NORTHERN TERRITORY OF AUSTRALIA

technote

DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES

No. 91
July 1994

THE USE OF CENTROSEMA HAY AS A FODDER SOURCE FOR THE NORTHERN TERRITORY CATTLE LIVE EXPORT INDUSTRY.

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SUMMARY:
A series of pen trials were conducted at Berrimah Agricultural Research Centre to examine the suitability of *Centrosema pascuorum* based feed cubes as a potential fodder source for the live cattle export trade. Pen trials were conducted to measure feed preferences, intake and weight gains, of export grade steers given a choice of commercially available feeds. There was a significant preference for lucerne cubes over all alternatives. In a single feed situation there were no differences in cattle weight gains or feed intake between the centro cubes and lucerne pellets. Feed cubes made primarily from *Centrosema pascuorum* were found to be suitable for the live export trade.

INTRODUCTION-

The recent growth of the South East Asian live cattle market has been a major boost to the economy of the Northern Territory. One offshoot of this lucrative industry is the need to feed the cattle pre-voyage (depoting and health testing), during the voyage (requiring a low weight and easily managed feed source) and post voyage while animals acclimatise. Due to the relatively short time period that the animals need to be fed (up to 21 days), and the high levels of stress experienced during this time, minimising weight loss is as high a priority as maximising weight gain.

Probably the most critical feed characteristics in achieving this is palatability, digestibility and the time it takes for cattle to adjust and eat adequate quantities of any newly introduced feed. Presently, the main source of fodder is lucerne cubes or pellets, both grown and sourced from interstate. Ideally a locally grown substitute for the highly nutritious lucerne product would encourage a local industry to value add to a local product and encourage vertical integration in the live export industry. One potential source of feed is *Centrosema pascuorum* cv Cavalcade and Bundey, a pasture legume well adapted to the Top End environment.

METHOD:

The investigation was undertaken in two stages. Both consisted of controlled, replicated pen trials.
Stage 1 measured the relative palatability of the centro cube to two other commonly used export stock feeds over a short "introductory" period. Preferred feed intake was used to compare palatabilities.

Stage 2 examined cattle liveweight gains, feed intake and feed conversion efficiency of centro cubes compared to lucerne pellets over a 21 day period. Lucerne pellets were chosen for the comparison as it is primarily the lucerne pellet market that the centro cube is aiming to fill.

AGDEX 125/81

ISSN 0158-2755

STAGE 1 PALATABILITY TEST:

The centro cubes were compared for palatability with one commercial lucerne pellet and a commercial lucerne cube. Twenty Brahman-X cattle (mixed sex) from Berrimah Agricultural Research Centre were fasted overnight, weighed then allocated to one of four treatment groups. Animals were stratified on a weight and sex basis, then randomly allocated to treatments. Five animals were allocated to each treatment. Treatments 1-3 involve ad-lib access to all three feed types,

lucerne pellets,
lucerne cubes,
centro cubes.

Treatment 4 consisted of one pen of animals with ad-lib access to the centro cubes only. This treatment was included to ensure cattle would eat centro cubes thus avoiding the possibility of extreme weight loss of animals in Stage 2 of the trial.

Daily intake of each feed was measured to estimate the relative palatability (via preference) of each feed type. Animals were then weighed again at the completion of Stage 1, a period of 3 days. Feed samples were collected during the trial, dried and analysed for total nitrogen, phosphorus, calcium, sodium, potassium and digestibility.

STAGE 2 - WEIGHT GAIN COMPARISON

Sixty four Brahman X feeder steers meeting export specifications were weighed and allocated to treatment groups. Animals were stratified on weight then randomly assigned to the two experimental groups. Pen replicates were randomised throughout the block. Half were fed *ad lib* on imported lucerne pellets, the remaining *ad lib* on centro cubes. Bi-weekly feed consumption, cattle liveweight gains and feed efficiencies for each were calculated over a 23 day period.

