What should we use From the New Zealand pastoral industry?

Rob Eccles

Agriculture New Zealand, Ashburton, New Zealand

New Zealand has been described as a land of potting mix. So fertile and green does it appear that to the average person from the New South Wales farming community it looks like one big dairy farm. It is so obviously different and yet we people from New South Wales are in awe and envy at the productivity from this near neighbour.

So impressed are we by the grazing industry of New Zealand that we import a lot of its science and technology. More specifically we bring in many pasture cultivars and try and benchmark our field performance with theirs. It seems to be a requirement of anybody trying to obtain wisdom in pastures to make a pilgrimage to New Zealand to learn from the masters.

We are not really comparing apples with apples and this flow from New Zealand is not really a friendly cultural exchange for New Zealand looks more to the United Kingdom for its new sources of technology and practically ignores Australian agriculture. It disregards technology from the North American farm system in a similar way.

If we are to "fertilise" our New South Wales farm system with components imported from New Zealand we should consider the ingredients that make up New Zealand's farm climate. Instead of transplanting their practices or pasture components we can then separate out their attitudes and methodologies which will be of greater value to us.

Natural history

There has been some excellent publications in recent years on the natural history of Australia and New Zealand. Tim Flannery's "The Future Eaters", Mary White's "After The Greening" and Graeme Stevens' "Prehistoric New Zealand."

These publications detail how New Zealand and Australia was once linked together. Some 80 million years ago New Zealand drifted away from Australia and Antarctica. This process formed a sub-continent that rivalled present day Australia in size. Over the next 70 million years this landmass succumbed to the forces of erosion that steadily reduced it to a flat and small archipelago of islands barely above sea level.

About 6 million years ago a new process began which has shaped the New Zealand we know today. It found itself involved in a major re-arrangement of the huge tectonic plates that make up the surface of our planet. The Indian-Australian Continental Plate began colliding with the Pacific Oceanic Plate and New Zealand straddled the boundary between the two. Ever since then New Zealand has been stirred up as the two plates have jostled one another and a vast array of troughs and welts developed.

A mountainous terrain has been thrusted up by earth movements. This has been attacked by fast-flowing rivers and streams plus the effects of frost, snow and ice. The scree-strewn slopes of the Southern Alps and debris-laden rivers particularly of the South Island bare testimony to the sheer power of the forces involved. The Southern Alps on the Western side of the South Island are presently growing at 10 cm/yr and the whole land has had a sustained uplift of 6-10 mm/yr for the last 3 million years with a calculated 2-6 mm/yr continually been stripped from the high country. If it was not for the erosion that has formed the coastal plains and foothills, the highest peaks of New Zealand would be over 18,000 m and far higher than the Himalayas instead of having its highest point, Mt Cook, standing at 3,764 m.

The North Island is a slightly different phenomenon. Where in the South Island the Pacific Oceanic Plate is riding over the Indian-Australian Continental Plate and folding into mountain ranges things change over in Cooks Straight between the islands. In the North Island the Pacific Plate is being subducted or thrusted down into the interior of the planet underneath the continental plate. Typically in such cases, the oceanic plate melts and much of this material pushes through crustal fractures and surfaces again as volcanoes. This runs North-South like an open wound through the centre of the North Island. Over 20,000 cubic kilometres has been blown out over the country side in the last 1.5 million years, enough to bury the whole country 18 m deep.

There are many types of volcanoes represented in the country. The viscosity of the magma varies and this influences the shape of the volcano and type of eruption. Some like Mt Ruapahu erupt regularly as it did in 1996. Others have cycles of tens of thousands of years and their eruptions are huge. Mt St Helens 1980 eruption in the USA appeared very violent and this ejected 1 cubic kilometre of material and had a blast zone of 17 km radius. Compare this with some of the central North Island's eruptions of up to 300 cubic kilometres and blast zones

Figure 1: The area of devastation following the Taupo eruption 180 AD.

