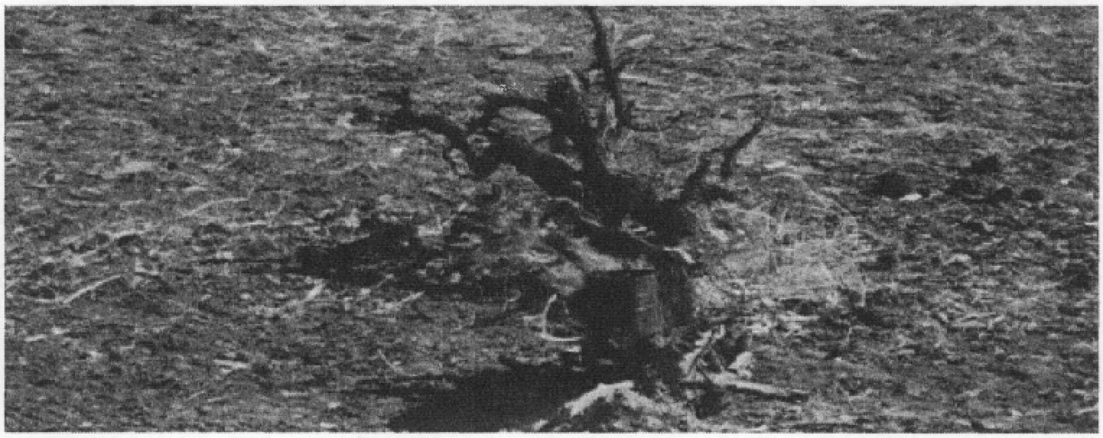
MOLASSES-UREA BLOCK SUPPLEMENTATION OF BEEF CATTLE ON THE BARKLY TABLELANDS DURING THE DRY SEASON



1 Abstract

One challenge of nutrition of cattle in extensive situations in Australia is to supplement the pasture deficiencies to achieve better productivity. 'Productivity' includes increased fertility, decreased mortality of breeding cattle and calves and increases in growth rates leading to decreased time to sale. The use of multi-nutritional supplements in the form of blocks is one method used to try to achieve this increase in productivity. The problems with conducting research to verify what effect the supplements are exerting, especially on properties in the Northern Territory, are:

1 The sizes of individual paddocks are usually so large that a regular total muster of animals is impractical

2. The unhandled nature of the animals precludes the use of invasive techniques or sophisticated procedures and the effect of the stress of handling becomes significant

3. The setting up of controlled experiments in the extensive situation is very difficult.

This has often led to short-term experiments, examining retrospective parameters, to achieve measurable responses. The measurements made are usually short-term weight gain and branding rates.

The Northern Territory cattle property 'Anthony Lagoon' running *Bos indicus* cattle, practises two types of supplementation, *viz.* urea/molasses lick blocks all year round and phosphorus/molasses lick blocks in the wet. This has led to the apparent increased branding percentage of calves from 48% in 1994, pre-supplementation, to 80 % in 1997 – the first year that the effects of a full year-round supplementation program occurred – to 85 % in 1998.

This study was undertaken to ascertain if it was possible to establish the intake pattern of this supplement and verify the intake over a number of samplings up to 12 months apart. Lithium chloride was added to the supplement and used as a marker that could to be examined in blood samples to determine the intake of individual cattle (Suharyono et al. 1991).

The intake distribution with the first sampling revealed 82 % of animals eating 1-40 g urea with 76 % consuming 1-30 g urea over the preceding 24-hour period. With the second sampling 10 days later, 75 % of the animals consumed between 1 and 40 g of urea with 66 % consuming between 1 and 30 g of urea. At the third sampling 12 months later, 84 % were consuming between 1-40 g urea with 83% consuming between 1 and 30 g urea/day. The animals found to be consuming none of the block varied between 3 and 7 %.

The result of the three samplings therefore established a relatively repeatable intake pattern of consumption of 'Dry Season' supplement on this property.

