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Prepared by: **Peter Williams**

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Meat & Livestock Australia Limited
Locked Bag 991
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Red Meat Targets: Applying known feed base technologies to increase output from beef production systems at Winnaleah-Ringarooma

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Abstract

This project aimed to evaluate, in terms of annual live weight gain per hectare, the consequence of progressively adopting grazing management, nitrogen application, and irrigation technologies, individually known to influence animal production from pasture.

All grazing managements resulted in annual production of at least 1200 kg live weight gain/ha. The four-paddock rotation and the intensive rotation resulted in 100 kg/ha and 200 kg/ha respectively more than the set stocked management.

Adopting intensive rotation as the best practice grazing management, and applying nitrogen fertiliser resulted in production of 1208 kg and 1563 kg live weight per hectare, from the annual application of 90 kg and 210 kg of nitrogen respectively.

Combining intensive rotational grazing, with monthly nitrogen applications and irrigation, resulted in production of 1628 kg live weight gain per hectare. This compared to 1366 kg from nitrogen application without irrigation and 868 kg from the dry land, no nitrogen control.

This project has established animal production benchmarks for pasture based systems to enable producers to make an informed decision as to the adoption of the technologies studied in this work.

Executive Summary

The two main drivers of profitability for beef production are price and production per hectare. Producers have little control over commodity prices but can significantly influence productivity. The business plan for the Red Meat Targets program along with the Meat and Livestock Australia strategic plan, clearly identify increasing pasture production and utilisation as a significant opportunity for beef producers to increase their enterprise profitability. Many factors (pasture species, fertiliser, grazing management) driving pasture production and utilisation, have individually been shown to increase animal production, but there are few examples of measuring their effect when combined as a best practice system. This project aimed to achieve this and in doing so quantify benchmarks producers can use in order to make informed decisions with regard to adoption of the technologies.

In 2006 the grazing managements of set stocking, four paddock rotation and three shifts per week resulting in a 28 day intensive rotation were compared, with the results being presented in table 1.

Table 1 Animal production from three grazing systems

	Beef Production kg/ha Live-weight Gain		
Grazing system	Set stocked	4 paddock rotation	Intensive rotation
Production	1218	1317	1419

Table 2 displays the results obtained in 2007 which compared two nitrogen application regimes using an intensive grazing system. Nitrogen was applied in autumn and winter at the rate of 45 kg/ha, and at 28 day intervals at the rate of 30 kg/ha whilst soil moisture was not limiting plant growth.

Table 2 Animal production from applying nitrogen with an intensive grazing rotation

	Beef Production kg/ha Live-weight Gain		
Nitrogen application (kg/ha)	0	90	210
Production	1020	1208	1563

In 2008 irrigation was applied to an intensive grazing system, with nitrogen applied at the rate of 30 kg/ha/month whilst soil moisture was not limiting plant growth. The results are presented in Table 3.

Table 3 Animal production from irrigating an intensive grazing rotation with nitrogen

	Beef Production kg/ha Live-weight Gain		
Irrigation	0	0 + N	Irrigation + N
Production	868	1366	1628

2007 and 2008 were difficult years with below average rainfall, particularly in spring and early summer. Best practice management was not achieved with the irrigation treatment because of technical difficulties with its installation, and a lack of available irrigation water in autumn 2007.

The above results clearly indicate a series of benchmarks for beef production from management systems based on adoption of a range of well-understood technologies. Obviously the absolute value of these benchmarks can vary according to season but their relativities would be expected to remain similar. Even under set stocking, good pasture utilisation can annually produce at least 1000 kg live weight gain.

The driving force of this level of animal production is growth and utilisation of pasture. Animal production systems can focus on either achieving high individual animal performance or high group performance by having more animals with lesser individual production. In reality, economics dictate a compromise, so this work has been undertaken with the aim of achieving such a situation. Over the years the system has been fairly successful in achieving this compromise because the observed levels of animal production per hectare have not been at the expense of performance per animal. Although individual animal performance varied with season it remained within the window of 0.75kg – 1.62 kg/head/day irrespective of stocking rate.

In order for a system to annually produce 1628 kg live weight, about 11.4 tonnes of pasture dry matter must have been consumed per hectare. Accepting utilisation of 70% implies 16.3 tonne of dry matter must have been annually produced per hectare. This equates well to pasture production reported by the dairy industry.