Figure 2: General soil types of New Zealand (Source: "Fertiliser Use On Sheep and Beef Farm" NZFMRA).

of hundreds of kilometres. The longest/ loudest bang in recorded history was the explosion that formed Lake Taupo in the centre of the North Island some 1800 years ago. It ejected 160 cubic kilometres over approximately 3 hours.

New Zealand is therefore a happening place in geological terms. It is continually being shaken in the mountain forming process with earth quakes as frequent as 300 times a year monitored in cities like Christchurch, frequent land slides, large glacial ice-caps during the last 13 iceages and vulcanism. In comparison Australia has not had major mountain building activity or any substantial ice caps for 100 million years.

Ingredients for the successful pastoral system

Australia and New Zealand are very much the same culturally and socially. We both have the same technological availability and ability to apply it. The same plant and animal genetics are used. There are common plant cultivars and so many common sires are used in the beef cattle industries that we can have Australasian Group Breed Plan. Therefore the technology and social skills are the same so it is the physical features of the countries that make the agriculture different.

The physical features of New Zealand provides its farmers with a number of ingredients that allow a different management system to be applied and achieve its levels of productivity. This paper will be focusing now only on the low country and foothills for discussion purposes and will ignore the High Country system.

Due to its natural history New Zealand soils are very young. They are measured in hundred's or a few thousand years where Australian soils are that old they have been described as fossils soils. The New Zealand soils are very even in nature over a property. Even though they are youthful they still have their problems but they offer the advantage of allowing a common fertiliser program over the whole property. Given their smaller property size, for the same dollar value in fertiliser as is used on average in NSW, these farms can have soil fertility removed as a limitation to production.

In comparison to NSW, the rainfall is quite reliable and can be quite high. The highest is just over 8,000 mm/yr in Fiordland down in the deep South but most of the useful farming land is under 1250 mm/yr and can be down to 500 mm/yr. High country farms can be lower. Whatever the annual rainfall it is more effective than in NSW. The Western half is much wetter than the Eastern. The Eastern half experiences El Nino related droughts as we do in NSW. Even when there are droughts, the animals usually need only be transported for one to two hours and they are in another climatic zone with feed. Droughts do not effect market prices as they do in Australia.

The climate is consistently a cool temperate one. As most farms are within an hours drive of the coast and the surrounding seas buffer the extremes of the weather. This gives the pastoral system a consistency throughout the country. We would think of New Zealand as a cold country but it is not really the case in the major farming regions, it is not like the Northern Hemisphere.

The climate gives New Zealand the opportunity to use temperate pasture species. The major ones being ryegrass and white clover. Two species the world has spent hundreds of millions of dollars developing. They are provided with an almost heavenly environment where the temperatures are rarely

over 30ºC or under 9ºC during the day with the exception of Winter providing them with their ideal temperature range for growth. Outside the times when there is moisture stress these two species grow vegetatively from early Spring right through to late Autumn pausing only for their reproductive cycle.

Other species play a comparatively minor role such as tall fescue, cocksfoot, subterranean clover, red clover and lucerne. Even more minor at present are species such as phalaris, caucasian clover and chicory. None of these are particularly well managed as most farms would have greater than 90% in a ryegrass base. The entire industry has its skill base dealing with managing a ryegrass/white clover pasture system.

Pastures when sown usually can last for over a generation, particularly in the moister Western regions. This compares with NSW's 5 year average life span including one slow year of establishment and tolerated a lower degenerated pasture a year or so before being re-sown as a pasture or rotated in a cropping phase.

The drymatter production from the pastoral system is comparatively high. In NSW a good tablelands farm would be producing 5,000-6,000 kg/DM/yr and running 7 DSE/ha. Typical farms in New Zealand would be producing 10,000-16,000 kg/DM/yr and running 12 to 18 stock units per hectare (SU). A SU is about 2.3 DSE so these New Zealand farms run 28 to 44 DSE/ha. Moisture is still the biggest determining factor as the highest stocking rates are in the moist North and South of the country.