The sera obtained from the cattle at the three samplings were also analysed for blood urea nitrogen concentration which was found to be within the normal range (<200 mg /100 mL, the mean was 9.25 ± 2.75) in all samplings with no significant difference between samplings.

At the 1996 sampling, the cows also were examined for the presence of lactation and were pregnancy tested. The intake pattern did not appear to be affected by physiological status. Moreover, there was no significant difference in intake between pregnant, non-pregnant, lactating or dry cows.

Although the average intake of block increased with increasing gestation length – early: mid: late – the difference was not significant.

The pregnant wet (lactating) animals constituted 10 % of the cows examined, pregnant and dry 49 %, non-pregnant and wet (lactating) 16 % and non-pregnant and dry 25 %.

When pregnancy tested, the pregnant group of animals consisted of 30 % pregnant up to 3 months' duration, 33 % between three and six months' pregnant and 37%, seven or more months' pregnant.

The daily mean intake of the pregnant cows increased from 76 g in early pregnant cows, to 115 g in mid pregnant cows and 138 g in late term cows. In comparison, intakes were 133 g in non-pregnant, lactating cows and 98 g in non-pregnant, dry cows.

The significance of the percentage of animals pregnant and lactating is that it can be used as an index when assessing an immediate response to supplement. When the supplement is exerting an effect independent of environment, the number of pregnant, lactating animals will increase, relative to the number of pregnant, non-lactating animals and relative to non-supplemented animals. This is another method for assessing the effect of the supplements in addition to branding rate.

Serum progesterone hormone assays were performed on the blood sera of the cattle bled in 1996. The unexpected finding was that 13 % of the non-pregnant, dry cows and 10 % of the non-pregnant, lactating cows had a serum progesterone concentration that was greater than 13 nmol/L.

Progesterone levels greater than 13 nmol/ml are taken to indicate the presence of pregnancy but, in the case of non pregnant animals, could indicate that supression of ovarian activity is occurring. A mechanism involving the retention of a corpus luteum may be a more frequent cause of anoestrus in *Bos -Indicus* beef cattle than either cystic ovaries or non-functioning ovaries.The pulsatile progesterone secretion that occur during the oestrus cycle may affect the interpretation of single blood progesterone samples. Also the individual variation in progesterone concentrations in the luteal phase and during pregnancy may have contributed to the unexpected findings with progesterone. Further research should be undertaken to examine this aspect.

Blood oestradiol hormone estimations were also carried out on those cattle with low progesterone readings and it was found that there were no animals with low concurrent oestradiol concentrations, indicating that anoestrus caused by inactive ovaries was not occurring.

The weights of 25 calves selected at random from the herd at the bleeding in 1996showed a range of between 75 kg and 234 kg with the average of 155 kg and 68 % of calves were between 101 and 200 kg. It was concluded that the age of calves was 2-8 months, with the majority being 3 – 7 months old.

The establishment of a research protocol based on the animal population around watering points and the application of epidemiological statistical data techniques, when measuring the hormones progesterone and oestradiol or pregnancy indexes described above, provide the possibility of examining responses to supplementation. This would also give managers the opportunity to change the formulation of the supplement or increase the amount of supplement supplied at a time early enough to influence the ensuing year's calf drop.

The results of the research reported here have numerous nutritional management implications. These include the increased use of improved nutritional formulations and the move to seasonal mating that could improve productivity and profitability on this property. Pregnancy testing of a percentage of cows of the herd, noting if the cows were lactating or dry and classifying if they are in early, mid or late pregnancy will also give more information on the nutritional status of the animals and the effect of supplementation.

'from the spinefex hills we came to limitless plains,, occasionally crossing dry watercourses fringed with coolibahs, sometimes passing water holes. The cattle watering there were gaunt and miserable. We passed bores with great windmills towering over them.