Feed conversion efficiencies (FCE) estimate the amount of each feed (kg) required for the animal to gain 1kg liveweight.

Feed Conversion Efficiency = Average daily intake of feed / Average daily weight gain.

Overall experimental design consisted of a 2x4 randomised block incorporating two feed treatments (centro cubes and lucerne pellets) with four pen replicates of eight animals in each pen using the relationship:

$$\delta = \sqrt{\frac{2ks^2\phi^2}{n}}$$

where - δ = minimal detectable difference
k = number of treatment groups
s^2 = sample variance; an estimate of population variance from initial cattle liveweights
Φ^2 = non centrality parameter; an estimate of the power of the analysis of variance (Zar 1984)
n = number of animals within each treatment

it was estimated that a treatment difference of 10kg liveweight between groups could have been detected.

RESULTS:
STAGE 1:

Cattle fed solely on centro cubes showed an average daily intake of 6.86 kg/head over the three day period. The centro cubes would be eaten when supplied.

There was a significant preference for the lucerne cubes over both the lucerne pellets and the centro cubes. There was no significant difference in choice between the latter two feeds. There was no difference between pens in their intake.

There were daily feed intake differences within pens as animals become accustomed, however there where no significant changes in cattle liveweight between the treatments over the three day period.

Analysis of variance summaries are found in Appendix 1. Nutrient analysis is summarised in Table 1.

Table 1: Nutrient analysis of feeds.

	Phosphorus %	Calcium %	Sodium %	Potassium %	Nitrogen %	Protein %
Centro Cubes	0.10	1.95	0.12	1.82	1.42	8.85
Lucerne Cubes	0.25	1.27	0.22	2.18	2.37	14.79
Lucerne Pellets	0.24	1.64	0.60	1.49	1.75	10.92

All results on dry matter basis. Protein = Total Nitrogen x 6.25
Mean digestibilities of samples taken throughout the trial are shown in Table 2.

Table 2: Average digestibilities.

	Digestibilities %
Centro Cubes	64.7
Lucerne Cubes	66.5
Lucerne Pellets	64.1

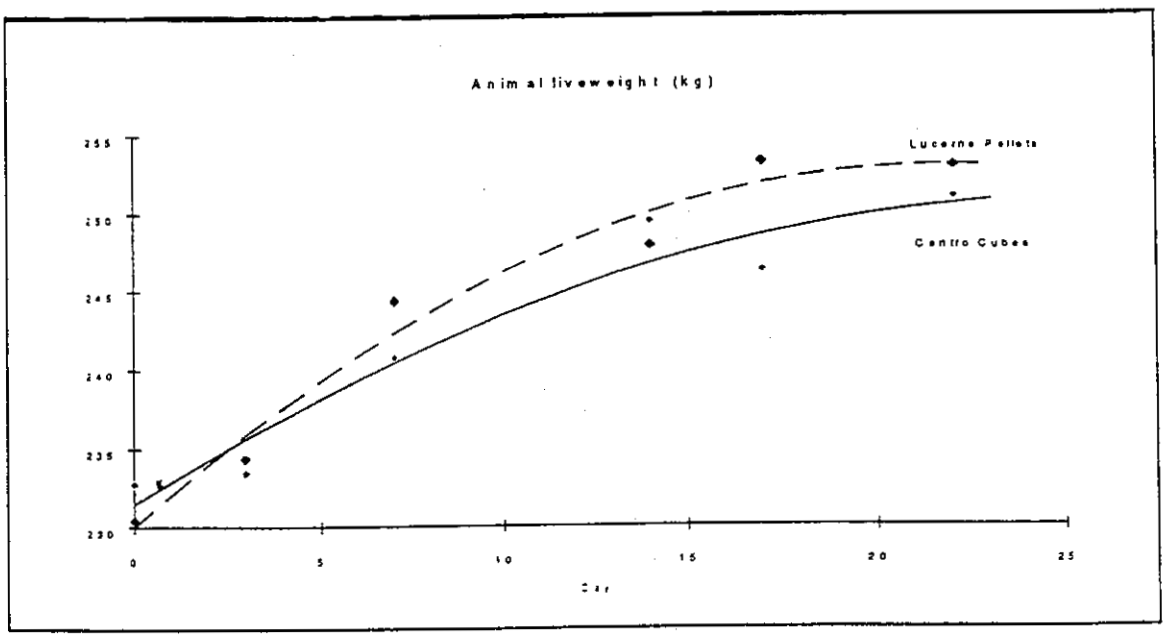
Analysis of variance showed no difference in digestibilities between groups.

