

ENLARGED THYROID GLANDS IN CATTLE GRAZING LEUCAENA PASTURES

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ABSTRACT

Enlarged thyroid glands in cattle grazing Leucaena leucocephala cv. Peru pastures in Queensland, Northern West Australia and New Guinea are reported. Associated effects of prolonged leucaena grazing are low liveweight gains, excessive salivation and hair loss.

INTRODUCTION

Leucaena leucocephala (leucaena) is a pan-tropical leguminous shrub with considerable potential as a pasture legume in the tropics and subtropics (Oakes 1968, Gray 1968 and Hill 1971). These reviews show that leucaena is high yielding in a range of tropical environments, is highly palatable and persistent. However, animal production on leucaena pastures is not well documented.

Leucaena contains a toxic amino acid, mimosine, which causes hair loss in some situations (Owen 1958, Vohradsky 1972). It has frequently been stated that cattle are not affected by the toxic principles in leucaena. Leucaena is also known to cause fleece shedding, excessive salivation, and even loss of hooves in sheep (Hegarty, Schinckel and Court 1964; Reis, Tunks and Chapman 1975). Heifers in pens fed a sole diet of leucaena grew normally but produced small calves with enlarged thyroid glands (Hamilton, Donaldson and Lambourne 1971).

OBSERVATIONS ON CATTLE GRAZING LEUCAENA FOR PROLONGED PERIODS

In this paper we report the occurrence of enlarged thyroid glands in adult cattle grazing mixed pastures of leucaena in three different environments.

1. Samford, S.E. Queensland (Lat. 27° 22'S)

In 1970 a group of three steers (one Hereford steer and two Droughtmasters), which had grazed continuously a *Leucaena leucocephala* cv. Peru-*Chloris gayana-Digitaria didactyla* pasture for eight months with no apparent ill effects, lost hair severely. The Hereford steer lost the most hair. The coronets were somewhat swollen and bleeding—possibly through friction or damage by the leucaena stems. The tail hair and switch were completely lost. Two of the animals salivated profusely, became listless and could be moved only with considerable provocation. The neck of the Hereford and one of the Droughtmasters was noticeably swollen when placed in a neck yoke. Animals failed to gain weight then lost weight in the presence of ample, good quality feed. Animals unaccustomed to leucaena made gains of 1 kg day⁻¹ when introduced to the same pasture.

Enlarged thyroid glands were detected in all cattle at slaughter; two were grossly enlarged with each lobe measuring > 10 cm × 8 cm. The specimens were preserved in association with the trachea for demonstration purposes and were not weighed. From experience with other thyroids all three animals would have had thyroid weights in excess of 200 g. The adrenal glands appeared normal.

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During the years 1970-1974 no clinical signs of leucaena toxicity were recorded in groups of cattle grazing this same pasture, but thyroid weights were not measured. With the 1974-75 batch of four heifers, however, listlessness, incoordination of gait and hair loss were noted in March, 84 days after the commencement of grazing. Blood serum analyses at this time showed low levels of thyroxine for T_4 with values below $1.2 \mu\text{g}/100 \text{ ml}$ for all animals, indicating a pronounced hypothyroid condition. Serum values for non-leucaena fed animals of the same age and breeding were normal at $8 \mu\text{g}/100 \text{ ml}$. Two of the group of four animals lost appreciable hair but surprisingly all retained the switch at the tip of the tail. At slaughter 168 days after entering the leucaena, all animals had enlarged thyroid glands (Table 1) but the adrenal glands appeared normal.

2. Kununurra, N.W. Australia (Lat. $15^\circ 39'S$)

Steers grazing irrigated Pangola grass—leucaena pastures at the C.S.I.R.O. Kimberley Research Station had mean gains of approximately $0.35 \text{ kg}/\text{head}^{-1}/\text{day}^{-1}$ day which was far lower than the condition of the pastures would lead us to expect (C. G. Blunt, unpublished data). Gains were good when the animals first entered the pastures, $0.6\text{-}1.0 \text{ kg head}^{-1} \text{ day}^{-1}$, but after several months of grazing liveweight gain was reduced. Steers regularly lost hair from the tail and other parts of the body, had skin lesions, particularly on the coronet, became listless and salivated profusely. A consistent feature was again the enlargement of thyroid glands (Table 1). Pregnant cows which grazed leucaena all the time produced calves in the wet season (Dec-Mar) with enlarged thyroids (Table 1) and most calves died within three days of birth. Steers on Pangola grass pastures and steers in a feed lot had normal thyroids (Table 1).