Always there were several hundred head of cattle standing around. And always there were anumber of dead ones with crows in hundreds feasting on the carcasses:'

- 'Hell West and Crooked'; Tom Cole, p. 16

2 INTRODUCTION

Considerable quantities of supplementary inputs are used annually by cattle farmers in diverse geographical areas of Australia. The idea for using the supplements is to improve production from these cattle. The cattle are kept on differing pasture plant types, but dry, fibrous pasture is a feature of these pastures for at least part of the year.

The method of supplying the supplements includes intra-ruminal devices, drenches, injections; dry licks as well as salt and molasses based multi-nutrient blocks.

The chemicals supplemented include a range of minerals and trace elements including selenium, copper and cobalt. Low protein pastures are supplemented with non-protein nitrogen in the form of urea and true protein from plant sources. Part of the true protein may be rendered insoluble in the rumen. This so called 'by-pass protein' can also be added to the supplements.

A technique of evaluating intake of supplement by individuals, as against the averaged intake of a group, in extensive production areas, would give more accurate information on individual nutritional needs. This will enable a better interpretation of the effects of supplying the supplements to the cattle to be achieved. The research is particularly necessary when the type of supplement is in a 'self help' solid form and where the physiological conditions of the cattle vary from the non-pregnant to post calving.

3 STATEMENT OF THE PROBLEM

Cattle production from the northern grazing areas of Australia has problems related to the seasonal nature pasture availability; its low quality and digestibility, the climatic stress (heat) and distance from water sources. The poor value of the pasture, contribute to low fertility and low calving rates, high weaner mortality and slow growth of weaners compared with the cattle in the southern pasture areas of Australia.

Owing to the extensive nature of the grazing areas in northern Australia, the ***in situ*** examination of the causes of poor cattle production, involving the nutritional factors affecting the production has been considered difficult to under take in a way that would provide meaningful results. The main parameter measured for a response apart from weight gain is that of branding rates. Although supplementation in various forms is extensively used in the north of Australia, little critical evaluation has taken place to determine the effectiveness of such supplements. A technique of evaluating individual intake of the supplement, as against averaged intake of supplement, must firstly be established to enable further meaningful results to be obtained. The physiological state of the animal with regard to its reproductive functions and nutritional requirements on the dry pastures can also be examined with reference to the type of supplement used.

Once it is possible to measure successfully supplement intake and establish a pattern of individual intake, critical evaluation that the effects of various formulations of the supplements have on the ovarian activity of the cows can be made. It is especially relevant if these results are collected in actual grazing situations. The ability to change from one formulation to another more suitable formulation, with respect to fertility, at a time that can influence the following year's calving rate, has important implications. The effectiveness of a supplementary program, measured by the number of calves dropped in the ensuing year (branding rate), occurs 8 - 12 months after the birth and 15 - 21 months after the time that conception can be influenced. With the ability to intervene with a supplementary program at the time around fertilisation, the following years calving result can be altered or increased, a prospective intervention rather than a retrospective one.

3.1 Specific aims

The purpose of the study presented here was to examine if supplementing breeding and growing *Bos Indicus* cattle grazing extensive dry pastures (containing 5 to 6 MJ/kg of energy and 2–4% crude protein) could be reflected in immediate responses on the ovary rather than retrospective parameters such as branding rates. Supplemention in the dry season in the form of multinutrient molasses- based urea blocks containing cottonseed meal and fortified with the trace elements were used to determine intake.Phosphorus supplementation also occurred in the wet season.

After establishing that sufficient of the cattle have eaten enough of the supplement to have an effect on their well being other parameters could also be examined. The other major parameters studied were those involved in the reproductive response. The possibility of using indicators of ovarian activity (progesterone and oestradiol) was also examined to ascertain if a more accurate and sensitive measure of the effects of supplements on reproductive efficiency, especially the occurrence of anoestrus could be found.

