OBSERVATIONS ON THE UTILIZATION BY CATTLE OF *AXONOPUS AFFINIS* FOLLOWING FOLIAR APPLICATION OF UREA, MOLASSES AND MONOSODIUM PHOSPHATE

By M. S. O'BRYAN*

SUMMARY

A supplement containing urea, molasses, monosodium phosphate and cobalt chloride was supplied in strips at weekly intervals to a mature carpet grass (Axonopus affinis) pasture in south-eastern Queensland during the autumn-winter months of 1958 and 1959.

In the period April to August 1958, Hereford heifers maintained weight on the treated pasture, but in the same period of 1959 lost considerable weight. There was no significant difference in body-weight between animals in the control and treated paddocks in either year.

In 1958 the total pasture available was moderately low in crude protein (5-7 per cent.) but in both groups the animals selected pasture containing 10-12 per cent. protein. In 1959 the protein content ranged from 3·5 to 5 per cent. and both groups selected pasture containing 8-10 per cent. protein. It is suggested that failure to gain weight was due to a low feed intake together with a high energy expenditure in selecting this diet.

In both experiments stock showed a marked preference for the treated strips immediately after spraying. This preference was not evident 24 hours after treatment.

Failure to obtain a response in body-weight in cattle from the foliar application of urea and molasses to mature carpet grass is attributed to the high degree of selectivity of grazing and the interval between treatments, together with the short-term response in palatability in this environment.

I. INTRODUCTION

Paspalum (*Paspalum dilatatum* Poir.) pastures established in the high-rainfall areas of south-eastern Queensland have, in recent years, been seriously invaded by narrow-leaf carpet grass (*Axonopus affinis* Chase). Growth of these pastures is related to temperature and rainfall, and in this area effective rainfall is usually limited to the summer months. In most years there is an abundant growth of pasture from November to April. Analytical records of the Queensland Department of Agriculture and Stock show that the protein, phosphate and energy values of mature carpet grass pastures are below the levels required for maintenance of adult cattle.

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* Assistant Adviser, Cattle Husbandry Branch, Queensland Department of Agriculture and Stock.

A beef cattle property 60 miles north of Brisbane was selected as a site for examining the effect of urea/molasses/phosphate supplements on the growth rate of cattle under grazing conditions. Previous investigations conducted on this property by Chester, Marriott, and Harvey (1957) suggested that failure to eat the mature carpet grass pasture is an important cause of the pronounced weight loss in animals during winter and early spring. Evidence of phosphate, copper and cobalt deficiency was also recorded by these workers.

Beames (1960) and Morris (1958) showed that the addition of urea markedly increased the feed intake of low quality pasture hay and prevented weight loss in cattle. The former worker fed a urea/molasses supplement to stalled animals, while Morris fed urea and grain sorghum mixed with pasture hay to cattle on a group basis.

The spraying of dry veldt pasture with urea and molasses has been practised extensively in South Africa (Kellermann and Groenewald 1956). Findings quoted by Tribe and Coombe (1958) indicate that dry veldt pasture sprayed with urea and molasses allowed the grazing animals to maintain body-weight, due to an improvement in both palatability and nutritive value of the grazing.

The experiments reported in this paper were made during the autumn and winter of the years 1958 and 1959.

II. METHODS AND MATERIALS

(a) Experimental Paddocks

An area of approximately 8 acres of relatively uniform river flats with a predominantly carpet grass pasture was fenced and subdivided into two comparable 4-acre paddocks.

In the 1958 experiment both paddocks were unstocked from March 11, 1958, to April 29, 1958, to ensure a good body of mature carpet grass. On April 29 both paddocks were stocked at the rate of two animals per acre and thereafter Paddock 1 was sprayed in strips at weekly intervals for the 16 weeks of the experiment.

For the 1959 experiment the area was unstocked from August 19, 1958, to March 12, 1959, when both paddocks were again stocked at the rate of two animals per acre. Commencing on March 20, Paddock 1 was sprayed in strips at weekly intervals for the 26 weeks of the experiment.

