GRAZING BEHAVIOUR STUDIES ON HOLSTEIN-ZEBU CATTLE IN TRINIDAD.

An investigation of the Relationship between Grazing Behaviour and Dry Matter intake.

by

C.J. MILLS

D.T.A. Report

Submitted in part fulfilment of the requirements for the Diploma in Tropical Agriculture of the Imperial College of Tropical Agriculture.

June 1960
Introduction.

General Review.

Objects.

Experimental Techniques and Material.

Results and the Discussion of Results.

Conclusions.

Summary.

References.

Acknowledgements.

Figures 1-2

The idea of watching animals, both eating and resting, in order to assess their state of health, has no new success in animal husbandry. Only recently has the idea been extended to the diurnal recording on the pasture in order to ascertain their grazing in different types of environment, and from these differences in grazing intensity is assessed their ability to adapt to different environmental conditions. Little work has been done to ascertain the extent of this hard variation, and this has been various disadvantage associated with this limitation is the fact that the values measured in grazing behaviour trials are not necessarily related to production - or even to pasture intake. A basic factor such as Dry Matter Intake, if incorporated into grazing behaviour trails, would increase their value essentially, both in the basis of individual results, and in any comparison between experiments.

If Dry Matter were taken as the basis means of comparison of results, any trial on grazing behaviour would involve some method of determining the D.M. intake. The methods at present in use are usually difficult and involve long laboratory analysis. It has been suggested that in fact some factor of behaviour, either grazing time or rumination time, may be directly related to Dry Matter intake. This trial attempts to demonstrate whether in fact, in a normal grazing behaviour trial, either of these factors, or any other easily measured, can be taken to give any indications of differences in D.M. intake.

The trial took place in two parts - the first in the wet season, and the second in the dry season. Therefore some discussion is also included on general differences in behaviour during these two periods. Within this general investigation was a pilot trial to measure grazing intensity variations.
INTRODUCTION

The idea of watching animals, both eating and resting, in order to assess their state of health, is no new concept in animal husbandry. Only recently however has the idea been extended to the systematic recording of their behaviour on the pasture in order to ascertain their reaction to different types of environment, and from these reactions attempt some evaluation of the factors making up the environment.

The emphasis so far in grazing behaviour studies has been on the comparing of different systems of management under a given set of environmental conditions. Little work has been done to assess the extent of individual and herd variation and this has been a serious disadvantage when attempting to understand the results from any one experiment in relation to other results. Associated with this limitation is the fact that the values measured in grazing behaviour trials are not necessarily related to production - or even to pasture intake. A basic factor such as Dry Matter Intake, if incorporated into grazing behaviour trials, would increase their value enormously, both in the use of individual results, and in any comparison between experiments.

If Dry Matter were taken as the basic means of comparison of results, any trial on grazing behaviour would involve some method of determining the D.M. intake. The methods at present in use are usually difficult and involve long laboratory analysis. It has been suggested that in fact some factor of behaviour, either grazing time or ruminating time, may be directly related to Dry Matter intake. This trial attempts to demonstrate whether in fact, in a normal grazing behaviour trial, either of these factors, or any other easily measured, can be taken to give any indications of differences in D.M. intake.

The trial took place in two parts - the first in the wet season, and the second in the dry season. Therefore some discussion is also included on general differences in behaviour during these two periods. Within this general investigation was a pilot trial to measure grazing intensity variations.
GENERAL REVIEW

General

The normal method of carrying out a grazing behaviour study is to record the activities of a number of cattle at fixed intervals over a period of time. The intervals vary from one minute, used by Rollinson, Harker and Taylor (1956), through to five minutes, used by Hancock (1953). However the former workers, in comparing four minute and one minute intervals found that the error introduced by using the longer period was less than that due to individuality. A former comparison made by Hughes and Reid (1951) would appear to confirm that anything less than four minute intervals is unnecessary.

A number of early workers (Rhoad 1938), (Atkeson, Shaw and Cave 1942), did not observe their cattle at night, but all workers now realize the importance of continuous recording for 24 hours. In order to eliminate day to day variations it is normal to take a continuous period of 72 hours (I.C.T.A. workers) or a number of isolated 24 hour periods (Hancock 1950).