STAGE 2:

Cattle liveweight:

There were no significant differences in initial cattle weights between the two treatment groups, nor were there any differences in weight gains over the trial period between each treatment. There was a significant change in weight for both treatment groups over the trial period, ie both treatment groups gained weight as intake increased. Figure 1 shows the exponential relationship between cattle liveweight and days on feed for the two treatment groups.

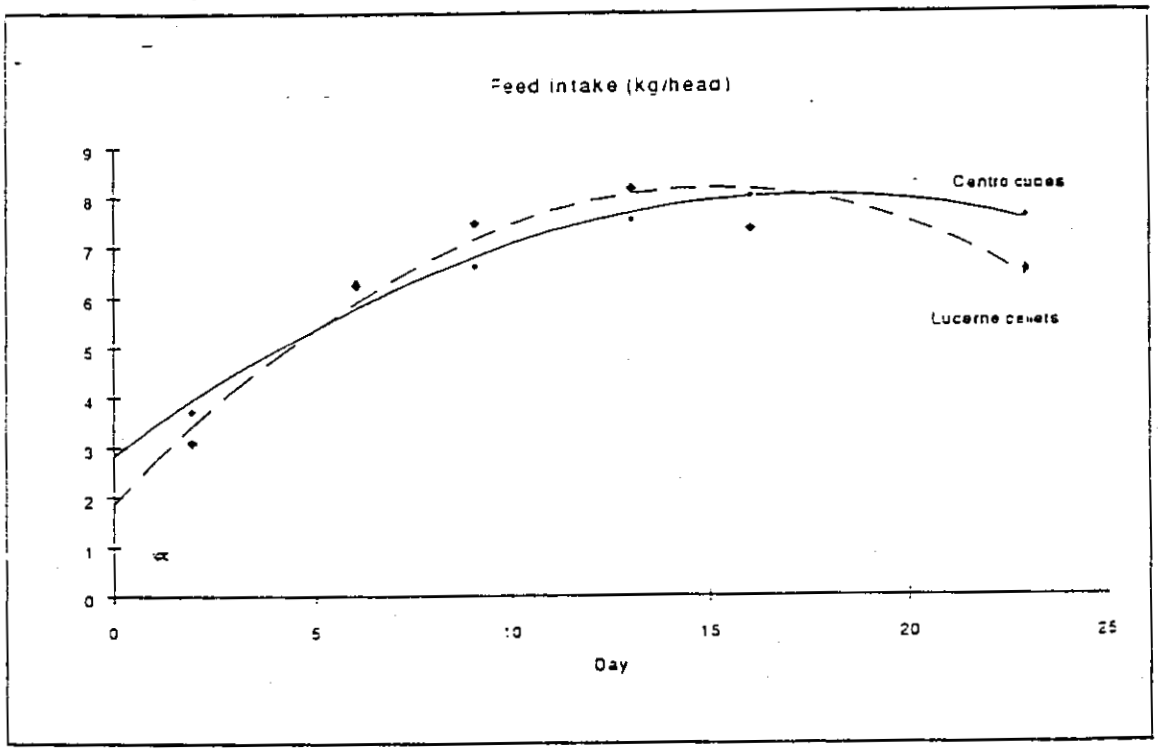
Figure 1: Average pen liveweights x days on feed.