(b) Experimental Animals

In 1958, 16 Hereford heifers 16–20 months of age were available. Two groups of eight heifers were selected by stratified random allocation on a body-weight basis. In 1959, 24 Hereford heifers 9–12 months of age were available. Two groups of eight heifers were selected by stratified random allocation on a body-weight basis.

The possible complication of copper deficiency was avoided by the intravenous injection of copper sulphate to all experimental animals one week prior to the commencement of each experiment.

In both experiments all animals were sprayed with diazinon plus DDT for tick (*Boophilus microplus*) control and drenched with phenothiazine for worm control at the commencement and thereafter at 28-day intervals. In 1958 the tick population was negligible for the last 12 weeks of the experiment and in 1959 for the last 18 weeks.

(c) Body-weight

This was determined initially and at 28-day intervals using a weighbridge. A standard procedure was adopted. The experimental animals were driven into small bare holding yards at 8.30 a.m.; weighing commenced at 10 a.m. and was completed by 10.30 a.m.

(d) Pasture

In 1958 line transects to determine pasture composition were made in each paddock in April prior to the commencement of the experiment and again in August at its conclusion. In 1959 line transects were made six weeks prior to the commencement of the experiment, at its commencement in March, in July and again in October one week after its conclusion.

Pasture yield was determined from quadrats cut in each paddock to a height of approximately 2 in. above ground level. Pre-experimental yield measurements on April 15, 1958, and March 20, 1959, were representative of total pasture in both treated and control paddocks. Subsequent measurements at 28-day intervals were representative of the strip just prior to spraying for the treated paddock and of a similar strip located in the adjacent control paddock. Pasture samples taken in this manner were analysed for nutritive value.

(e) Pasture Spraying

In the 1958 experiment the material* used contained 78 per cent. molasses, 12·5 per cent. urea, 4·4 per cent. monosodium phosphate and 0·005 per cent. cobalt chloride, the balance being added water. Just prior to use the material was diluted with twice its volume of water. Spraying was carried out with a boom spray fitted to a motor vehicle. The sediment of calcium phosphate which resulted from the addition of river water to the supplement necessitated the use of Rega No. 1 nozzles in the spray line and constant stirring during spraying. A spray pump, operating at 200 lb pressure and driven by a 1.25 h.p. motor, was used

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* This material was supplied by William Cooper and Nephews (Australia) Pty. Ltd. under the trade name "Fos-U-Mol".

Initially 0·25 ac strips were sprayed at weekly intervals with 42 lb of the proprietary material. This rate was provided to offer each animal the equivalent of 0·75 lb of the product daily. From the seventh week the area of the treated strip was reduced to 0·16 ac, to see if this restriction would induce overgrazing of the treated strips.

In the 1959 experiment the material used contained 75 per cent. molasses, 18 per cent. urea, 4·4 per cent. monosodium phosphate and 0·005 per cent. cobalt chloride. The same equipment as used in 1958 was employed to spray 0·16 ac strips in Paddock 1 with 42 lb of this material at weekly intervals.

(f) Faecal Samples

Samples from freshly voided faeces were collected in each paddock at weekly intervals by the unpublished procedure of K. W. Moir, of the Queensland Department of Agriculture and Stock. This involved the collection of samples of about 20 g from each of a minimum of 10 fresh dung pads. The bulked samples from each paddock were analysed for protein, phosphorus, calcium and organic Matter. From the regressions developed by Moir, the protein, phosphorus and calcium levels were assessed in the pasture selected by the animals.

(g) Chemical Methods

The Official Methods of the Association of Agricultural Chemists (1955) were used in the analyses of pasture and faecal samples.

(h) Rainfall Data

Monthly rainfall data were obtained from the district official recording station located about five miles from the experimental paddocks.

