DROUGHT FEEDING STUDIES WITH CATTLE AND SHEEP

4. The Use of Native Grass Hay (Bush Hay) and Sorghum Silage as Basal Components of Drought Fodders for Sheep.

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SUMMARY.

Four groups of 2-4-tooth Merino wethers were group-fed basal rations of either native grass hay (bush hay) ad lib. or sorghum silage ad lib. in bare yards with shade and water.

Wethers fed bush hay only for 19 weeks lost 20 per cent. of their initial body weight. Supplementation with either a salt-boneflour lick alone or with 2.3 oz. crushed sorghum per head per day did not markedly decrease body weight loss. Additional supplementation with 8 g. of urea and 0.6 g. of sodium sulphate per head per day reduced body weight loss to half of that of the unsupplemented group.

Wethers fed sorghum silage only for 22 weeks lost 30 per cent. of their initial body weight. The addition of 8 g. of urea + 0.8 g. sodium sulphate or 16 g. of urea + 1.6 g. sodium sulphate per head per day significantly decreased body weight loss. Urea supplementation increased silage consumption but the increase in wool growth was not significant.

Survival rate during bush hay feeding was 100 per cent. with a 4 per cent. mortality when sheep were returned to pasture. During sorghum silage feeding the mortality rate was 4 per cent. with a 100 per cent. recovery of survivors on pasture. Sheep fed sorghum silage recovered their body weight rapidly when returned to pasture.

A comparison was made of the performance of sheep and cattle fed the same basal diets of bush hay and sorghum silage. Sheep lost a greater percentage of their initial body weight, and showed a smaller response to urea supplementation.

I. INTRODUCTION.

As a result of the experiments of Franklin (1946a,b; 1952), Franklin *et al.* (1955), and Briggs, Franklin and McClymont (1956, 1957), a considerable amount of information on the drought feeding of sheep with rations containing a high proportion of grain is now available. The use of cereal chaff and straw as basal components of drought rations for sheep has been reported by Franklin, Briggs and McClymont (1955) and Briggs (1956).

Morris (1958a,b,c) has reported a series of experiments to investigate the value of native grass hay (bush hay), sorghum silage and grain sorghum as basal components of drought fodders for cattle. In the course of this work groups of sheep and cattle were fed the same basal ration and the same supplements.

In this paper the results of two experiments using bush hay and sorghum silage as basal components of drought fodders for sheep are reported. The effect of the rations upon the survival rate, changes in body weight and feed consumption of Merino wethers was studied. In the sorghum silage feeding experiment, wool production was also measured. A comparison of the performance of cattle and sheep fed the same basal rations and supplements is made.

II. METHODS AND MATERIALS.

(1) Experimental Animals.

In both experiments Merino wethers in store condition with two to four permanent incisor teeth were used as experimental animals. Prior to the experiment all sheep were inoculated with tetanus toxoid and blackleg vaccine and drenched with phenothiazine. Animals with dental abnormalities were rejected.

In the first experiment four groups of six wethers were selected by stratified random allocation on a body weight basis.

In the second experiment four groups of 13 wethers were selected by the same procedure from a line of 59 wethers originally selected from a flock for uniformity of weight. All sheep were shorn four weeks prior to the commencement of the experiment.

(2) Body Weight.

Body weight was recorded at weekly intervals between 7 a.m. and 8 a.m. by weighing the individual sheep on a cattle-weighing scale.

(3) Wool Growth Measurements.

Wool growth was measured on all sheep in the second experiment. A rectangular area 15 cm. by 10 cm. was tattooed over the right flank. At 2-monthly intervals this area was clipped and the weights of greasy and scoured wool recorded.

(4) Feedstuffs.

The bush hay which constituted the basal ration in the first experiment was portion of the same line of hay which was fed to cattle in Experiment II reported by Morris (1958a). In common with other mature native grasses in Queensland, this hay had a low crude protein content (4·5 per cent. on a dry matter basis). A description of the method of haymaking and botanical and chemical composition were reported by Morris (1958a). The bush hay was fed chaffed (average length 0·5 in.).

