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DIGESTIBILITY OF LUCERNE HAY WITH SPECIAL REFERENCE TO EXPERIMENTAL TECHNIQUE IN DIGESTION TRIALS (SECOND REPORT).

J. W. GROENEWALD, S. J. MYBURGH, AND J. G. LOUW,
Onderstepoort Laboratory.

In their first report Groenewald *et al.* (1950) attempted to test the reliability of a simplified technique, more adaptable to local conditions, for the carrying out of digestibility work. Instead of applying the recognized latin square or randomized block technique of Fisher (1925–46), the co-efficients of digestibility for dry matter, crude protein and fibre in lucerne hay were determined by means of six two-year old Afrikander steers which were fed on lucerne hay only for five consecutive periods. The object of the preliminary work was, therefore, to study the period influence on digestibility.

Watson (1936) suggested the possibility of a rhythm in the rate of digestibility. Unless the latin square were applied, therefore, a chance reading of a particular coefficient of digestibility may be obtained either on the crest or in the trough of a wave. Although the significance of this fact is recognized by Groenewald and co-workers, they, nevertheless, suggested an alternative technique based on different periods for testing of different feeds. In view of the slight variations in digestibility values obtained for fibre in the first experiment and desirability of obtaining additional information, especially in regard to the animal age factor, the work was repeated a year later and is reported here.

Experimental.

The original six Afrikander steers, now 3 years old, were used. Their mean live weights during the two series of digestion trials are presented in figure 1. It will be observed that the steers weighed considerably more during the present series than was the case at the time of the earlier experiment when the natural growth stimulus was greater, as is indicated by a levelling in the weight curve of the older animals. The steers were fed a balanced ration during the interim period.

Using lucerne hay as the only feed four consecutive digestion trials were conducted during May, July, October and December, 1948. At the outset, a supply of feed of uniform composition and adequate for the entire experiment was reserved. The experimental technique was the same as that previously described (Groenewald *et al.*, loc. cit.).

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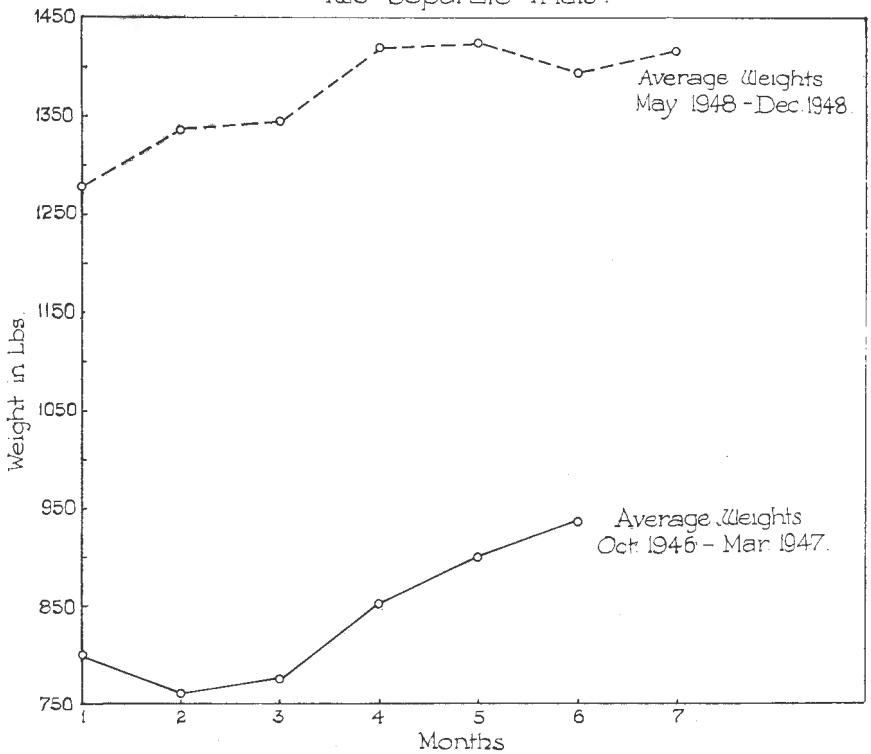
Fig 1 : Comparitive Weights of Steers in Two Separate Trials.



Results and Discussion.

The average chemical composition of the lucern hay used in the respective trials is given in table 1, as percentages on the basis of the dry matter. The figures show that in respect of chemical composition the quality of the lucerne hay was approximately the same in all the trials, thus excluding variation in digestibility from this source.

Table 1.

Average chemical composition of the lucerne hay.