III. RESULTS

Rainfall data are presented in Table 1 for the years 1953 to 1959. The year 1957 was unusually dry and effective summer rains did not occur until January 1958. This delayed the growth of pasture, so the amount of mature grass present at the commencement of the first experiment in April 1958 was less than in previous years. Good rains in April caused a prolonged period of pasture growth. Flooding of the paddocks resulted from unusually heavy rains in June. Good summer rains from December 1958 gave abundant mature grass at commencement of the second experiment in March 1959. Heavy rains in late March caused flooding and necessitated the withdrawal of stock from the experimental paddocks for one week. Late summer/autumn rains provided some green pick although the bulk of pasture was carpet grass at the standing hay stage of growth.

Table 1

MONTHLY RAINFALL (INCHES) RECORDED AT DISTRICT OFFICIAL RECORDING STATION

Month	1953	1954	1955	1956	1957	1958	1959
January	8·50	7·78	2·97	5·15	6·77	7·75	10·52
February	17·25	24·77	3·11	19·55	2·79	9·89	6·98
March	8·25	6·03	20·03	19·13	5·96	6·72 [1]	10·07 [4]
April	3·60	2·12	5·69	7·99	0·36	13·69 [2]	4·49
May	1·50	4·31	11·77	5·88	0·12	2·18	3·71
June	0·20	2·68	1·50	4·07	1·76	22·33	3·52
July	0·43	12·60	1·59	1·57	7·26	0·12	5·22
August	4·52	4·85	0·11	0·20	4·41	2·93 [3]	1·02
September	2·18	3·78	1·67	1·32	0·06	1·85	5·12 [5]
October	2·87	9·98	3·79	1·97	2·76	1·31	8·17
November	5·99	4·66	0·53	3·66	2·36	3·28	7·34
December	1·59	5·92	8·93	8·15	1·52	12·24	4·90
Totals—							
Apr.–Aug. ..	10·25	26·56	20·66	19·71	13·91	41·25	17·96
12 months ..	56·88	89·48	61·69	78·64	36·13	84·27	71·06

[1] Stock excluded from experimental paddocks on 18–iii–58.

[2] Commencement of first experiment on 29–iv–58.

[3] Conclusion of first experiment on 19–viii–58; stock excluded from experimental paddocks until 12–iii–59.

[4] Commencement of second experiment on 20–iii–59.

[5] Conclusion of second experiment on 29–ix–59.

The pasture composition from line transects in the two experimental paddocks is shown in Table 2. For both experimental paddocks in each year the

Table 2

PASTURE COMPOSITION IN EXPERIMENTAL PADDOCKS

(*Expressed as ground cover*)

Date	Experiment	Control Paddock		Treated Paddock	
		Axonopus affinis	*Paspalum dilatatum*	*Axonopus affinis*	*Paspalum dilatatum*
		Per cent.	Per cent.	Per cent.	Per cent.
9–iv–58	1	89·0	11·0	89·2	10·8
19–viii–58		90·9	9·1	90·7	9·3
6–ii–59	2	85·0	15·0	82·0	18·0
20–iii–59		86·0	14·0	85·0	15·0
3–vii–59		93·0	7·0	95·0	5·0
6–x–59		92·5	7·5	93·0	7·0

dominant pasture species was *Axonopus affinis*. *Paspalum dilatatum* was present in limited quantities.

Table 3

OVEN-DRY-MATTER YIELDS OF PASTURE AVAILABLE IN EXPERIMENTAL PADDOCKS

Date	Experiment	Control Paddock (lb per ac)	Treated Paddock (lb per ac)
15–iv–58	1	1,450	1,630
29–iv–58		1,940	2,300
27–v–58		1,450	2,180
24–vi–58		910	1,090
22–vii–58		730	910
19–viii–58		550	730
20–iii–59	2	3,270	3,630
14–iv–59		2,540	1,820
19–v–59		2,540	2,540
23–vi–59		1,450	2,540
11–viii–59		1,090	1,090
11–ix–59		1,450	1,090
6–x–59		360	360

