

THE NORTH AUSTRALIAN CATTLE INDUSTRY : RECENT RESEARCH DEVELOPMENTS  
IN NUTRITION

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SUMMARY

A major beef cattle research program has recently evolved in northern Australia with financial assistance from the Australian Meat and Live-stock Research and Development Corporation (AMLRDC). This program contains a large element of research into the nutrition of beef cattle. The nutritional research is done by four separate organisations which are coordinating inputs in accordance with finite goals. Increasing the turn-off of beef by 20% is the major objective and the nutrition-oriented endeavours are seeking to meet this through studies of growth, reproduction and mineral status.

Funding for these activities from AMLRDC is currently running at c. \$0.75M/year. These funds have provided a strong integrating force which has led to a high level of collaborative research. The specific aims of this research and progress to date are presented.

INTRODUCTION

While the North Australian beef herd approximates 11.5M or 50% of our national herd, the current level of productivity from northern pastures is low. This is due to the low net reproductive rate and relatively high age of turn-off. The North Australian Program (NAP) generated by the AMLRDC emanated from a review process which examined the existing information on pasture and animal productivity and the major constraints to production. Outputs from simulation models were then used to identify the most sensitive areas where research inputs could be expected to yield high returns. These returns were assessed in terms of the finite objective. The animal production sub-program carries both high and low risk elements of research but all are overtly aligned with the objective.

In order to maximise the flow of research findings into industry a formal mechanism has been developed. This has seen the development of a management component of NAP which seeks to apply research findings in the field. Application is largely directed towards on-property demonstration sites. The products of both pasture and animal research are formally aligned with industry in this manner.

The NAP has effectively been in force only since October 1986 and hence only a broad outline of activities and progress in the nutrition-oriented program is possible at this stage. Research and development projects are underway in Queensland, the Northern Territory and the Kimberley/Pilbara region of Western Australia. Some eight organisations are involved representing three State Departments (Queensland, Northern Territory, Western Australia), two CSIRO Divisions (Tropical Animal Science, Tropical Crops and Pastures), two Universities (James Cook, Queensland), and a private consultancy firm.

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PROGRESS TO DATE

The potential impact of effecting changes in slaughter weight, weaning rate or age of turn-off on productivity is depicted in Table 1. This table relates to the Brigalow Gidgee plant community area and it is the one chosen for presentation here since it is the major beef producing area in northern Australia.

TABLE 1 The effects of variations in growth rate, fertility and age at sale on beef production per adult equivalent (ae) in the Brigalow/Gidgee plant community in northern Australia (W.J. Taylor, pers comm)

Option	Increased liveweight sold	
	kg/ae	%
1. Increase sale weight (LWT) 600 to 650 kg ox i.e. 0.37 to 0.41 kg/hd/d	9.3	6.8
2. Increase fertility 65 to 80% weaning	10.1	7.3
3. Increase sale weight and fertility 650 kg ox; 80% weaning	20.6	15.0
4. Increase sale weight 600 to 700 kg ox i.e. 0.37 to 0.45 kg/hd/d	18.6	13.5
5. Increase sale weight and fertility 700 kg ox; 80% weaning	31.1	22.6
6. Reduce age at sale 3.5 to 2.5 years at 600 kg i.e. 0.37 to 0.55 kg/hd/d	35.0	25.8
7. Reduce sale age and increase fertility 3.5 to 2.5 years at 600 kg 80% weaning	53.8	39.3
<b>Base performance and management:</b>		
3.5 year sale age for ox	4% breeder mortality	
600 kg sale weight for ox	4% bulls	
420 kg sale weight for cull heifers	2-10 year breeding life for cows	
65% weaning	Cull dry empty cows	

Four other pasture communities have been modelled in this way in order to identify 'best bets' for research dollar investments. From Table 1 it is obvious that decreasing age of turn-off is a sensitive area with good potential for research reward. The following nutrition-oriented projects have evolved in an attempt to attain the reward:

(i) Weaner management This nutrition-oriented program, based at CSIRO, Townsville, is designed to manage breeder herds by early (down to three months) removal of weaners and to provide supplement regimes for these young cattle. The use of molasses based diets with the addition of true protein and roughage is the major thrust of the research. Table 2 gives some preliminary results to hand on effects of weaning and weaner supplement regimes on both weaner and cow performance.

An automatic spin-off from this research effort is the desirable impact that the management strategy has on breeder survival. The data in

TABLE 2 Effects of early weaning on weight changes (56 day period) in cows and calves (A J Schlink, pers comm)

Parameter	Weaned	Non weaned
Cow weight change (kg)	55	27
Calf growth rate kg/h/d	0.93	0.91

Table 1 are based on a constant mortality rate of 4%. If this rate is increased we see marked depressive effects on the associated levels of productivity.

(ii) Nutrition/ovarian function interactions The broad thrust of the reproduction-nutrition studies is to identify the nutritional factors influencing resumption of ovarian activity in the post-partum cow, and to develop nutritional strategies for improvement in fertility of grazing beef cattle.