The number of cattle used will often depend on the type of investigation and the facilities available. Hancock (1953) suggests a minimum of ten animals. He further suggests that variations due to individuality, and the reaction of individual with environment can be considerably reduced using monozygous twins. This work is further discussed when considering the differences due to individual.

The activities are normally classified as :-

1. Grazing Time.
2. Ruminating Time. (includes Standing Ruminating and Lying Ruminating)
3. Idling Time. (includes Standing, Walking and Lying Time.)

Within this general framework, other activities may be recorded (Time spent drinking etc.)

Some workers have in the past attempted to establish a "Normal
Pattern of behaviour. It is now generally realized that the variations due to outside stimuli, as well as to genetic factors, are so large as to render the idea meaningless. The author therefore intends to review Grazing Behaviour in relation to the various factors which will influence it.

Individuality and Breed

As has already been mentioned, little attention is usually paid to individual variations in grazing behaviour trials. Hancock (1953) devotes some time to the discussion of individual differences in behaviour and their possible cause. Using monozygous twins he has shown that individuality can be one of the most important factors governing both grazing and ruminating times in the animal. The differences in grazing time for any two animals with a similar intake must be due to differences in size and frequency of bite. In his opinion, these are largely determined genetically. He also suggests that ruminating time is influenced by inherent factors - each animal having a particular rhythm. The differentiation of genetic influences from genetic - environmental reactions would appear to be extremely difficult.

It would appear, then, that individual variation is likely to mask any variation in behaviour due to breed. Hill (1959) showed that in Trinidad - with fairly extreme climatic conditions - breed differences in dry cows, either in the time spent grazing, or in the time of grazing, are not easily demonstrated. However Truscott (1958) using lactating cattle, does suggest that Holstein-Zebu do show more more climatic stress than do pure Zebu cattle. It would seem likely that where there is any particular characteristic of a breed likely to interact with any factor of the grazing environment, there will be an effect on the grazing behaviour. This is particularly the case when considering heat tolerance.

Effect of Day and Night.

The relative proportions of day and night grazing would appear to vary with the climate, the length of day and the type of management. In temperate areas it is assumed that cows prefer to graze during daylight. Hein (1935) reported that with grazing steers in the United States, no grazing took place at night except under bright moonlight. Times given for grazing...
for grazing at night in temperate regions vary from 23% of the total (Johnstone-Wallace and Kennedy, 1944) to 0% (Taylor, 1953).

In the tropics, a different picture is shown - especially when using exotic breeds. Payne, Laing and Rawcka (1951) working in Fiji, reported 67% of the grazing done at night by grade friesian. This swing towards night grazing in the tropics is further considered in the discussion of the effect of climatic factors.

**Effect of Climate**

The most important factor of climate, as it effects grazing behaviour, is temperature. In temperate countries however, cows are little affected by climate, and only in cold driving rain will they stop grazing (Taylor, 1953). High temperatures as encountered in temperate regions may stimulate cattle to graze earlier in the day (Castle, Foot and Halley, 1950).

In the tropics, temperature is often one of the most important factors investigated in Grazing Behaviour trials. Here, the importance of the heat tolerance of the animal is concerned. Hill (1959) in a comparison of Holstein-Zebu and Zebu animals showed slightly more grazing done at night by the crossbreds. Seath and Miller (1947) suggested that often cows could not fully catch up at night on grazing time lost during the day - but this in fact may well be due to the general use of poor night pastures. Thompson (1959) compared the effect of poor and good night pastures on Holstein-Zebu cows subjected to daytime stress and established a definite switch from day to night grazing when good pastures were provided at night. He suggested that in Trinidad the best pastures should be provided at night, especially when they were unshaded.

As to the temperatures at which grazing behaviour becomes affected, these obviously depend on individual heat tolerance. Seath and Miller (1947) did their trial in a period when day temperatures were over 85°C. In Trinidad, where the grazing pattern of Holstein-Zebu cattle does not appear to be greatly affected, the ....
affected, the average day temperature is about 80° F. Whether the cattle are affected by direct sunlight supplying a visible stimulus for seeking shade, or only by skin temperature, has yet to be demonstrated. The cattle will certainly make use of shade in Trinidad - especially between 11 a.m. and 3 p.m. - if it is available (Allen 1960).