Table 4

CHEMICAL COMPOSITION OF TOTAL PASTURE AVAILABLE TO STOCK IN EXPERIMENTAL PADDOCKS

(*Moisture-free basis*)

Date	Paddock	Protein (%)	Fat (%)	Fibre (%)	Carbo-hydrate (%)	Ash (%)	Lime (%CaO)	Phosphoric Acid (%P_2O_5)
Experiment 1								
15–iv–58	Control ..	5·1	0·9	41·2	47·3	5·5	0·15	0·41
	Treated ..	4·9	0·6	41·5	47·5	5·5	0·18	0·40
29–iv–58	Control ..	6·4	0·9	29·9	55·3	7·5	0·22	0·29
	Treated ..	7·0	1·0	26·1	58·0	7·9	0·24	0·35
27–v–58	Control ..	6·7	1·1	32·9	51·4	7·9	0·22	0·34
	Treated ..	6·5	1·0	34·3	50·4	7·8	0·17	0·36
24–vi–58	Control ..	6·3	0·3	34·2	47·8	11·4	0·47	0·34
	Treated ..	7·0	0·3	31·9	47·7	13·1	0·39	0·40
22–vii–58	Control ..	5·7	0·6	29·6	48·7	15·4	0·41	0·34
	Treated ..	6·6	0·7	28·5	53·6	10·6	0·39	0·39
19–viii–58	Control ..	5·8	0·6	31·2	51·0	11·4	0·43	0·32
	Treated ..	6·9	0·7	28·9	51·8	11·7	0·54	0·33
Experiment 2								
20–iii–59	Control ..	4·7	1·0	40·3	46·5	7·5	0·12	0·32
	Treated ..	3·9	0·9	39·1	49·9	6·2	0·16	0·41
14–iv–59	Control ..	3·5	0·8	41·6	47·2	6·9	0·13	0·20
	Treated ..	4·7	0·8	39·0	48·9	6·6	0·14	0·25
19–v–59	Control ..	4·5	1·2	39·2	45·7	9·4	0·46	0·29
	Treated ..	4·4	1·4	37·8	48·2	8·2	0·33	0·22
23–vi–59	Control ..	3·8	0·8	39·3	47·8	8·3	0·39	0·22
	Treated ..	4·3	0·7	37·4	49·2	8·4	0·37	0·27
11–viii–59	Control ..	4·6	1·2	37·6	49·2	7·4	0·35	0·22
	Treated ..	4·8	1·2	33·9	52·0	8·1	0·30	0·22
11–ix–59	Control ..	4·2	1·1	39·2	47·7	7·8	0·45	0·19
	Treated ..	5·0	1·1	35·7	49·7	8·5	0·39	0·23
6–x–59	Control ..	6·1	0·9	35·5	48·1	4·4	0·36	0·26
	Treated ..	6·1	1·0	34·8	49·9	8·2	0·40	0·29

The oven-dry-matter yields of pasture available in each paddock at six sampling periods in 1958 and seven sampling periods in 1959 are recorded in Table 3. A higher yield of pasture is apparent in 1959. This is attributed to the better rainfall in the summer of 1958–59 together with the longer period in which the experimental paddocks were unstocked prior to the 1959 experiment.

The chemical composition of pasture samples collected for yield measurements is shown in Table 4. All samples are representative of total pasture available to stock from a height of 2 in. above ground level. They tend to be low in protein and high in fibre. The protein and phosphoric acid contents are lower in Experiment 2. This is in agreement with yield measurements, which showed a greater bulk of mature pasture in 1959. The higher ash content recorded from June 24, 1958, in Experiment 1 and from May 19, 1959, in Experiment 2 resulted from contamination of the pasture with soil following flooding of the paddocks.