3. Erap, Papua New Guinea (Lat $6^\circ 35'S$)

At the Beef Cattle Research Centre heifers grazing leucaena pastures (with unpalatable grass and dicotyledonous weed species) have exhibited the clinical signs already described but the thyroid glands have not attained the weights recorded at Samford and Kununurra (Table 1). The effect has been more noticeable in animals of Droughtmaster or half Brahman breeding than in three quarter Brahmans.

Some animals developed ulcers on the tongue and erosion of the gums. Papillae on the tongue were sometimes small and soft and rather clumped in appearance. In addition, the epithelium of the oesophagus was thinner than normal. Profuse salivation was common; affected animals also had somewhat enlarged parotid glands. Liveweight gain in groups of cattle on the same pasture differed widely from 0.06 to 0.43 kg day^{-1} .

DISCUSSION

The effects reported here differ markedly from the acute effects of mimosine toxicity resulting from feeding pure diets of this plant to sheep (Hegarty, Schinckel and Court 1964) and cattle (Vohradsky 1972). The loss of hair, excessive salivation and weight loss in most of the animals only occurred after periods of several months on leucaena pastures; a period which should have conditioned the animals, via adaptation of the rumen micro-organisms, to degrade mimosine and so avoid its toxic effects (Hegarty, Schinckel and Court 1964). The good gains of animals previously unaccustomed to leucaena compared with the poor gains of animals on leucaena for 8 to 12 months at Samford strongly suggest a cumulative effect of leucaena on animal performance.

The occurrence of enlarged thyroid glands in all the cattle slaughtered from these experiments (Table 1) is indicative of a goitrogenic substance in or developed from leucaena. In earlier work at Samford ewes fed dried leucaena in pens developed enlarged thyroids and also produced lambs with enlarged thyroids (Bindon and Lamond 1966); and heifers fed leucaena produced calves with enlarged thyroids (Hamilton, Donaldson and Lambourne, 1971).

TABLE 1
Thyroid weights of cattle with and without a history of grazing on *Leucaena leucocephala* cv Peru at three experimental sites

Site	Feed or Pasture Type	Type of Cattle	Time on Leucaena	No. of Cattle	Mean Thyroid weights (g)
SAMFORD	Leucaena/Rhodes grass/ blue couch	20-30 month old Hereford × Afrikaner heifers. 380 kg liveweight	168 days	4	171 ± 57
	Leucaena/Setaria	4 years old Hereford × Afrikaner cows	2 years (off Leucaena for 8 months prior to slaughter)	3	90 ± 14
	N fertilized Setaria and Rhodes grass	Hereford × Afrikaner steers 2½ years old. 350-400 kg liveweight.	Nil	20	24 ± 1.6
	Legume/grass†	30 month old Hereford × Afrikaner steers. 350-400 kg liveweight	Nil	12	21 ± 0.7
KUNUNURRA	Leucaena/Pangola	3 year old Kimberley shorthorn steers. 480 kg liveweight	370 days	7	170 ± 139
	Leucaena/Pangola	Calves up to 3 days old from cows continuously grazing Leucaena/Pangola for more than 3 months.	>90 days	4	109 ± 39
	Pangola	3 year old Kimberley shorthorn steers. 280 kg liveweight	Nil	6	21 ± 4
	Sorghum and grain in feedlot	20 month old Kimberley shorthorns. 410 kg liveweight.	Nil	5	25 ± 4
ERAP	Leucaena and unpalatable weeds	2 year old half to three quarter Brahman heifers 225-325 kg liveweight	198 days†	6	72 ± 48

† Animals grazed on Siratro, white clover and Kenya white clover based pastures.

In the present experiments variation in size of thyroids has been extremely large and weight gains of animals grazing the same pasture have also differed widely. No relation between size of thyroids and weight gain has been detected, neither has there been a consistent association between size of thyroid and severity of hair loss, excessive salivation or incoordination.

The extremely low thyroxine levels in the blood serum of the Samford cattle after three months of grazing raises the possibility that these low hormone levels, and not acute mimosine toxicity, may be the cause of the hair loss noted.

Investigations are being carried out by the C.S.I.R.O. Division of Tropical Crops and Pastures to determine if the enlarged thyroid glands are associated with the presence of mimosine in the diet or with other goitrogenic substances.

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