The affect of Relative Humidity has not been investigated as yet. Human beings are far more comfortable in a hot dry climate than in a hot wet one. The same may be true of cattle. In comparing the behaviour in the wet and dry seasons, the most important factor will most certainly be the variation in the quality and quantity of herbage rather than any variation in climatic stress. Only very heavy rain will cause the animals to stop grazing.

**Effect of Quality and Quantity of Pasture.**

The majority of evidence concerning the effects of quality and quantity of grass on grazing behaviour is vague and often conflicting, owing to the lack of uniformity in pasture evaluation.

For instance Johnstone-Walla ce and Kennedy (1944) - some of the earliest workers on animal behaviour - state that in their experience, grazing time was constant, even though available feed varied from 250lbs to 1000lbs of Dry Matter per acre. However before them, Atkeson, Shaw and Cave (1943), comparing poor, fair and good pasture (on a length and density basis) found that cattle grazed for 62%, 56% and 48% of the available time respectively. Halley (1953) also showed that when available Dry Matter fell, grazing time increased.

It is now generally accepted that the quality and quantity of pasture will markedly affect the time spent grazing, and in a comprehensive trial Hancock (1953) using monozygous twins, showed that:

1. Where quantity is high, grazing time is short, and where quantity is low, grazing time is long.

2. On already
2. Where quality is high grazing time is short, and where low, grazing time is long, and this effect is carried through into ruminating time—due to the fibrous nature of poor quality pasture.

3. On already grazed fields, grazing time is longer due to more selection of herbage.

The actual Dry Matter intake of the cattle on these different swards bears no relation to grazing times—and in fact differences in intake may be negligible although the swards differ considerably, as noted by Waits, Macdonald and Holmes (1951).

In conclusion, the work of Thompson (1959) must again be mentioned. Although he obtained a marked change in grazing pattern by switching good pastures from day to night grazing, thus emphasising the effect of the type of sward on the grazing behaviour, he did not in fact affect the total grazing time. This would appear to indicate that any stress suffered by the animals receiving good quality day pastures, was not affecting their grazing habits.

Relation of Grazing and Rumination times to Dry Matter Intake.

As Hancock (1953) pointed out, variations in grazing time depend on intake and the size and frequency of bite. The first is the factor we are endeavouring to measure. Although in Hancock's opinion the other two factors are largely determined genetically, they are likely also to be dependent on quality and quantity of pasture (see section on Grazing Intensity). However for any accurate relation of grazing to pasture intake (as total wet matter) it is necessary to know total grazing time, numbers of bites per minute and the size of bite. The first two can be measured (as total number of bites) in a normal Grazing Behaviour trial. The last would seem to be extremely difficult to measure, and to what extent it is dependent on individual and environmental variations and the reaction between them is unknown. The relation of wet matter intake to dry matter intake can easily be found.

Similarly rumination......
Similarly total ruminating time will be dependent on the size and number of bolus per minute and the number of times the animal will ruminate the same material. In this case there are two factors that cannot be measured - the size of bolus and the amount of rumination for a given amount of material. To what extent this last factor is governed by Dry Matter intake and how much it is influenced by other factors such as percentage fibre and genetic differences and interactions is the most important question when considering the relation of Dry Matter intake to total ruminating time. If mainly dependent on total Dry Matter, then the main variable is size of bolus and it could be suggested that total ruminating time will give the best idea of total dry matter intake. If however the ruminating time is much influenced by other factors, such as the genetic rhythm mentioned by Hancock, and the fibre percentage in the grass, then it may be that a knowledge of total grazing time, frequency of bites, and the dry matter percentage of the grass, will give a better idea of total dry matter intake.