Several studies are examining relationships of nutrition to post partum ovarian function. A project at QDPI Swan's Lagoon has examined the effects of pre-partum supplementation on post partum reproductive performance in Bos indicus cows. Preliminary analyses of some of the ovarian data indicate that supplemented cows had small (<4 mm) follicle populations 25% higher than in unsupplemented cows, and that approximately 20% more supplemented cows had ovulated by 80 days after calving (G. Fordyce, pers comm). Another study at James Cook University (JCU) has shown that ovulation rate in response to a standard Follicle Stimulating Hormone challenge in prepubertal heifers is inversely related to plane of nutrition. The possibilities of using the prepubertal heifer model for studying nutritional relationships to ovarian function are being explored, with particular reference to specific nutrients (**energy, protein**) influencing ovarian function.

(iii) Automatic Cattle Management An ancillary development to the nutrition program is a project designed to facilitate automatic separation/segregation of cattle on the basis of size/weight (QDPI). This program integrates with the nutritional programs designed to facilitate weaner growth and those examining effects of weaning on subsequent cow reproductive performance. The methodology developed also offers opportunities for automatic application of insecticides and medicaments such as rumen modifiers.

(iv) Improving liveweight gain and reducing age at turn-off One method of increasing annual liveweight gain in the dry tropics is to minimise the typical dry season liveweight loss which normally occurs. This can be done with traditional supplements based on molasses or protein meals. Rumen modifiers such as monensin and avoparcin are known to improve ration utilisation and may provide an alternative means of improving liveweight, and these aspects are being examined in several studies at Swan's Lagoon. Early results indicate significant liveweight response to avoparcin under both pen and field conditions (Table 3). Studies in this area are proceeding and rumen modifier and growth promotant studies being undertaken by QDPI, CSIRO and JCU are being consolidated and coordinated.

(v) Diagnosis and treatment of mineral deficiencies in northern Australia This project involves staff from the CSIRO Division of Tropical Animal Science and from James Cook and Queensland Universities. Preliminary work (CSIRO) has been concerned primarily with phosphorus (P) and sodium deficiency studies, particularly in cattle grazing Stylosanthes improved pastures. A close degree of integration has been developed with several

TABLE 3 Effect of Avoparcin (AVP - 150 mg/day) on liveweight gain and condition scores in steers on different diets (J. A. Lindsay, pers comm)

Treatment	Liveweight gain (kg/d)	Condition Score
Native pasture (NP)	-0.40	1.25
NP + P. Prot	0.05	3.42
NP + P. Prot + AVP	0.17	3.50
NP + M8U	-0.02	2.63
NP + M8U + AVP	0.15	3.38

P. Prot - 500 g protected protein mixture.  
M8U - ad lib molasses + 8% urea.

pasture related projects at Mareeba, Townsville and Mundubbera in which significant animal responses to either fertiliser or supplemental P have been recorded. A major problem identified in this preliminary work has been the unsuitability and unreliability of traditional diagnostic techniques for P deficiency. The new project has as its aims:

- a) Development of improved diagnostic techniques for P deficiency, in particular to determine the validity and practicality of bone densitometry measurements
- b) To determine the importance of interactions of protein and calcium status on P absorption and uptake
- c) To determine the effects of physiological state (pregnancy/lactation) on P requirements and status
- d) To develop practical formulations and delivery systems for P and other mineral supplementation regimes.

Concurrent studies in this project include those on sodium and sulphur deficiencies and work on trace element requirements in cattle grazing poor quality tropical native pastures.

(vi) Manipulation of growth of cattle This project involves both CSIRO and QDPI staff and is based at the CSIRO Rendel Laboratory, Rockhampton. The basic aims of the project are to develop techniques for a reduction in dry season weight loss and a stimulation of wet season weight gain. This will involve development of methods to reduce maintenance requirements when nutrition is limiting. A research technique recently developed involving the hind limb preparation is being used to measure rates of protein synthesis and degradation across skeletal muscle, in cattle. This preparation will also be used in a series of studies to examine the effects of a range of compounds such as sex steroids, growth promotants, immunisation procedures and other energy controlling hormones which may be effective in changing energy utilisation through effects on protein degradation. Alternative approaches being explored include the possible use of naturally occurring compounds stimulating energy consumption rather than looking for energy use inhibitors.

(vii) Hormonal control of reproduction A related project based at CSIRO Rockhampton with some collaborative work at Townsville (CSIRO; JCU), is concerned with the development of methods for hormonal control of reproduction in northern beef herds. Most of the research thrust is seeking to use luteinising hormone releasing hormone (LH-RH) in a biomedical matrix which will enable desired hormone profiles to be established at the right time of the year in cows normally in anoestrus. Integrated activities of this project relate particularly to the effects of nutritional status on endocrine activity during the post partum period.

That then is a brief and very broad outline of the North Australian Program of the **AMLRDC**. The initial role of the Coordinators has been to identify those research areas with a high probability of being able to contribute to the objectives and having done this, to develop a coordinated program across disciplines and across organisations. This has been a challenging though difficult role to undertake and is not without its critics. In particular the important implications of longer term funding of other research activities is an area requiring separate consideration. An additional advantage of the Program approach we have outlined is that scientific personnel, familiar with an industry and with its problems, are able to provide soundly based recommendations to a funding organisation. The opportunity for such contributions has not always been available in the past and is an important consideration.

Given the demonstrated willingness of individual scientists and of their **organisations** to participate in such a program, we are hopeful of a successful outcome which will enable the Corporation to achieve objectives which will assist the viability of the northern cattle industry.