Trial No.	Crude Protein.	Crude Fibre.	Ether Extract.	Ash.	N-free Extractives.
1 (May).....	15·2	30·85	2·80	9·38	41·77
2 (July).....	15·1	32·48	2·79	9·66	39·97
3 (October).....	15·7	32·50	2·62	9·11	40·06
4 (December).....	15·7	31·00	2·95	9·50	40·85

A summary of the mean coefficients of digestibility of the lucerne hay in the different trials is presented in table 2 together with statistical data relating to the differences necessary for significance at the 5 and 1 per cent. levels. The daily dry matter consumption per bovine averaged 19·4, 19·7, 20·0 and 19·6 lb. in trials 1, 2, 3 and 4, respectively.

TABLE 2.

Average coefficients of digestibility and statistical data.

Trial No.	Coefficients of Digestibility.				
	Dry Matter.	Crude Protein.	Crude Fibre.	Ether Extract.	N-free Extract.
1	62·8	73·3	49·3	42·6	72·5
2	61·5	74·6	46·5	42·2	71·8
3	63·2	77·3	48·9	45·3	70·9
4	63·9	77·2	48·6	48·0	71·7

	Necessary Differences at—	
	P = ·05.	P = ·01.
Dry Matter	1·41	1·95
Crude Protein	1·09	1·50
Crude Fibre	2·58	3·57

According to these data, the following differences in mean digestibility were significant:—

(*a*) *Dry matter.*

(i) Mean of trial 4 differed from that of trial 2 at P = ·01.

(ii) Mean of trial 3 differed from that of trial 2 at P = ·05.

(*b*) *Crude protein.*

(i) Means of trials 3 and 4 differed from those of trials 1 and 2 at P = ·01.

(ii) Mean of trial 2 differed from that of trial 1 at P = ·05.

(*c*) *Crude fibre.*

(i) Mean of trial 1 differed from that of trial 2 at P = ·05.

These variations in the digestibility of the dry matter of the same feeding stuff by the same individuals at different times were approximately of the same magnitude as those observed in the first report of this study. In the present case, however, crude protein also contributed to this period influence, the mean coefficients for this component ranging from 73·3 per cent. in trial 1 to 77·3 per cent. in trial 3. In the earlier investigation period had no influence on the digestibility of crude protein.

The variations due to period are admittedly so small that they may, for all practical purposes, be ignored. However, when making a scientific study of the relative digestibility of different feeding stuffs, it becomes necessary to eliminate this period effect as far as possible. In the first report of this study it was pointed out that the latin square or randomized block technique offers the best means of reducing any bias due to a period influence, but that the somewhat complicated feeding program demanded by this system might result in mistakes, especially when use has to be made of unskilled labour. For this reason a simplified technique was suggested, involving, for the purpose of reducing any period effect, a repetition of the de ermination of digestibility in the order A B B A, A and B representing two different feeding stuffs.

That the period effect could be eliminated by following this simplified system becomes evident on applying it, by way of illustration, to some of the data of the present trials. Individual and mean coefficients of digistibility for dry matter,

TABLE 3.

Coefficients of digestibilty of the dry matter of lucerne hay.

Trial No.	Individual Coefficients of Digestibility.						Average.	Average for Trials 1 & 4 (AA).	Average for Trials 2 & 3 (BB).
1 (A).....	63·7	65·0	63·4	60·5	60·1	63·9	62·8	63·4	—
2 (B).....	61·4	62·4	62·1	62·2	59·1	61·6	61·5	—	62·4
3 (B).....	62·9	62·9	63·6	63·2	61·6	64·9	63·2	—	—
4 (A).....	62·2	65·0	63·5	63·2	61·6	67·6	63·9	—	—

the constituent least subject to error, are given in table 3. The figure in column 4 represents the average of the twelve observations made in trials 1 and 4 whilst that in the last column is the mean for those of trials 2 and 3. The small difference between these two averages was found to possess no statistical significance, thus demonstrating the value of the A B B A technique in countering the period influence.

The digestibility (average of all periods) of the lucerne hays used in this and the earlier series of trials is summarized in table 4.

TABLE 4.

Percentage digestibility of sun-cured lucerne hay for steers.

Number of Trials.	Dry Matter.	Crude Protein.	Carbohydrates.		Ether Extract.	Reference.
			Fibre.	N-free Extract.		
5.....	57·7	75·3	36·5	70·2	28·3	Groenewald *et al* (loc. cit.)
4.....	63·0	75·6	48·3	71·7	44·5	This Report.

Of special significance is the improved utilization of crude fibre and fat in the present experiment, in spite of the fact that, judged by chemical composition, the hay used was somewhat inferior in quality to that employed in the earlier work. This may be due to such factors as increased age and weight of the steers, a question which will receive attention in future work.

SUMMARY.

(1) In a continuation of the study of the digestibility of the same lucerne hay by the same steers at different times further evidence of a period influence on digestibility was obtained. This influence could be reduced or eliminated by following a simplified technique in planning digestion trials with different feeding stuffs.

(2) The digestion of lucerne hay by bovines would seem to improve with age in these animals.

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