In the work done so far total ruminating times have given a more reliable estimate of dry matter intake than have total grazing times. Hancock (1954) demonstrated a strong relationship between ruminating time and dry matter intake in an indoor feeding trial. He did further work, using monozygous twins on pasture, and measured genetic and genetic-environmental factors governing grazing behaviour. He found that the biggest factor governing grazing and ruminating times was in fact food requirement, but that between cow variations were very large - being up to 30% in grazing times and up to 6% in ruminating times for the same intake. The environmental-inheritance interaction also constituted a significant, if small, part of the variation. He concludes from this trial that ruminating time is strongly dependent on the quantity (and also quality) of grass eaten, but that it is also influenced by inherent factors in the cow. Grazing time is less dependent on the grass actually eaten and more on the density and length of herbage available. The rates of grazing and rumination are in his opinion largely determined genetically.
In a further trial Hancock (1958) incorporated grazing behaviour studies into a trial comparing the effect of different stocking rates on the efficiency of production of cows and pasture. He again notes that ruminating times appeared to correspond to estimated feed requirements and went on to measure actual intakes and prove that these were exactly proportional to ruminating times in all three groups that he was using.

Brumby (1959) continuing along the same lines, makes the following summary from his results:

1. There was a small positive relationship between grazing and ruminating times and intake.
2. There was a small positive relationship between grazing and ruminating times and fat corrected milk production.

He does however make the point that the relationship between ruminating time and intake was much smaller than in Hancock's original indoor trial.

The discussion of grazing behaviour and its relation to dry matter intake is continued in the discussion of results.

Grazing Intensity

The intensity of grazing of an animal is here considered to mean the size and frequency of bite. As has already been mentioned, no work can be found on the factors affecting the size of bite, although Hancock (1953) suggests that it is largely determined genetically. He considers the same of frequency of bite but considers that age of the animal, and the time within each grazing cycle have an effect. With monozygous twins he found that frequency increased with age up to maturity, and that it fell off over each grazing period - in one instance being 60 - 70 bites at the beginning of the cycle and 30 - 40 bites at the end (measured per minute).

However Johnstone-Wallace and Kennedy (1953) state that in their experiments, bites per minute mainly depended on the length of sward. As the length increased, then bites per minute decreased.

Selection is ........
Selection is obviously also an important factor governing the rate of grazing. Which of the above factors is the most important source of variation is not clear, but it will obviously depend to some extent on circumstances.

2. To make a general comparison of the grazing behaviour of Delstein-Dehli tamarind cattle in the wet and dry seasons in Beaufort.

3. To make a preliminary investigation of individual variations in the number of bites taken per minute.
OBJECTS

1. To investigate the relationship between Grazing Behaviour and Pasture Intake.

2. To make a general comparison of the Grazing Behaviour of Holstein-Zebu crossbred cattle in the wet and dry seasons in Trinidad.

3. To make a preliminary investigation of individual variations in the number of bites taken per minute.

2. Measurement of Dry Matter Intake

The Dry Matter intake of the cattle was measured using the Champion Oxide marker method. After a preliminary period of 7 days, during which the marker was only administered, there was a collection period of 10 days. Management and pasture remained the same over the whole period (see later sections.) The behaviour trials were placed to take place towards the beginning of the 10 day collection period.

3. Measurement of Bites per Minute

These were measured using a stop watch and counter. In Trial No. 1 (March 6th) bites per minute were recorded for one minute in every twelve minutes whilst the cow was grazing. One cow was recorded for each 12 hour period. If during a sample minute, the cow ceased grazing, the sample was still recorded, but with a notation regarding the interruption made beside it. In Trial No. 2 (September 30th, 1957) recordings were made once every eight minutes, and interrupted samples were made up to a full minute of grazing (with again a notation recording the fact.)

4. Site of Trials

Field 21 at the Central Experimental Station, Sanaoa, was used for both trials. The field consisted of 10 three rod beds (about 1000 sq. yds) and was completely unshaded.

Botanical composition ......
EXPERIMENTAL TECHNIQUES AND MATERIAL

1. Grazing Behaviour Study.

The cattle were observed at 4 minute intervals over two 72 hour periods. The observations started at 6 a.m. in both trials. They were recorded as grazing, ruminating or idling. Five cows were recorded as individuals in each trial, and a total of eleven cows was used in both trials. The 72 hour periods used were from 6 a.m. on the 25th of November 1957, to 6 a.m. on the 28th, and from 6 a.m. on the 14th of March 1960 to 6 a.m. on the 17th.

