedure for implementing ration grazing in New Zealand:

- Research your resource;
- Define your limitations;
- Select species to improve feed supply;
- Topdress prudently;
- Fence effectively; and
- Efficiently utilise forage produced.

MONITORING - AN ESSENTIAL ACTIVITY FOR GOOD MANAGEMENT

While the principles of ration grazing apply throughout New Zealand, the actual mechanics of implementations such as the lengths of grazing and rests periods will vary from region to region and farm to farm according to the site potential. This means that close monitoring of feed levels and the number, weights and weight gains of livestock is necessary for efficient pasture management.

Although farmers may intuitively and from experience know how long to leave stock in a paddock, only exceptional individuals can plan the feed flow for a whole farm without quantitatively monitoring changes in feed levels. Such monitoring is invaluable because it provides advanced warning of possible feed deficits which allows more time to respond with remedial measures such as a tighter rationing, supplementary feeding, or application of nitrogen.

The most common methods of monitoring forage on offer on New Zealand farms is the capacitance probe and the rising plate which measures height. Both methods are quick to implement and fairly accurate. A ready reckoner is available which relates height to yield on a seasonal basis.

It was significant that all leading farmers visited used pasture monitoring in order to match livestock demands with forage available. The current interest in pasture and livestock monitoring in Australia suggests that the time is right to implement change in strategies to better utilise pastures.

CONCLUDING COMMENTS

Key points in New Zealand grazing management practices that emerge across dry and wetter environments are:

- that the general pattern of livestock demand must match the pasture production curve as closely as possible - most producers lamb or calve their animals in spring.
- to maximise the number of animals carried through the limiting winter period the daily intake of stock is rationed, using temporary fencing and fodder budgets.
- once animals near lambing or calving set stocking is preferred.
- a quick rotation to take the top off pastures is practiced in spring to try and limit rank growth.
- summer grazing practices are variable, depending on the environment, though most seem to set stock or use a slow rotation. Ewes may be rationed to reduce bodyweights, then flushed prior to mating in order to improve lambing percentages.
- if any season starts to become less productive than normal, *eg.* in dry or cold weather, producers will shift to strip grazing and rationing stock.

- scales are frequently used to check the performance of animals allowing earlier adjustments to management than visual appraisals would allow. Within a mob stocking, rotational system, animals have less than full stomachs just prior to their next move, hence visual estimates of liveweight can be confusing.

Fodder conservation is very common in New Zealand. Producers use conserved fodder to supplement stock when ever they consider it necessary. They do not seem to tolerate large fluctuations in liveweight among their animals. The advent of baled silage has developed a better market for that product such that the better dairy farmers will use all their land for grazing to maximise carrying capacities and buy in silage as well as hay.

In the driest environments in New Zealand, *eg.* the south island high country, grazing management practices are less sophisticated. Research at Tara Hills for instance, is suggesting that a two paddock rotation system is better than one paddock. In general their extensive grazing practices were similar to what Australian producers would do. However many of the high country properties also have some valley flats, which may also be irrigated, that are used in similar ways to the higher rainfall environments for their more profitable animals.

One important difference between Australia and New Zealand is that Australia's climate is inherently more variable. In considering how New Zealand grazing practices may be adapted to Australia a few key issues emerge. The main season when the management needs to be at it's best is during winter as that is when feed supply is at a minimum and stock numbers are at the limit for a property. In southern parts of Australia, as well as in New Zealand, winter is the period of most consistent, reliable rainfall. Given that condition it is possible to envisage the adoption of winter grazing practices in Australia that can be planned and implemented in most years. Producers in Tasmania and Western Australia have shown that can be done. The problem of the variable timing of the autumn break does though, mean that Australian producers need contingency plans which will vary from year to year, for supplementary feeding their stock until pasture growth is sufficient for grazing. In spring similar problems of controlling rank growth exist as in New Zealand, though feed quality is likely to deteriorate faster, while over summer the drier climate in Australia does limit the options for manipulating animal liveweight.

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