In each paddock the chemical composition of the diet selected was assessed from analyses of representative faecal samples. Values are shown in Table 5. It

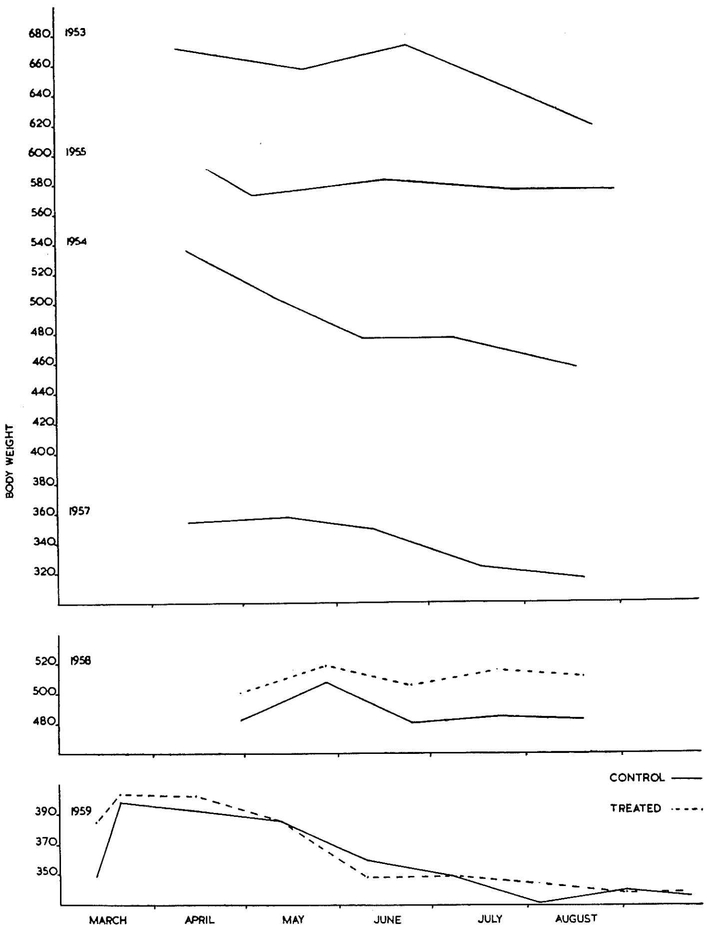

Fig. 1.—Changes in body-weight in Hereford heifers during autumn-winter

is apparent that the composition of the diet selected was much better than that indicated from analysis of total feed available. It is also apparent that the diet selected in Experiment 2 (1959) was much lower in protein and phosphoric acid than that selected in Experiment 1 (1958). These findings are in keeping with the body-weight records of experimental animals.

Table 5

CHEMICAL COMPOSITION OF PASTURE SELECTED BY STOCK IN EXPERIMENTAL PADDOCKS

(*Moisture-free basis*)