The sorghum silage fed to sheep was taken from the same pit over the same period as the silage fed to cattle in the experiment reported by Morris (1958b). This silage had a low crude protein content (5·2 per cent. on a dry matter basis).

The salt-boneflour mineralised lick was prepared by the method described by Morris (1958a).

(5) Experimental Yards.

Both experiments were conducted in a unit of four open yards each 16 ft. x 32 ft. These yards were kept devoid of vegetation by spraying with fuel oil. A galvanised iron roof 8 ft. x 8 ft. insulated with dry grass provided shade and protected the feed troughs and lick boxes from the weather. Each yard had two feed troughs each 3 ft. long. Water was available *ad lib.*

III. EXPERIMENT I.

(1) Design.

The four groups of six wethers were fed the following rations:—

Group I : Bush hay *ad lib.*

Group II : Bush hay *ad lib.* + lick *ad lib.*

Group III: Bush hay *ad lib.* + lick *ad lib.* + 2·3 oz. crushed sorghum grain per head per day.

Group IV: Bush hay *ad lib.* + lick *ad lib.* + 2·3 oz. crushed sorghum grain + 8 g. urea and 0·6 g. sodium sulphate per head per day.

At the end of each week the uneaten residue of bush hay was removed, weighed and discarded after sampling for chemical analysis.

The duration of bush hay feeding was 19 weeks, at the end of which time all sheep were allowed to graze *Paspalum dilatatum* pasture.

(2) Results.

All sheep survived the period on bush hay feeding. Mean group body weight changes and group average consumption of bush hay and lick are given in Table 1. The weekly mean body weight and bush hay and lick consumption are shown in Fig. 1.

The linear growth rate for each group was not statistically different at a probability of $P<0·05$.

Results of the analysis of composite group samples of the residues of bush hay showed that for Groups I, II and III the residue had a lower crude protein content than the hay as fed. Analysis of the residue from

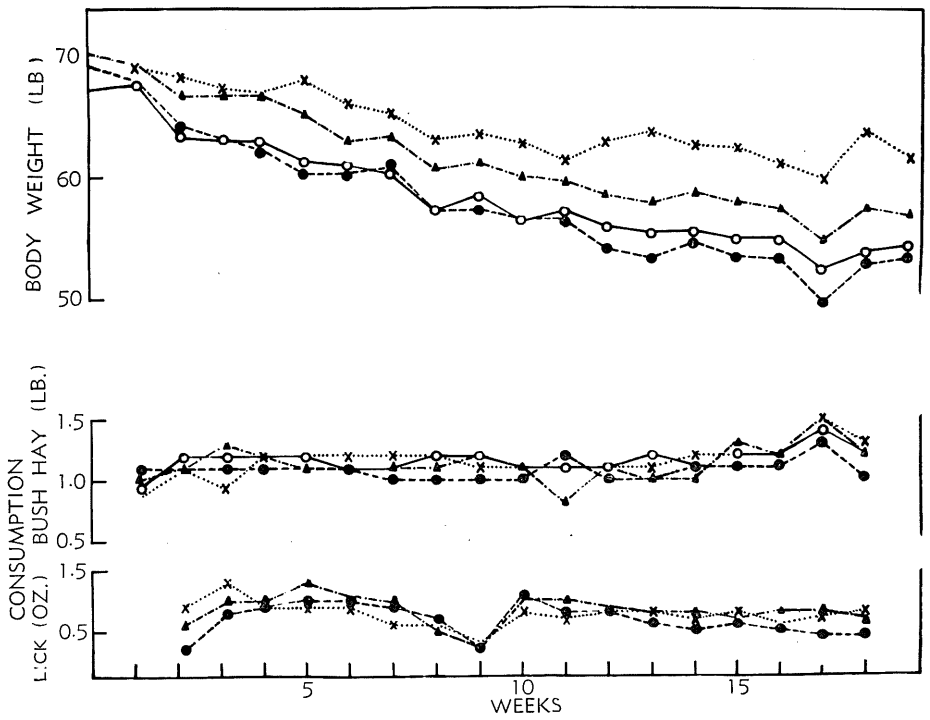

Fig. 1.