Squires (1981) states that traditionally the levels of production from beef producing herds in inland Australia have been low. The branding percentage from the Barkly region in the Northern Territory and Gulf country in Queensland is quoted as 47%. In excellent seasonal conditions 1974-79 the branding % was between 65 and 67% (B.A.E., 1974). The figures for branding % in 1990 breeder survey (O'Rourke et al. 1992) for the Central and Northern rolling downs which includes the Mitchell grass country of the Barkly tablelands is given as 58.5%, whilst the gulf and peninsular branding rates are 48.3 %.

Results of the calf branding percentages and average weaning weights for age of the calves from the property 'Anthony Lagoon', where the research for this thesis was undertaken, has shown a steady increase in the years 1995–1997. These increases appear to correspond with an increasing use of supplementation during those years Table 1).

Table 1. Effect of supplement value on branding and weaning weights

Year	Branding %	Weaning weight	$ value supplement used
1995	60	186	105,085
1996	69	198	242,681
1997	81	220	337,280

Source: I. Rush (pers. com.)

3.2 Site description

'Anthony Lagoon' is a 4675-km^2 cattle property in Northern Territory of Australia, on the western side of the tableland highway latitude 18^0 south and longitude 135.5^0 east. It is about 230-km northeast of Tennant Creek, on the northern extremity of the area known as the Barkly Tableland. Definition of country type is given in Table 2.

Table 2 'Anthony Lagoon' physical characteristics

Pasture	Northern Mitchell rolling downs
Soil	Ug 5.25 cc66
Tree basal area	0.0
Stocking rate	0.029 beast/ha (34 ha/ 350 kg beast)

Source: Hall (1997)

Figure 1 'Anthony Lagoon' Bore 19 and surrounding paddock.