Date	Control Paddocks			Treated Paddock		
	Protein (%)	Lime (%CaO)	Phosphoric Acid (% P_2O_5)	Protein (%)	Lime (%CaO)	Phosphoric Acid (% P_2O_5)
Experiment 1—						
13–v–58	10·9	0·32	0·43	10·8	0·32	0·45
20–v–58	11·5	0·34	0·49	10·8	0·31	0·45
27–v–58	10·8	0·32	0·45	11·2	0·32	0·45
3–vi–58 ..	9·7	0·37	0·45	10·5	0·34	0·43
17–vi–58	10·8	0·32	0·33	10·9	0·32	0·35
24–vi–58	10·3	0·34	0·43	10·7	0·34	0·45
1–vii–58 ..	10·5	0·31	0·43	10·4	0·36	0·43
8–vii–58 ..	11·1	0·37	0·45	10·3	0·34	0·40
15–vii–58 ..	11·7	0·36	0·47	10·3	0·34	0·43
22–vii–58 ..	12·0	0·36	0·45	11·1	0·34	0·43
29–vii–58 ..	11·6	0·36	0·43	11·0	0·36	0·45
5–viii–58 ..	10·4	0·33	0·40	10·3	0·34	0·43
12–viii–58 ..	9·5	0·33	0·38	9·7	0·36	0·40
19–viii–58 ..	10·8	0·33	0·40	9·5	0·34	0·45
Experiment 2—						
26–iii–59	7·8	0·19	0·20	8·2	0·17	0·18
7–iv–59	7·5	0·18	0·20	8·0	0·17	0·21
14–iv–59	9·3	0·17	0·21	9·3	0·17	0·22
21–iv–59	7·7	0·19	0·21	9·5	0·18	0·21
28–iv–59	8·4	0·14	0·23	8·7	0·18	0·25
5–v–59	8·5	0·17	0·21	8·7	0·17	0·23
12–v–59	9·5	0·13	0·22	8·6	0·14	0·23
19–v–59	8·6	0·12	0·26	8·7	0·14	0·26
26–v–59	7·8	0·20	0·23	8·5	0·20	0·23
2–vi–59	8·5	0·19	0·25	8·7	0·20	0·25
9–vi–59	7·8	0·16	0·23	8·0	0·16	0·21
23–vi–59	9·5	0·21	0·25	8·5	0·17	0·25
30–vi–59	9·1	0·17	0·23	9·1	0·21	0·23
8–vii–59 ..	8·7	0·20	0·23	8·9	0·19	0·23
14–vii–59 ..	8·7	0·22	0·28	8·5	0·21	0·23
28–vii–59 ..	8·4	0·21	0·28	8·3	0·20	0·23
4–viii–59 ..	8·4	0·20	0·28	8·5	0·19	0·22
11–viii–59 ..	10·5	0·20	0·25	8·5	0·19	0·27
18–viii–59 ..	8·8	0·18	0·20	8·0	0·19	0·20
8–ix–59	10·2	0·19	0·22	7·6	0·14	0·18
15–ix–59	9·6	0·19	0·23	9·7	0·18	0·23
22–ix–59	10·5	0·20	0·23	10·0	0·19	0·24

Mean body-weight changes in experimental animals are shown in Figure 1. Body-weight data are included for non-pregnant Hereford heifers on this property from April to August in the years 1953, 1954, 1955 and 1957. Of the years for which records are available on the property, it was only during 1958 that weight losses did not occur during autumn/winter. There were no significant differences in body-weight between cattle in the control and treated paddocks either in 1958 or in 1959.

IV. DISCUSSION

Urea has been used extensively as a source of nitrogen which can be converted to bacterial protein in the rumen. It has the advantage that the cost per unit of nitrogen is low compared with that of protein concentrates. Disadvantages, related to its high toxicity unless consumed slowly, are overcome by its inclusion in bulky feeds which ensure a slow intake by the animal. Theoretically, its use with molasses and phosphate as a pasture spray could provide nutrients known to be deficient in mature *Axonopus affinis* pastures in Queensland and prevent the fall in production in grazing animals during the winter months.

The property selected for these observations was that described by Chester, Marriott, and Harvey (1957). A number of factors influenced this selection. The area is typical of much of south-eastern coastal Queensland. Studies on pasture and on growth rate of Hereford heifers since 1953 are available. In all years there has been an abundance of pasture at the standing hay stage in April. The predominant pasture species is *Axonopus affinis,* which is not eaten readily by stock at the standing hay stage and is low in protein, phosphoric acid and metabolizable energy. This pasture provides a complete ground cover, which is desirable to minimize losses in pasture spraying. Body-weight records show that in the years 1953 to 1957 all animals lost weight during the winter months.

The rate of application of the molasses/urea/phosphate mixture allowed 0·75 lb, equivalent to 1.5 oz urea in 1958 and 2·1 oz urea in 1959, per head per day. Tribe and Coombe (1958) stated that the amount of urea for yearling cattle should not exceed 2 oz per head per day.