The use of temperate species and an even climate allows a steady production of quality pasture. It is very seasonally predictable when dry matter will be supplied. Deficiencies and surpluses can be planned for and feed quality does not quickly deteriorate if not used immediately. Ground cover is nearly always 100% and as farmers are dealing mostly with a ryegrass/white clover pasture estimating paddock feed supply and quality is a basic skill.

Markets are much more stable in their pricing. The dairy pay-out, lamb, beef and deer schedules are announced ahead of the coming season. The red meat varies a little but not to any great extent. The specifications are outlined in terms of weight ranges, fat etc and this all allows the farmers to focus on production without wondering about the timing of marketing their commodities or the effects of droughts on returns. Farmers can benchmark their production. For example, they aim for a 13.5 kg plus lamb carcase and steer carcases greater than 240 kg.

In summary the major pastoral regions of New Zealand have these ingredients on side for their farmers:

- consistent and young soil across a property
- soil fertility eliminated from being a production limitation
- a true temperate environment that provides a regular climate with few extremes
- the pastoral species used are already matched to the environment and strongly based on one grass and clover species.
- very high ground cover that makes feed supply easy to predict, minimises weeds and minimises erosion potential
- the whole farm system is more reliable and predictable.
- stable markets

The national farm statistics

Table 1 gives a summary of some of the grazing farm systems. There are some 68,000 farm holdings in total in all industries, averaging 216 ha. A total of 16.6 million ha are used out of 26.8 million total land mass. Table 2 gives national stock numbers.

Management solutions

Inputs

All the above detailed ingredients offer a stabilising effect on the New Zealand pastoral system. Farmers with the assistance of their technology research and development organisations have focused on fine tuning the production from their farms. It is this technology that has shaped the farm systems of the country.

Table 1: Statistics of typical New Zealand farms (Source: Ministry of Agriculture and Statistics of New Zealand).

Farm Type	Number of farms	Area ('000 ha)	Typical size (ha)	Typical carrying capacity (DSE)[1]	Typical commodity price 1997 $NZ	Typical farm surplus/DSE ($NZ)
Dairying	16,710	1,542	86	8600	$3.32/kg milk solids	140
Sheep and/or Beef	32,473	9,904	240	7500	$37.70/lamb $4.94/kg wool $1.80/kg beef carcase[3]	32-73
Deer	2,115	187	88[2]	1000	$6.80/kg carcase	N/A
Cropping	640	212	260		$300/t wheat	630/ha

[1] DSE calculations are a conversion of the New Zealand stock unit (SU) by a multiplication factor of 2.3; [2]A deer farm is typically a farm unit within a larger farm; [3]Refers to manufacturing beef carcase..

Table 2: National stock numbers (Source: Ministry of Agriculture and Statistics of New Zealand).

Year	Cattle		Sheep	Deer
	Dairy ('000)	Beef ('000)	('000)	('000)
1995	4,090	5,182	48,816	1,179

Attitudes are more positive towards inputs. It is a cultural habit of New Zealand farmers to fertilise every year and expect to lime about every 5 years. They do not question this. They are aggressive without being reckless. Those who have not practiced regular fertilising have disappeared from the industry. Farmers who have survived in NSW and New Zealand do not cull their inputs when times get tough. Banks who encourage this are not doing their clients a service. Banks perhaps should be arranging their loans and repayments on a rainfall index.

The tonnage applied nationally per annum reflects this attitude as it is higher now than in 1984 when the fertiliser subsidy was removed. Australia has never matched the fertiliser volume when the bounty was removed in the 1970's.

Monitoring via soil testing is regularly done to apply fertiliser strategically. Typically superphosphate is applied at 250 kg/ha/yr maintenance and up to 800 kg/ha as a "capital" fertiliser application if a farm is being converted to dairy or other development. Animal health problems are anticipated at these levels and do occur in these circumstances. The 250 kg/yr of topdressing fertiliser may sound high when compared with NSW, but as the output per hectare is greater this is truly only maintenance. Consider also the smaller property size and their annual bill is likely to be lower than a typical farm in NSW. It would be like the cost of applying an average of 100 kg/ha/yr of single superphosphate in NSW.