Economics must always be considered as part of the decision making process associated with adopting new technology. Adoption of an intensive grazing management system does require adequate sub division and provision of sufficient water points. Portable electric fencing may also be required to sub divide areas but paddock size can be adjusted to suit herd size. In this experimental area each plot is 1.86ha, divided in half by a two wire permanent electric fence. Each half is then further sub divided into six breaks with temporary electric fences requiring about an hour's labour per week. The break-even cost for this operation and capital equipment is the value of about 200kg of beef live weight per hectare.

The economics of applying nitrogen and or irrigation will largely be driven by the response of the pasture to these inputs. Although the pasture botanical composition at this site is characterised by a low level of legume and a ryegrass cultivar (Jackaroo) developed over a decade ago, it is responsive to all the managements imposed. Over two year's, application of 30 kg/ha/month of nitrogen resulted in a pasture response of 24 kg dry matter per kg of nitrogen. Assuming 70% utilisation, this dry matter would produce about 70kg beef live weight. If nitrogen costs $1.76/kg applied, the break-even price for beef is about $0.75/kg.

Similarly, the break even beef price for applying nitrogen and irrigation is about $1.30/kg live weight.

This work has set pasture and beef live weight production benchmarks for perennial pastures typical of those found in cool temperate and temperate environments. Consequently they should be applicable to all producers in this climatic zone with a production system based on finishing weaned steers as local trade or feedlot entry animals at 450kg live weight.

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1 Background

The two main drivers of profitability for beef production are price and production per hectare. Producers have little control over commodity prices but can significantly influence productivity. The business plan for the Red Meat Targets program along with the Meat and Livestock Australia strategic plan clearly identify increasing pasture production and utilisation as a significant opportunity for beef producers to increase their enterprise profitability. Many factors (pasture species, fertiliser, grazing management) driving pasture production and utilisation, have individually been shown to increase animal production, but there are few examples of measuring their effect when combined as a best practice system. This project aimed to achieve this and in doing so quantify benchmarks producers can use in order to make informed decisions with regard to adoption of technologies.

2 Project Objectives

This project aimed to establish pasture and animal production benchmarks for production systems based on the progressive adoption of best practice grazing management, nitrogen application and irrigation. In order to determine best practice the following practices were evaluated:

Grazing management – comparing set stocking, four paddock rotation and intensive rotation based on three shifts per week.

Nitrogen fertiliser – strategic winter application compared with regular application whilst moisture is not limiting plant growth.

Irrigation – Comparing full irrigation with dry land conditions.

3 Methodology

Six 1.86 ha paddocks were created from an area sown to Jackaroo ryegrass, Astred red clover and Pitau white clover. In year one two paddocks were grazed by either set stocking, a four paddock rotation or an intensive rotation based on three shifts per week to give a 28 day rotation. Average pasture cover using a rising plate pasture meter, and animal live weight was assessed monthly. Stocking rate on each treatment area was adjusted so as the average pasture cover remained in the window of 850 –1800 kg DM/ha. Weaned Angus steers with a mean live weight of about 220kg were use to graze the areas. These animals were sold when they reached a target weight of about 450kg.

In year two the intensive rotation was selected as the best practice grazing system based on the results from the first year. Consequently all plots were rotationally grazed with two plots being treated with each of the following nitrogen rates – nil, 45kg/ha applied in autumn and winter and 30kg/ha being applied every 28 days whilst moisture was not limiting plant growth. This latter treatment resulted in 210kg nitrogen applied per hectare. The animals were managed as described in year one.

The management for year three was intensive rotational grazing, coupled with the application of nitrogen whilst soil moisture was not limiting plant growth, coupled with irrigation. Irrigation was applied using a long lateral system in which sprinklers were shifted daily. Nitrogen was applied at the rate of 330 kg/ha on the irrigated blocks and 210 kg/ha on the dry land blocks. The animals were managed as described in year one.

4 Results and Discussion

The objectives of quantifying benchmarks associated with the various management practices were achieved.

5 Success in Achieving Objectives

The objective of quantifying benchmarks associated with the various management practices was achieved. The irrigation practice was hampered by logistical problems associated with supply and installation of irrigation equipment, and the lack of availability of irrigation water. As a consequence the performance of this treatment is considered to have been under-estimated. Given that the infrastructure is already installed, this phase of the work will be repeated in 2008-09.