The cattle showed marked preference for the sprayed strip. However, the preference did not persist for more than two days and at no time were the sprayed strips eaten bare in the manner reported by Tribe and Coombe (1958).

Total pasture available to stock in the experimental paddocks was low in protein in 1958 and considerably lower in protein and phosphoric acid and considerably higher in fibre in 1959. Pasture of this composition fed to animals under pen or stall conditions would not be expected to maintain body-weight.

Application of the technique of Moir, who developed regressions relating faecal composition to pasture composition, indicates that the experimental animals were able to select a production diet in 1958 and a diet better than maintenance in 1959. Failure to gain weight could be a function of a low feed intake together with high energy expenditure in selecting this diet. The former was suggested also by Chester, Marriott, and Harvey (1957).

The chemical composition of the selected diet in terms of protein and phosphorus was higher in 1958 than in 1959. This is reflected in body-weight. In 1958, experimental animals mantained body-weight from April to August, whereas in 1959 all animals showed a considerable loss in weight during this period.

Under seasonal conditions pertaining in the autumn/winter of 1958, experimental animals in the control paddock were selecting a diet containing approximately 11 per cent. protein. In the treated paddock, urea was added to lift the protein equivalent of the total pasture available from about 6 per cent. to approximately 11 per cent. In 1959 the experimental animals in the control paddock were selecting a diet containing approximately 8·5 per cent. protein. In the treated paddock urea was added to lift the protein equivalent of the total pasture available from about 4 per cent. to approximately 8·5 per cent. Faecal analyses and body-weight data support the conclusion that in both experiments the intake and composition of the selected diets were similar for both treated and control groups.

The findings of South African workers, referred to by Tribe and Coombe (1958), indicate that the spraying of veldt pasture with urea and molasses allows grazing cattle to at least maintain body-weight. Thus in 1958 failure to get a measurable response in body-weight in animals in the treated paddock may be related to the unusual seasonal conditions in this locality, which resulted in all animals being able to select a diet of sufficient quality and quantity to maintain weight. However, the season in 1959 was comparable with previous years for which data are included, and body-weight losses from April to August averaged approximately 60 lb per head in both the treated and the control areas. From 1959 data two conclusions are drawn:—

(1) In the control paddock experimental animals were unable to select sufficient pasture of the quality necessary to maintain body-weight.

(2) In the treated paddock pasture spraying with urea, molasses, phosphate and cobalt chloride did not improve the overall quality and quantity of pasture consumed.

Failure to get a weight response in grazing cattle from the foliar application of urea, molasses, phosphate and cobalt to a predominantly carpet grass pasture under Queensland conditions may be due to a number of factors. These include the frequency of treatment (weekly in both experiments), the heavy dews which are a feature of this locality, the intermittent rainfall during the experimental period, the known low palatability to cattle of mature carpet grass and the high degree of selective grazing by cattle on these pastures. It is considered that more frequent treatments would be uneconomical and impracticable under Queensland conditions. It is possible that a response from such treatment might result on pastures which would not permit the same degree of selective grazing. However, in the light of present knowledge it is suggested that in Queensland an economic response from urea and molasses can only be anticipated when these are used as a supplement to cattle fed low quality pasture hay under pen conditions as described by Beames (1960) and Morris (1958).

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REFERENCES

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS (1955).—Methods of Analysis of the Association of Official Agricultural Chemists, 8th Ed.

BEAMES, R. (1960).—*Qd J. Agric. Sci.* 17: 205.

CHESTER, R. D., MARRIOTT, S., and HARVEY, J. M. (1957).—*Qd J. Agric. Sci.* 14: 1.

KELLERMANN, J. A., and GROENEWALD, J. W. (1956).—*Fmg. S. Afr.* 32: 61.

MORRIS, J. G. (1958).—*Qd J. Agric. Sci.* 15: 161.

TRIBE, D. E., and COOMBE, J. B. (1958).—*Pastoral Rev. and Graziers Rec.* 68: 759.

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