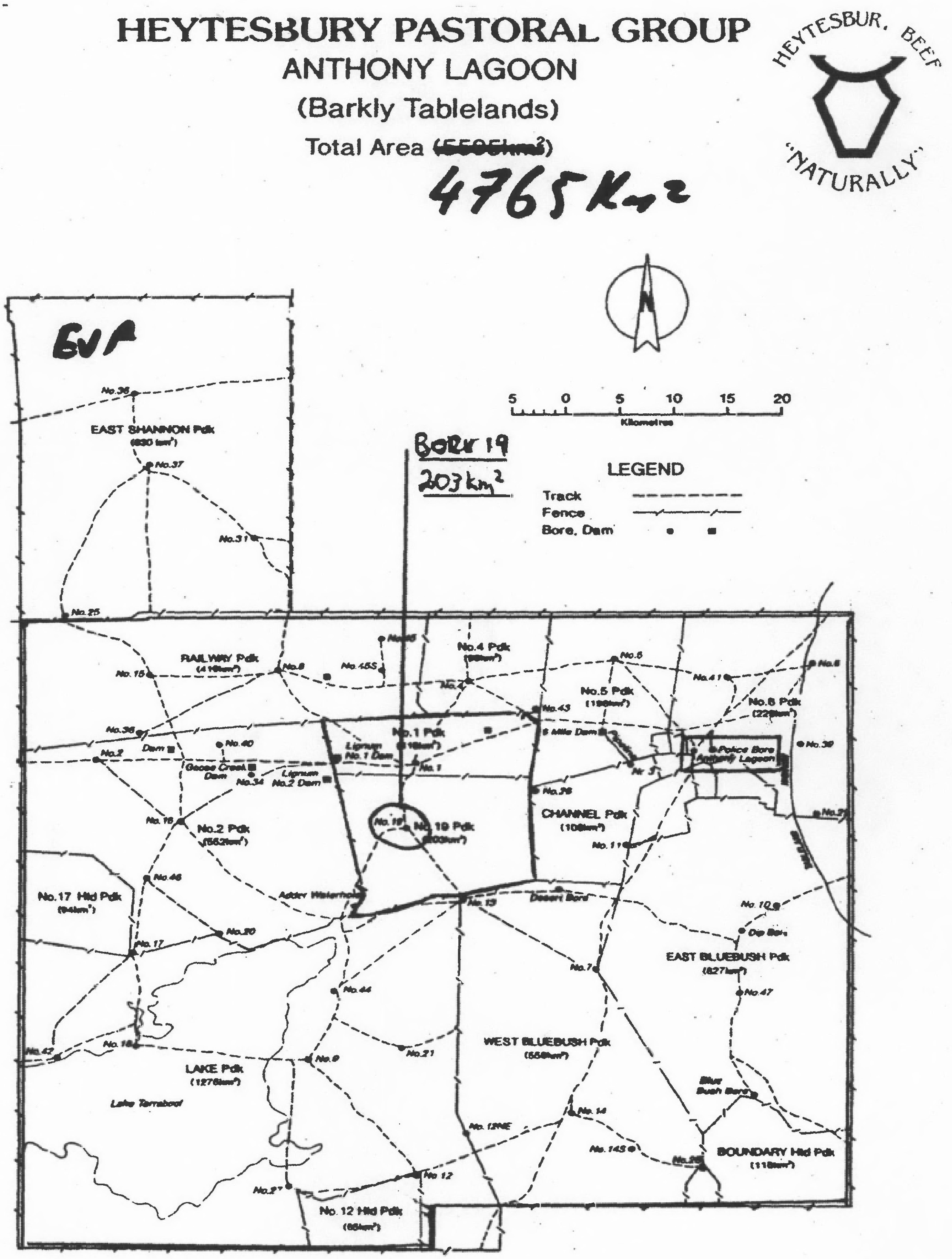
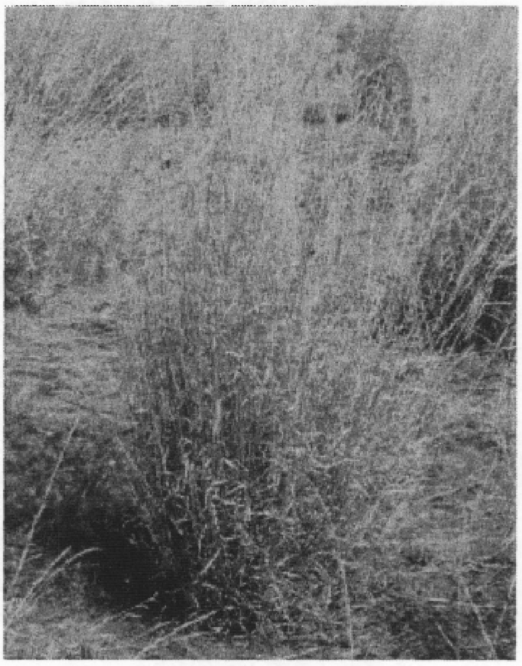


Figure 2 **Mitchell grass stand at 'Anthony Lagoon'**



Mitchell grass predominates in the mixture of species and pasture growth fluctuates in amount and quality throughout the year and this is reflected in the condition of the cattle;

