In Experiment 2, results were similar to Experiment 1 when starch was continuously infused into the rumen or sprayed on the feed. However, intake of hay was not significantly increased when starch was given only once daily or infused into the abomasum. Infusion of casein into the abomasum gave similar results.

When cattle were given wheat supplements once daily, there was no significant change in intake of hay (Experiment 3) which confirms findings in Experiment 2 that starch given once daily did not increase feed intake or N balance in wethers (Diet 5), but the continuous supply of starch increased feed intake (Diets 2 and 3). The treatment of barley grain with alkali results in a slower release of energy than feeding cracked grain once daily (Sriskandarajah et al. 1980) and this may also result in a greater intake of roughages.

It may be concluded that small supplements of starch (10% of air dry feed) can increase the intake of paspalum hay if the supplement is fed continuously. This would agree with the observation of Blaxter and Wilson (1963), Crabtree and Williams (1971) and Lamb and Eadie (1979), and this response was not due to the N content of the supplement as urea or meat meal was given in addition to the energy supplements.

SUPPLEMENTATION OF PREGNANT COWS WITH PROTECTED PROTEINS WHEN FED TROPICAL FORAGE DIETS

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Native pastures in the dry tropics rapidly decline in digestibility and N content with the onset of the dry season. N supplementation is offered as a management strategy to overcome the dry season nutritional deficit. This deficit occurs despite an abundance of dry standing pasture and one of the susceptible groups of cattle is lactating cows.

MATERIALS AND METHODS

Twenty mature pregnant Brahman crossbred cows were allocated on the basis of foetal age and fasting live weight to one of four treatments. All cows had reared a calf the previous year. The treatments imposed were: chaffed native pasture hay (NP); NP plus a supplement of 55 g N as urea sulphur (US); NP plus US and 1 kg of protected protein (US+PP) - 80% formaldehyde cottonseed meal; 10% fish meal; 10% meat and bone meal; and NP plus 2.0 kg lucerne chaff (MS). The cows were individually fed in pens on a basal diet of ad libitum native pasture hay (predominantly Heteropogon contortus) containing 0.4% N. Urea was sprayed onto the hay in a water solution and the other supplements were fed in a separate trough. The experiment took place during the last 60 days of pregnancy and feed intake, cow live weights and calf birth weights were recorded.

Data were analyzed by analysis of variance for a randomized block design. Differences between treatment means were tested using the LSD procedure.

RESULTS AND DISCUSSION

The results for liveweight change and dry matter intake during a 60-day feeding period are presented in Table 4.

One animal on the NP control treatment died from nutritional deprivation otherwise health and calving were normal.

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TABLE 4 Mean liveweight change (LWC), mean dry matter intake (DMI) and mean calf birth weights of cows fed native pasture diets with N supplementation for 60 days pre-calving

	Treatment				SEM
	NP	US	US+PP	MS	
LWC (g/day)	-815^a	-308^b	750^c	405^c	105
DMI (kg/day)					
Roughage	4.21^a	6.21^b	8.12^c	6.68^b	0.17
Total	4.24^a	6.33^b	9.13^c	8.47^c	0.17
Calf birth weight (kg)	22.0^a	30.9^b	32.1^b	32.1^b	0.7

Means within rows with dissimilar superscripts are significantly different ($P < 0.01$).

The liveweight loss of the NP animals was dramatic, with a mean loss of 48.9 kg recorded. There was a significant reduction in liveweight loss ($P < 0.01$) when the US supplement was offered and the PP and MS supplements initiated a significant liveweight gain ($P < 0.01$). Much of the response in live weight appeared to be explained by a stimulus in roughage intake with N supplementation. Lee et al. (1980) working with lactating beef cows also observed that protected protein supplementation increased hay intake. There was a concomitant response in liveweight gain and milk yield. The significant increase in roughage intake ($P < 0.01$) when PP was added to the US supplement indicates a response to slowly degraded ruminal N supplement or to increased nutrient supply post-ruminally (Sriskandarajah et al. 1980).

The calves of the NP control cows had a mean live weight of 22 kg and the calves from supplemented cows were on average 44% heavier. The supplements merely allowed the cows to produce a calf of normal birth weight (R.G. Holroyd, personal communication) and the NP diet limited nutrient supply sufficiently to influence foetal growth. A similar depression in calf birth weight was observed by Russell et al. (1979) when pre partum energy intake was severely restricted.

These results indicate that the pregnant cows fed on the poor quality tropical forage diet used in this experiment required an increased supply of nutrients to reduce liveweight losses and ensure a normal calf birth weight. Supplementation with urea sulphur will meet this requirement. However, if the cows are in poor body condition it is likely that supplementation with protected protein or lucerne hay is necessary not only to minimize liveweight loss but also to enable an increase in live weight to occur.

THE ROLE OF PROTEIN SUPPLEMENTS IN THE NUTRITION OF BEEF CATTLE GRAZING NATIVE PASTURES OF THE NORTH COAST OF NEW SOUTH WALES

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The north coast of N.S.W. has a climate in which 60% of the annual rainfall (1000 mm) falls in the hot summer months, when the temperature range is 15-40°C, and this favours the dominance of pastures by summer-growing grasses. However, by July, cattle are faced with a forage which has a digestibility as low as 43% and N as low as 0.4% (Cohen 1978). Cattle are unable to meet their maintenance require-

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