As well as fertiliser they ensure there are viable species in all their paddocks. These essential production inputs are therefore not the first thing dropped when things get a little tough. The cost per kilogram of drymatter is frequently monitored (normally ranging 3-5 cent/kg) and is a determinant if deciding on the benefits of another input like a strategic nitrogen application in late Autumn. Observations in both countries demonstrate that money not spent on essential inputs end up far more costly in the end. Those who do stop have subtly delayed the hard decisions.

Monitoring

The whole farm system in New Zealand is more reliable and predictable. This allows much more measurement and control over their systems. Being a more temperate environment things are more seasonal. Winter is harder but Spring, Summer and Autumn are all productive. Lambing and calving happen across the country in the same months. Milk production and red meat processing is also seasonal. There is no scattered birth dates or marketing. This has allowed a more controlled management culture.

Using the prime lamb system as an example, (figure 3) the rams go out on basically an industry determined date, the ewes must be at a certain weight at check point dates during the year particularly when the rams go out. Ewes are normally put out on good pasture or sometimes given quality stored feed to "flush" them just prior to "mating" and should be 60 kg or greater when the rams start. This ensures the maximum conception in the first cycle and increases twinning. Ewes are commonly scanned to separate them into three management groups: dry ewes, single bearing ewes and twin bearing. Special supplementary feeding is given to the twin bearers. This helps to prevent pregnancy tozaemia due to heavy in lamb ewes now around 70kg not being able to consume enough energy in late Winter as they are about to lamb.

Ram performance is benchmarked. Flocks are benchmarked for kg of lamb per ewe, per hectare and lambing percentage. A typical flock depending on the season ranges between 115 and 135% lambs marked. Some flocks selecting for twinning are

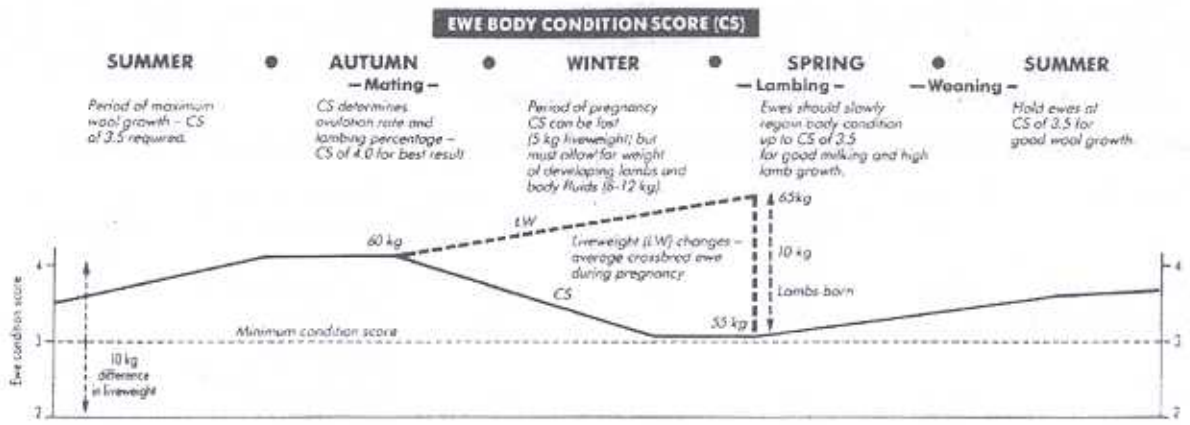

Figure 3: Ewe condition score and target weights (Source: "A Guide to Feed Planning", NZ Sheep Council).

achieving as high as 170%. Merinos are around 90% but are mainly in the high country and a different environment. Similar monitoring via calender date have been developed for dairy, deer and to a lesser extent beef.

In the monitoring process farms in New Zealand are very big on budgeting. Unlike in Australia they as not obsolete after four weeks. Managers follow their budgets closely and ask big questions if they are out by + or - 10%. The management however is not as reactive and flexible as in Australia.