Weekly Changes in the Group Mean Body Weight and Bush Hay and Lick Consumption of Four Groups of Merino Wethers.

O———O Group I: Bush hay *ad lib.*

●— — —● Group II: Bush hay *ad lib.* + lick *ad lib.*

△ — · — △ Group III: Bush hay *ad lib.* + lick *ad lib.* + 2.3 oz. crushed grain sorghum per head per day.

× ..... × Group IV: Bush hay *ad lib.* + lick *ad lib.* + 2.3 oz. crushed sorghum + 8 g. urea + 0.6 g. sodium sulphate per head per day.

Table 1.

GROUP AVERAGE BODY WEIGHT CHANGES AND DRY MATTER CONSUMPTION OF SHEEP FED A BASAL RATION OF BUSH HAY WITH VARIOUS SUPPLEMENTS.

Group.	Supplement.	Body Weight.			Dry Matter Consumption Per Head Per Day.		
		Initial.	After 19 weeks.	Change*.	Bush Hay.	Lick.	Total.
		lb.	lb.	lb.	lb.	oz.	lb.
I ..	Nil	68	54	−14	1·1	..	1·1
II ..	Lick *ad lib.*	68	53	−15	1·0	0·6	1·0
III ..	Lick *ad lib.* + 2·3 oz. crushed sorghum	69	57	−12	1·0	0·8	1·2
IV ..	Lick *ad lib.* + 2·3 oz. crushed sorghum + 8g. urea + 0·6 g. sodium sulphate	69	62	−7	1·1	0·8	1·3

* None of these differences were significant at a probability of $P<0.5$.

Group IV showed a higher crude protein (N × 6·25) content (7·1 per cent. on a dry matter basis) than the hay fed, due to added urea. Visual examination of the residues from all groups showed that they had a greater percentage of stalk than the hay before feeding. Thus the visual observations and the chemical analyses indicate the selection of the more nutritious portions of the hay. The average wastage of hay from uneaten residues accounted for 0·3 lb. per head per day, or 21 per cent. of the hay fed.

At the termination of the bush hay feeding all sheep were lethargic and unwilling to be exercised.

All sheep with the exception of one animal in Group I, which was the poorest sheep at the conclusion of the experiment, recovered when turned out on pasture, and after 15 weeks exceeded the pre-experimental body weight.

A comparison of body weight changes and dry matter consumption of sheep and cattle fed the same bush hay and supplements is given in Table 2.

Table 2.

COMPARATIVE CHANGES IN BODY WEIGHT AND INTAKE OF BUSH HAY BY SHEEP AND CATTLE* FED THE SAME HAY AND SUPPLEMENTS FOR 19 WEEKS.

Group.	Supplements Per Head Per Day.		Percentage Change in Initial Body Weight.		Bush Hay Intake as a Percentage of Group I.	
	Sheep.	Cattle.	Sheep.	Cattle.	Sheep.	Cattle.
I ..	Nil	Nil	−20	−8	100	100
II ..	Lick	Lick	−22	−9	91	102
III ..	Lick + 2·3 oz. crushed grain sorghum	Lick + 1 lb. crushed grain sorghum	−17	−4	91	110
IV ..	Lick + 2·3 oz. crushed grain sorghum + 8 g. urea + 0·6 g. sodium sulphate	Lick + 1 lb. crushed grain sorghum + 2 oz. urea + 0·17 oz. sodium sulphate	−10	+10	100	125

* From the data of Morris (1958*a*) calculated for the first 19 weeks of the experiment.

IV. EXPERIMENT II.

(1) Design.

Four groups of 13 wethers were fed the following rations:—

Group I : Sorghum silage *ad lib.*

Group II : Sorghum silage, the same amount as fed to Group I, + 8 g. urea and 0·8 g. sodium sulphate per head per day.