Analysis of variance results for cattle weight gains are summarised in Appendix 2

Feed Intake:
There were no differences in feed intake between the two treatment groups, there was a difference within groups over the trial period as animals became accustomed to feed and environment.
Analysis of variance summaries for feed intake are presented in Appendix 2. Figure 2 shows the exponential relationship between feed intake and days on feed.

Figure 2: Average daily intake of each of the two feed types.



Feed Conversion Efficiencies:
Paired t-tests showed no differences in pen average feed conversion efficiencies between the two treatment groups. Average feed conversion efficiencies are shown in Table 3.

Table 3: Average Feed Conversion Efficiencies.(kg/kg liveweight)

	FCE
Centro Cubes	8.1 ± 3.4
Lucerne Pellets	5.9 ± 1.7

DISCUSSION:

Stage 1 showed there was a clear preference for lucerne cubes over the other two feed types, it also demonstrated that by not giving a choice centro cubes would be consumed in adequate quantities. Using the manufacturer's analysis of the centro cubes and "Take Away" feed analysis software (S.A Department of Primary Industry) the composition of the centro based cube should be adequate for a Brahman 230 kg steer to gain 1 kg per day with an intake of 8 kg of feed per day. The centro feed is suitably balanced for cattle weight gains.

Overall there was no statistically significant difference between the two feeds trialed in Stage 2. Intake, weight gains and conversion efficiencies, although varying, showed no differences between the two treatment groups. There was an improvement in feed intake (observed in both feeds) as cattle became accustomed to both the feed and the environment.

The centro cubes trialed proved to be suitable for use in the cattle live export industry.

ACKNOWLEDGMENTS:

The authors wish to acknowledge the considerable assistance of David Heath (Carabao Exports) and John Vidler (Bonalbo Station) for supplying feed used in both trials. The cattle used in Stage 2 were supplied by Carabao Exports.

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Appendix 1:

Feed effects x pen (replicate) effects.
Table 1.1: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
FEED	133.794	2	66.897	255.552	0.000
PEN	0.044	2	0.022	0.085	0.919
FEED*PEN	2.591	4	0.648	2.475	0.081
ERROR	4.712	18	0.262		

Table 1.2: MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	Centro Cubes	Lucerne Cubes	Lucerne Pellets
Centro Cubes	1.000		
Lucerne Cubes	0.000	1.000	
Lucerne Pellets	0.059	0.000	1.000

Feed x intake/day x day.
Table 1.3: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
FEED	133.794	2	66.897	338.573	0.000
DAY	1.909	2	0.954	4.830	0.021
FEED*DAY	1.882	4	0.471	2.381	0.090
ERROR	3.557	18	0.198		

Initial and final cattle liveweights (kg) x pen.
Table 1.4: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
IN*OUT	1.601	1	1.601	0.001	0.972
PEN	7860.120	3	2620.040	2.044	0.129
IN*OUT*PEN	74.288	3	24.763	0.019	0.996
ERROR	38452.750	30	1281.758		

Appendix 2:

Initial weights x feed treatments.
Table 2.1: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
FEED	54.932	1	54.932	3.536	0.068
ERROR	590.371	38	15.536		

Weight gains x feed treatments.

Table 2.2: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
FEED	226.719	1	226.719	3.636	0.064
ERROR	2369.266	38	62.349		

Weight gains x days on feed.

Table 2.3: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
DAY	1715.459	4	428.865	17.047	0.000
ERROR	880.525	35	25.158		

Intake x feed treatments.

Table 2.4: ANALYSIS OF VARIANCE

SOURCE	SS	DF	MS	F-RATIO	P
FEED	0.308	1	0.308	0.108	0.744
ERROR	131.102	46	2.850		

Intake x day treatments.

Table 2.5: ANALYSIS OF VARIANCE

SOURCE	DF	MS	F-RATIO	P	
DAY	107.416	5	21.483	37.606	0.000
ERROR	23.994	42	0.571		