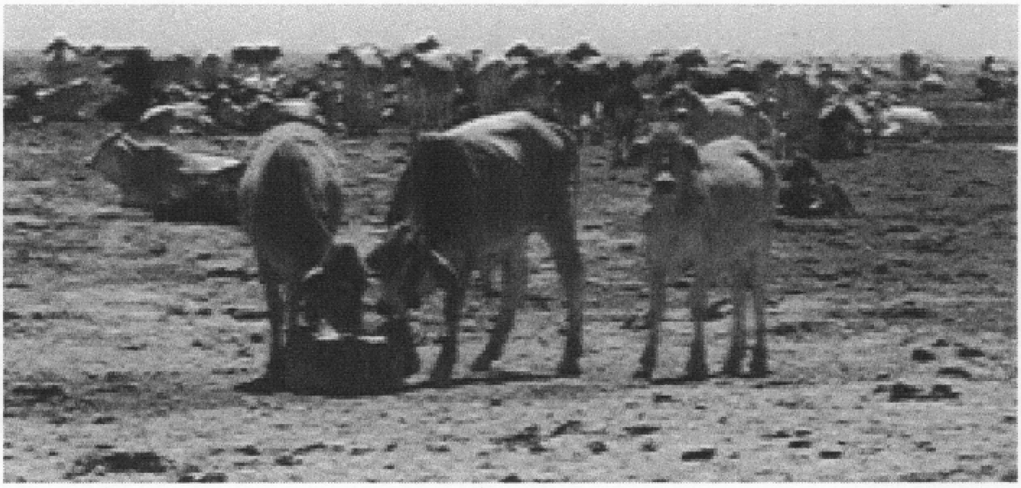
Table 3 Mitchell Grass nutritional quality

Plant part	Crude Protein %	Energy (MJ ME/kg)	Digestibility %	Calcium %	Phosphorus %
Green leaf	6 - 25	4 - 10	33 - 71	0.31 - 0.81	0.07 - 0.35
Dry leaf	3 - 7	4 - 8	16 - 57	0.32 - 0.66	0.02 - 0.07
Green stem	4 - 9	2 - 8	17 - 60	0.11 - 0.40	0.06 - 0.19
Dry stem	2 - 8	3 - 5	20 -35	0.14 - 0.35	0.02 - 0.09
Seed	5 - 12	6 - 9	41 - 64	0.22 - 0.32	0.17 - 0.30

Source: Bawden (1998).

Figure 3 **Cows and Calves on 'Anthony Lagoon' during the dry season.**

Figure 4 **Yearling cattle one month after the end of the wet season**

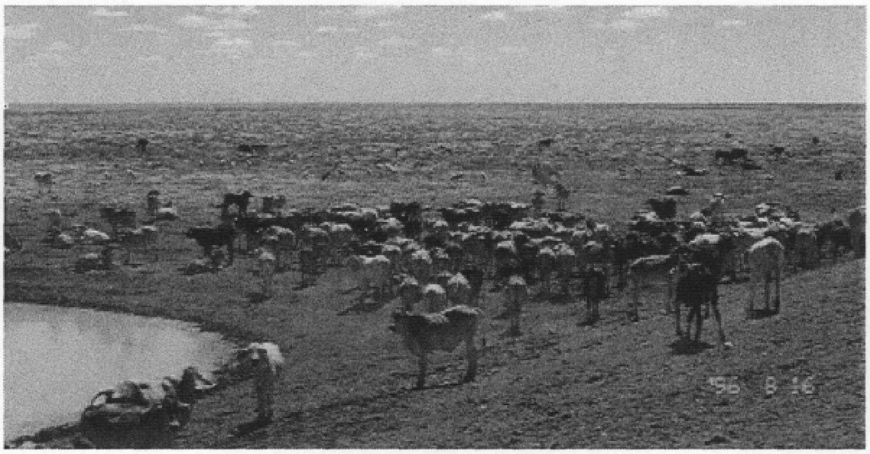


3.3 Pasture availability

Pasture fluctuations in both amount and quality will be reflected in the condition of the cattle on those pastures. At 'Anthony Lagoon' the usual annual occurrence of the rains in the wet season from November to January is followed by a prolonged dry period, where a large body of dry feed is produced. This will support fattening in the wet and for a variable period after, but as the dry becomes established the quantity and quality of the forage diminishes. This feed will at best, maintain body weight but mostly results in major losses of body weight of cattle. The period of time that the grass is in its most nutritious phase is short, (after the wet), in these Northern areas. Cattle breeding has traditionally been the main enterprise here with fattening and growing taking place traditionally further south in Queensland.