6 Impact on Meat and Livestock Industry

6.1 Now and in five years time

Given increasing costs of production, the long-term profitability of the beef industry in temperate Australia will largely be dependent upon adopting technologies that allow production to be increased. As has been identified by several studies, the greatest opportunity for increasing profitability lies with increasing pasture production and utilisation. The results from this work set benchmarks to which producer's can aspire. The results also allow producers to make rational adoption decisions by using the physical responses coupled with the economic factors current at the time.

Current industry benchmark's, although confounded by season and physical location, suggest commercial producers are annually achieving less than 1000 kg live weight gain per hectare. The results reported here therefore suggest most cattle finishing businesses in temperate Australia have considerable room to improve production without large capital investments. Increasing production by 500kg/ha has the potential to double enterprise profitability.

The technologies used in this work are all well known and researched but industry has largely failed to adopt them either individually or as part of an integrated system. This is despite such technologies being routinely used by the dairy industry. Perhaps the results from this work can be used to inspire producers, particularly if their adoption on a whole farm scale can be documented.

7 Conclusions and Recommendations

This work has clearly shown that at least 1600 kg live weight gain per hectare can be produced annually by adoption of simple principles that increase pasture growth and utilisation. The important principles highlighted by this study are pastures based on perennial grass species, grazing managements that incorporate rest from grazing, ensuring nitrogen sufficiency and maintaining adequate soil moisture. It is also clear that the production response to these inputs is additive, suggesting that unless the basic principle is applied, moving to a more intensive system will probably not give the desired response, or at least will not substitute for poorer more basic management.

The results achieved with this work set benchmarks for pasture and animal production for a number of management systems. Whilst these absolute benchmarks are specific to a year and environmental conditions, their relativity should remain constant across systems. This will enable producers to make informed decisions regarding adoption of these technologies, and the complexity of their management system.

Commentators have been critical of the methodology used in this work in that it does not represent a system that will be practically operated on a commercial farm. This is true in the sense that a commercial farm would not have access to a pool of animals from which to add or subtract individuals, depending upon the pasture supply. This would normally be managed by conservation and feeding of pasture as silage or hay. Transferring pasture feed between seasons as conserved material is not practical in this experimental setting because of the practicalities of conserving fodder in a small area and feeding it back without inducing nutrient transfer issues. The design is defendable from the sense that it focuses on growing and consuming pasture in situ and therefore estimates the biological limits of pasture production in any one season.

Benchmarking data for beef production in temperate Australia is relatively scarce and often involves a breeding cow component, which will result in a lower level of production because of their relatively high maintenance demands. Results from a breeding and finishing benchmarking study on King Island suggest the best producers annually output about 470 kg live weight gain per hectare. The dairy industry has a much longer history of benchmarking than the beef industry and a relatively much simpler system because production is easier to measure. Results from the 2006 Tasmanian dairy business award show that the pasture utilised by the winner and average entrant was 11806 kg/ha and 8731 kg/ha respectively. These compares favourably to the results reported here, therefore suggesting the results are real and repeatable on a farm scale.

The technologies adopted in this work are well known and have been the subject of many individual studies, but rarely has a study focused on progressively applying them. A number of economic and environmental factors are currently acting to depress profitability of beef production, (terms of trade annually decreasing by at least 1.5%) so it is imperative that technologies such as these are adopted by the industry. The reasons for non-adoption are not clear and perhaps should form the subject of a separate sociological study. The reason could perhaps be summarised as the “people factor” which may be complex but worthy of elucidating, because if simple technologies are so slow to adopt, are more complex ones even worth contemplating?

The response to nitrogen is a major component of this work. Many Tasmanian pastures show the classic symptoms of nitrogen deficiency because their legume component is sparse and sub optimal. The price and environmental consequences for using nitrogen fertiliser are increasing, thereby making it imperative to improve the legume content of pastures. This raises the issues of determining the most appropriate legumes from the perspective of persistence and production. Together with how to introduce these species into already established pastures dominated by perennial grasses and undesirable annual and perennial weeds, as re-sowing pastures would be difficult to justify economically. Addressing these issues should for the basis of future research, development and extension work.

8 Appendices

Detailed results for each of the three years work is available on our Department of Primary Industries and Water website: http://www.dpiw.tas.gov.au