Consultants are used by the better half of farmers. They are used more for a monitoring role with financial analysis and budgeting their major tools. There is an hourly fee for service as they are independent of retail stores or other companies. Technical agronomy service are not being provided by the retail sector as is increasingly done in Australia.

There is a big void developing in New Zealand of applying science in New Zealand Agriculture. Privatisation of the technical advisory service similar in function to the NSW Department of Agriculture occurred some five years ago. It has not really worked from the industry's point of view. It has only been a successful bean counting exercise for ministerial minders. Those still practicing extension now focus more on financial analysis, monitoring and the "extension process". This takes less resources to keep ahead in this area as this technology is not updated as quickly. Descriptive consultancy is now the norm and much less new technology is being adapted to the New Zealand industry. It is this writer's view that privatisation has not worked. The technical brains trust has on the whole been lost. The impacts of this has not yet been felt.

Utilisation

Pasture feed utilisation is high in New Zealand. Dairy farms measure it very accurately, their monitoring shows 85% is achieved by some and about 75% the norm. Other grazing systems would be towards the lower end of this range. In NSW with our more extensive systems, creating an under grazed over stocked effect, it would be not much higher than 50%-60%.

The system used is designed to ensure every kilogram of drymatter produced has a chance to be consumed by an animal. It is generally believed that a minimum of 35 paddocks are required for maximum utilisation of pasture. Farmers rotationally graze, break fence and conserve fodder during growth peaks (usually October - November).

The main management tool is the practice of rotational grazing. Farmers and advisers estimate feed supply in kilograms drymatter per hectare. With the ryegrass/white clover pastures stock are usually placed in a paddock when there is 2500 kg/ha and removed to leave a residual of 1000 kg/ha. The high residual is to maximise recovery.

They have not heard of Cell Grazing or its related terminology. Maybe they have no need to look for another system of grass utilisation. There is not a lot of difference between New Zealand's rotational grazing technique and cell grazing. It facilitates maximum drymatter production and achieves high utilisation and a high water use efficiency. The apparent high stock density with cell grazing is no higher than with New Zealand's break fencing and back fencing technique. Interestingly as suspected in Australia, individual animal performance is not maximised but production on a per hectare basis is.

Fodder crops called "greenfeed crops" are grown to provide feed for periods of low pasture growth. These are either brassicas, winter cereals or for a little more longevity, short term ryegrasses. Normally, these are used in May through to July.

Feed budgets are done by many farmers or their advisers. A feed budget calculates the daily feed demand of all animal classes and predicts feed surpluses or shortfalls. These are particularly useful in getting the livestock through Winter with a minimum of feeding out stored feed. Dry matter allowance and some consideration to energy requirements are made.

The whole grazing system works at its peak efficiency as farms enter Winter. Once it is too cold for significant drymatter production, equipped with the feed budgets, a kind of rear guard action is deployed. All greenfeed crops and standing feed is break fenced with a calculated daily allowance given to stock. The break fence may only move a few metres each day. This way the animals have daily a fresh 2000 kg/ha DM or greater body of feed to consume which is taken down to around 500 kg/ha DM. Runoff paddocks where some conserved fodder is fed and often used.

What we should be using in NSW

In NSW, we can not transpose the whole New Zealand system or many of its components into our own grazing farm systems. NSW has missed out by some 15 million years the opportunity to be in the right latitude where temperate pastures will perform the way they do in New Zealand. It is typically hotter and drier in NSW's major pasture areas which lay between the latitudes of 29°-36°. New Zealand is between 38°-47° with half the land mass South of Tasmania.

New Zealand's farm system is very production orientated and very seasonal. Some people see this as New Zealand's "Achilles heel". The farms and processing sectors are geared for volume and we have a considerable advantage in being able to supply quality products to specifications. We should keep focusing on building this strength.