'Sutton said, 'are you losing many cattle?' Dodd looked grave. 'I would say
Overall, about a hundred a day and the rate must increase until it rains.
The trouble is the surface water dries up and I've got nowhere much to move them.
Sure I can put them on bores, but every bore is overstocked now.'

From 'Hell West and Crooked'; Tom Cole, p. 19

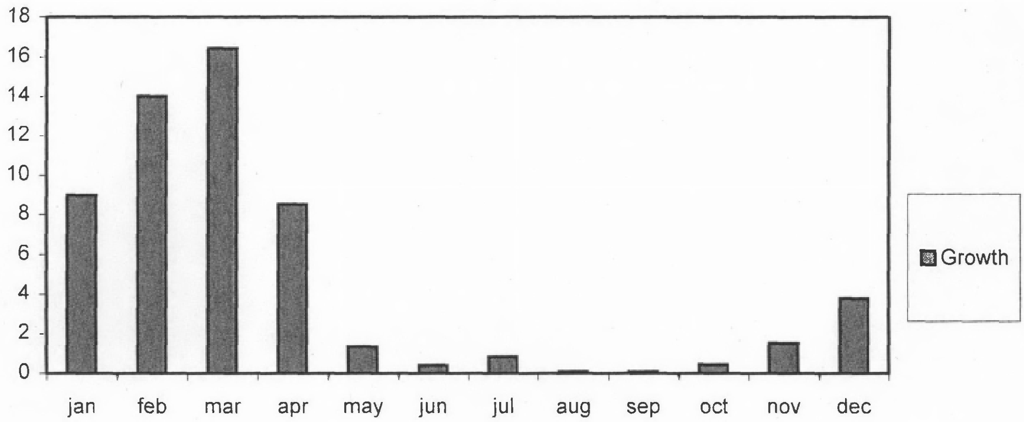


3.3.1 Pasture composition

Pasture growth, both quality and quantity, is very variable which, as will be discussed later, has implications for the structuring of a seasonal breeding program and ultimately the overall number and viability of calves produced. This pasture variation also has effects on mortality in female cattle related to the stage of pregnancy and time of calving especially when the forage is at its poorest nutritional level.

The pasture growth history for 'Anthony Lagoon' for the years 1958 to 1995 is given in Fig. 5.

Figure 5 Mean pasture growth 1950-1967 (tonnes/ha)



Source: Hall (1997)

The months of December, January, February, March and April represent the periods of higher pasture growth, with the major green pool also at this time. The green pool represents the periods of highest protein and nutritional availability from the plant. This, ideally, is the time at which the protein demands in the animal should also be at their maximum.

Due to the decreased level of protein in pastures from April to November / December the introduction of seasonal breeding, where the bulls are in with the cows for a specified time, would help to achieve synchronisation between pasture protein availability and the cow and calves' maximum protein needs. The bulls, if restricted to running with the cattle from March to May-June, would have the following advantages. It would reduce the period of calving from year round to December through to March-April. If the calving could be manipulated to occur between mid November - early December to March - April, there is a high probability that there will still be enough protein in the pasture. Thus providing nutrients for the ensuing two to four months for good milk production from the lactating cows. More importantly, the protein content of the grass has been relatively high during the last trimester of pregnancy. The reduced time over which calving would occur would have the following advantages:

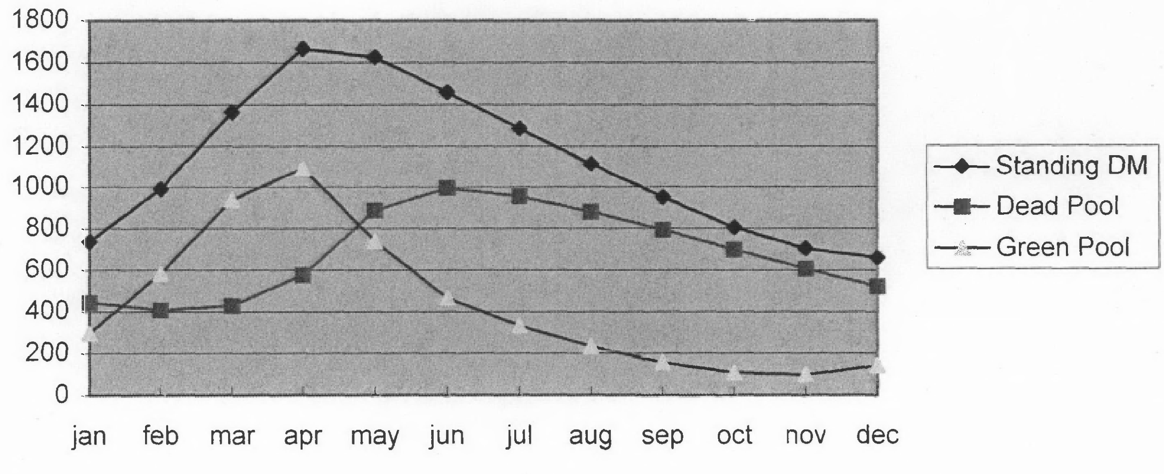
1. It would reduce the number of times cattle have to be mustered for weaning and so decrease the number of employees, saving wages.

2. Cut down the time supplements would have to be put out and would allow for the more discriminating use of supplement.

If, however, only 10–20 % of calving occurs over this period, the other 80 -90% will occur from May to October, when the protein level in the pasture is deficient. This results in higher deaths in both cows and calves, lower milk production from cows and so lower growth rates in calves. The lower milk production will result in lower weaning weights in the calves and lower return to pregnancy rates in the females. Male fertility also follows the requirements of the females and so semen quality and quantity also decreased when protein availability drops.

Dry matter (see Fig. 6 Dead Pool), increases from the end of April with the maximum dead pool (dry feed) and lignification and leaching out in the plant occurring from June to September and total feed availability diminishing until late December.

Figure 6 **Pasture dry matter (kg/ ha) at 'Anthony Lagoon'**



Source: Department of Primary Industries Qld. (W.Hall, pers.com.1997)

These figures are averages only and the grass cycle is very variable as signified by the variability of when the rains begin. The subsequent effect on pasture is reflected in the large standard deviations in the primary data. (see Table 4).

Table 4 **Total standing dry matter (kg /ha)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	738	991	1366	1666	1627	1460	1285	1114	950	807	705	661
SD	666	945	1246	1466	1403	1211	1037	883	743	627	550	514

Source: Department of Primary Industries Qld. (W. Hall, pers. com. – computer model)

However, on average the normal wet season occurs from October to April while from May to November there is an increasing reliance on dry feed (Fig. 6). This results in dry pasture being the main forage for the animals for a majority of the 12 months.

The primary deficiency occurring in dry and aging pasture –along with digestible energy deficiency – is nitrogen (protein) deficiency. A nitrogen source (sometimes including also sulphur) will therefore be a major requirement for successful production from cattle on these pastures. The nitrogen from the feed eaten by the cattle has to be efficiently synthesised to rumen microbial protein. This optimisation of microbial proliferation has implications on the digestibility of the feed (see Section 3.1). A source of protein non-degraded in the rumen (by-pass), provided when the cows have higher protein requirements than can be achieved in the rumen from microbial protein, has an effect on productivity. These higher requirements occur in late pregnancy, early lactation and for the calves at the time of weaning. Small amounts of by-pass protein improves production, (Preston and Leng, 1987). Once the protein needs are satisfied, both rumen protein and by-pass protein, the energy availability will also be affected and improved (Section 4.2, 5.1.6) through improvements in digestibility of the dry pasture and rumen efficiency. When these major deficiencies are rectified, the next limiting mineral/ element(s), probably phosphorus, but also calcium and sulphur become the limiting factors to production. Before examining in depth the subjects alluded too above the anatomy and physiology of the ruminant intestinal tract will be discussed in the next section.