Group III: Sorghum silage *ad lib.* + 8 g. urea and 0·8 g. sodium sulphate per head per day.

Group IV: Sorghum silage *ad lib.* + 16 g. urea and 1·6 g. sodium sulphate per head per day.

Supplements of urea and sodium sulphate were sprinkled over the silage and mixed with the upper layers in the trough.

Twice a week the uneaten residues of silage were removed, weighed and discarded after sampling. On the other five days of the week, the uneaten silage was removed and replaced on the freshly added silage.

Sorghum silage feeding continued for 22 weeks until the supply of silage was exhausted. All wethers were then shorn and grazed on a *Paspalum dilatatum* pasture.

(2) Results.

Two animals did not survive the period on sorghum silage feeding, one animal in Group IV died from inanition at 17 weeks and another in Group II died from the same cause after 21 weeks. The remaining 50 animals survived the period on sorghum silage and made rapid body weight gains when returned to pasture.

Table 3.

GROUP AVERAGE BODY WEIGHT CHANGES AND DRY MATTER CONSUMPTION OF SHEEP FED A BASAL RATION OF SORGHUM SILAGE WITH VARIOUS LEVELS OF UREA SUPPLEMENTATION.

Group.	Sorghum Silage.	Supplement.	Body Weight.			Silage Consumption (lb. D.M./day).	Body Weight After 10 Weeks on Pasture.
			Initial.	After 22 weeks.	Change.		
			lb.	lb.	lb.		lb.
I ..	*ad lib.* ..	Nil	63	44	−19	0·73	71
II ..	Same as fed to Group I	8 g. urea + 0·8 g. sodium sulphate	63	50	−13	0·85	76
III ..	*ad lib.* ..	8 g. urea + 0·8 g. sodium sulphate	64	50	−14	0·87	76
IV ..	*ad lib.* ..	16 g. urea + 1·6 g. sodium sulphate	64	49	−15	0·80	76

Group average changes in body weight for the periods of sorghum silage feeding and of recovery on pasture, and the group mean dry matter intake of silage, are given in Table 3. The weekly group average body weight and silage consumption are shown in Fig. 2. Statistical analyses of the group average body weight at 8, 15 and 22 weeks and the linear component of growth rate are given in Table 4.

Silage consumption was greatest in the urea-supplemented groups. Group III ate 21 per cent. and Group IV 11 per cent. more silage than Group I. The consumption of silage by wethers in Group II was greater than in Group I, although the same amount of silage was presented daily to both groups. An excess of silage over consumption was fed to Group I to maintain *ad lib.* intake and feed residues were less in Group II.