We still carry a strong legacy of the European origin of our farm system. We need to look objec-

tively at New Zealand and how they run their farm system and look at their practises, adopt some of their attitudes and methodology. We could then look at our farm system and develop ways of achieving the same results but with different tools. These will be ones that suit our highly erratic climate and ancient continent. They will not be a technology transfer from another country unless by looking more closely at the environments throughout the world with similar features to NSW some are found.

We need our own pasture species and varieties to be developed to suit our environment. Grazing management systems must be developed that work in harmony in a climate that has the only thing consistent about it is the inconsistency.

Present breeding programs for the major temperate species are not focused on NSW. They look towards the needs of New Zealand, Victoria and Tasmania. If they work up here then it is just a stroke of luck. The farming community of NSW need to put pressure on the industry to develop the cultivars for us. There are some programs running but these need more resources. The subterranean clover and medic programs are successful but grasses are not. At the same time management packages need refining that suit our climatic variations and the unique pressure it places on our pasture species. One example could be to mimic nature more in the way our pastures are grazed and intensify the grazing then rest our paddocks longer.

An example of how a system has been developed that suits our environment is on the Liverpool Plains in Northern NSW with grain cropping. This is an Australian system not one with a European legacy. Its production of grain per mm of rainfall is quite comparable to New Zealand.

Therefore, if we want a comparable benchmark with New Zealand then compare water use efficiency (WUE) or kilograms drymatter per mm of rainfall. A paper at last years conference by R.D. Freebairn et al. provided a figure for fertilised and unfertilised pasture. The WUE of the unfertilised pasture was 2.03 kgDM/ha/mm and in the case of the fertilised pasture it was 11.13 kgDM/ha/mm.

This compares favourably with two areas of New Zealand. The dry Canterbury Region of the South Island would have a WUE of 12.5 kg DM/ha/mm and the wet Waikato area of the North Island, the highest carrying capacity of New Zealand, would be 14.4 kg DM/ha/mm. This demonstrates that NSW can be as efficient. The slight increase in New Zealand's favour would be from species matched better to their environment. This highlights the importance for a NSW grazing system without being reckless to eliminate all limitations to production except for rainfall. This will also achieve good ground cover and thus protect from erosion.

We must ensure that soil fertility is not a limitation to production and that there are pasture plants either placed or managed to maximise the opportunities for growth whenever they occur. We cannot expect an environmental low input farm system that is portrayed by some, as the saviour to farm sustainability and economics.

In NSW, we should not be so hard on ourselves or get depressed when we compare ourselves to New Zealand. Maybe we in NSW are looking for or chasing rainbows. This may be a reaction to the fact we do not yet have the management tools and solutions that best suits our environment. The New Zealand grazing industry model offers a prime example of how an industry has married together the features of its environment with its own developed technology out of a European base. It is not the system for us but we can learn from their attitudes and technology and further develop our own components and practices that suit our erratic climate.

References

Cox, G.C. (1989) The Volcanoes and Thermal Regions of the Central North Island. *Collins*, New Zealand.

Freebairn, R.D., Mullen, C. L. and Matthew's B.A., (1997) Pasture for Acid Soil in the North and Central West. *Proceedings of the Twelfth Annual Conference of the Grassland Society of NSW*, pp. 33-37.

Geenty, K. (1994) A Guide to Feed Planning For Sheep Farmers. *The New Zealand Sheep Council*.

MAF South Central Region Monitoring Team (1997) MAF Farm Monitoring Report. *Ministry of Agriculture NZ*. pp. 7-48

Morton, J. and Roberts, A.H.C. (1994) Fertiliser Use On Sheep and Beef Farms. *The New Zealand Fertiliser Manufacturers Research Association*.

Statistics New Zealand (1997) Agriculture Statistics 1994-1995. *Statistics New Zealand Te Tari Tatau*.

Stevens G., McGlone, M. and McCulloch, B. (1995) Prehistoric New Zealand. *Reed Books*, Auckland.

White, M.E. (1994) After the Greening - the Browning of Australia. *Kangaroo Press*.