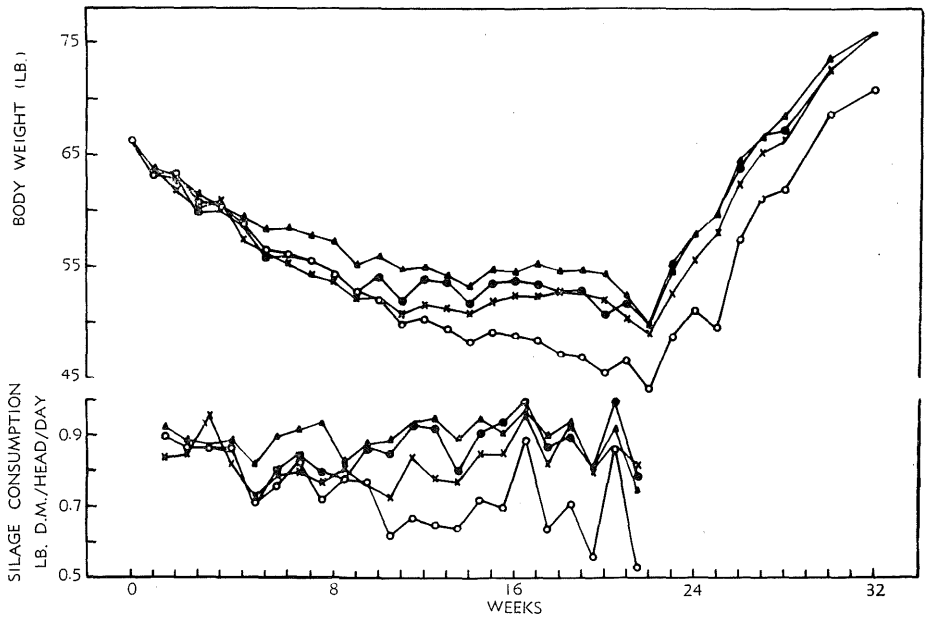

Fig. 2.

Changes in the Group Mean Body Weight of Four Groups of Merino Wethers during Sorghum Silage Feeding (0–22 weeks) and Recovery on Pasture (22–32 weeks) and the Group Mean Daily Dry Matter Intake during Sorghum Silage Feeding.

O————O Group I: Sorghum silage *ad lib.*

●— — —● Group II: Sorghum silage same amount as fed to Group I + 8 g. urea and 0.8 g. sodium sulphate per head per day.

△ — · — △ Group III: Sorghum silage *ad lib.* + 8 g. urea and 0.8 g. sodium sulphate per head per day.

× ..... × Group IV: Sorghum silage *ad lib.* + 16 g. urea and 1-6 g. sodium sulphate per head per day.

Table 4.

Statistical Analysis of the Body Weight and Linear Component of Growth Rate of Sheep Fed Sorghum Silage with Various Rates of Urea Supplementation.

Between Groups.	Body Weight at—			Linear Growth Rate.
	8 weeks.	15 weeks.	22 weeks.	
Group IV greater than Group I ..	NS	NS	†	†
Group III greater than Group I ..	*	†	†	†
Group II greater than Group I ..	NS	*	†	†
Group III greater than Group IV ..	†	NS	NS	NS

NS = Not significant.
* = P<0·05.
† = P<0·01.

The percentage of the silage presented to the animals that was subsequently eaten was 80 for Group I, 90 for Groups II and III and 84 for Group IV. The crude protein content of the residue from Group I was 4·0 per cent. on a dry matter basis, which is less than the crude protein content of the silage fed out. The crude protein (N × 6·25) content of the residues from Group II was 8·0 per cent., Group III 7·5 per cent., and Group IV 10·6 per cent. The higher apparent crude protein content of these residues was due to the added urea. The crude fibre content of the residue from all groups was greater than the crude fibre content of the silage presented to the animals. Visual examination of the silage revealed that a high proportion of the rejected silage consisted of portions of the stems of sorghum plants and in particular the lower part of the stems. Thus visual observations and chemical analyses indicate the selection of the more nutritious portions of the silage.

The mean wool growth on the tattooed areas was similar for all groups at two months. At four months the mean wool growth was greater in the urea-supplemented groups than in the unsupplemented group, but the difference was not statistically significant at the $P<0·05$ level. The mean greasy wool weight at the conclusion of sorghum silage feeding was 3·0 lb. for Group I, 3·4 lb. for Groups II and III and 3·3 lb. for Group IV.

As the period of sorghum silage feeding lengthened all animals became lethargic and dejected in appearance.

A comparison of body weight changes and dry matter consumption of sheep and cattle fed the same sorghum silage with and without urea supplements is given in Table 5.

Table 5.

COMPARATIVE CHANGES IN THE BODY WEIGHT AND THE SILAGE CONSUMPTION OF SHEEP AND CATTLE* FED THE SAME SORGHUM SILAGE AND SUPPLEMENTS FOR 22 WEEKS.

Group.	Silage.	Supplements Per Head Per Day.		Percentage Change in Initial Body Weight.		Dry Matter Intake of Silage as a Percentage of Group I.	
		Sheep.	Cattle.	Sheep.	Cattle.	Sheep.	Cattle.
I ..	*ad lib.* ..	Nil	Nil	−30	−16	100	100
II ..	Same as fed to Group I	8 g. urea; 0·8 g. sodium sulphate	1·5 oz. urea; 0·14 oz. sodium sulphate	−21	−9	116	100
III ..	*ad lib.* ..	8 g. urea; 0·8 g. sodium sulphate	1·5 oz. urea; 0·14 oz. sodium sulphate	−22	+11	121	159
IV ..	*ad lib.* ..	16 g. urea; 1·6 g. sodium sulphate	2·5 oz. urea; 0·18 oz. sodium sulphate	−23	+24	111	173

*From the data of Morris (1958*b*) calculated for the first 22 weeks of the experiment.

V. DISCUSSION.

Basal rations of bush hay and sorghum silage fed to groups of Merino wethers in bare yards with shade and water *ad lib.* kept a high percentage of sheep alive for periods up to 19 and 22 weeks respectively. Body weight loss, however, was considerable on the basal rations, averaging 20 per cent. in experiment 1 and 30 per cent. in experiment 2.

Supplementing bush hay with a lick did not decrease body weight loss, while the further addition of 2·3 oz. crushed grain sorghum produced only a slight decrease in body weight loss. When 8 g. urea per head per day was fed in addition to the lick and grain sorghum, body weight loss was only half that on the basal ration of bush hay. Statistical significance was not obtained at the $P<0·05$ level due to individual variations and the small number of sheep per group. Supplementation of the basal diet of sorghum silage with 8 g. or 16 g. urea significantly ($P<0·01$) reduced body weight loss.

Consumption of the basal ration of bush hay was unaffected by supplements. The intake of sorghum silage was increased by 8 and 16 g. urea per head per day. The higher level of urea tended to decrease silage intake of Group IV compared with Group III. This is in agreement with the findings of Peirce, Moule and Jackson (1955), who recorded that rations containing urea were unpalatable to Merino sheep.

Urea has been shown by Peirce (1951a,b) to increase wool production of Merino sheep fed low-protein rations. In Experiment II, at two and four months wool growth on the tattooed areas of the urea-supplemented sheep was not statistically greater than in the unsupplemented group. The mean group greasy fleece weight at the conclusion of the sorghum silage feeding was approximately 10 per cent. greater in the urea-supplemented groups. This was not statistically significant. The within-group variation was large, due to the number of sheep in each group losing part of their fleece through a "break" in the wool.

All sheep fed sorghum silage showed a rapid gain in body weight when returned to pasture, but group differences in body weight at the conclusion of sorghum silage feeding were maintained after 10 weeks on pasture. Sheep fed bush hay did not regain body weight when returned to pasture as rapidly as sheep fed sorghum silage. However, the pasture conditions were more favourable at the conclusion of sorghum silage feeding.

A comparison of the performance of sheep and cattle fed the same basal rations and the same supplements showed that sheep lost a greater percentage of their initial body weight when fed the basal rations; sheep did not respond as favourably to urea supplementation as indicated either by body weight or by intake of the basal ration; and sheep were more selective in the choice of portions of the bush hay and sorghum silage.

Digestibility coefficients of the bush hay for sheep and cattle reported by Morris (1958a) indicated that the coefficients tended to be greater for cattle than for sheep. This is in agreement with the findings of Cipolloni *et al.* (1951), who found, by statistically analysing the results from a large number of sheep and cattle digestibility trials, an average difference of 3 per cent. greater digestibility of the organic matter by cattle than by sheep. This was significant ($P<0{\cdot}01$) for dry roughages but not for silage. However, it appears unlikely that these small differences in digestibility would explain the superior performance of cattle on either bush hay or silage.

The comparative performance of sheep and cattle to urea supplementation in these experiments is in agreement with the general conclusion of Reid (1953), who stated: "The effectiveness of urea as a protein replacement for growing fattening lambs is not as clear cut as it is for cattle." A similar statement was made by Morrison (1956).

The lethargic behaviour of all groups of sheep in both experiments was similar to that described for human subjects (Keys *et al.* 1950) and cattle (Morris 1958a,b,c) on low-calorie diets.

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