2. Measurement of Dry Matter Intake

The Dry Matter intake of the cattle was measured using the Chromic Oxide marker method. After a preliminary period of 7 days, during which the marker was only administered, there was a collection period of 10 days. Management and pasture remained the same over the whole period (see later sections.) The behaviour trials were timed to take place towards the beginning of the 10 day collection period.

3. Measurement of Bites per Minute

These were measured using a stop watch and counter. In Trial No. 1 (25th Nov.) bites per minute were recorded for one minute in every twelve minutes whilst the cow was grazing. One cow was recorded for each 24 hour period. If during a sample minute, the cow ceased grazing, the sample was still recorded, but with a notation recording the interruption made beside it. In Trial No 2 (14th Mar.) recordings were made once every eight minutes, and interrupted samples were made up to a full minute of grazing (with again a notation recording the fact.)

4. Site of Trials.

Field 21 at the Central Experimental Station, Centeno, was used for both trials. The field consisted of 10 three rod beds (about 100yds long) and was completely unshaded.

Botanical composition
Botanical composition of the pasture available to the animals was estimated to be as follows:

- **Digitaria decumbens** (Stent) (Pangola grass) 78%
- **Ischaemum timorense** (Lucuntu grass) 15%
- **Mimosa pudica** (Sensitive plant) 2%
- Other weeds 5%

The Lucuntu grass and the Sensitive plant grew mainly along the drain edges.

The actual length and density of the pasture varied between the two trials and was estimated to be as follows:

- **Wet Season**
  - Av. Length: 10 - 12 ins.
  - Av. cover: 90%
- **Dry Season**
  - Av. Length: 8 - 9 ins.
  - Av. cover: 80%

5. **Cattle used in the Trials**

The cows used in both experiments came from the milking herd at Centeno. They were mainly Holstein-Zebu crossbreds, with varying amounts of Holstein blood. Some cows appeared to have a Channel Island background.

The cows used and their mean weights over the trials, and the week of lactation when they entered the trials are given in Table I.

### TABLE I  Cattle used in the Experiment

#### (a) Wet Season - Trial 1.

<table>
<thead>
<tr>
<th>Cow No.</th>
<th>Mean Weight (lbs.)</th>
<th>Wk. of Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>959</td>
<td>33</td>
</tr>
<tr>
<td>72</td>
<td>920</td>
<td>27</td>
</tr>
<tr>
<td>79</td>
<td>1120</td>
<td>29</td>
</tr>
<tr>
<td>104</td>
<td>934</td>
<td>10</td>
</tr>
<tr>
<td>107</td>
<td>1011</td>
<td>33</td>
</tr>
<tr>
<td>111</td>
<td>1025</td>
<td>18</td>
</tr>
<tr>
<td>112</td>
<td>969</td>
<td>26</td>
</tr>
<tr>
<td>118</td>
<td>983</td>
<td>19</td>
</tr>
<tr>
<td>137</td>
<td>836</td>
<td>27</td>
</tr>
<tr>
<td>146</td>
<td>787</td>
<td>10</td>
</tr>
<tr>
<td>1 dry cow</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

#### (b) Dry Season

...
(b) Dry Season - Trial No. 2

<table>
<thead>
<tr>
<th>Cow No.</th>
<th>Mean Wt. (lbs.)</th>
<th>Wk. of lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>875</td>
<td>9</td>
</tr>
<tr>
<td>16</td>
<td>1011</td>
<td>12</td>
</tr>
<tr>
<td>61</td>
<td>1075</td>
<td>17</td>
</tr>
<tr>
<td>100</td>
<td>1229</td>
<td>19</td>
</tr>
<tr>
<td>101</td>
<td>1050</td>
<td>14</td>
</tr>
<tr>
<td>104</td>
<td>982</td>
<td>25</td>
</tr>
<tr>
<td>120</td>
<td>840</td>
<td>11</td>
</tr>
<tr>
<td>140</td>
<td>1032</td>
<td>-</td>
</tr>
<tr>
<td>146</td>
<td>871</td>
<td>25</td>
</tr>
<tr>
<td>153</td>
<td>1117</td>
<td>13</td>
</tr>
<tr>
<td>1 dry cow</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes:
1. Average weight of all cattle
   - Wet Season = 954 lbs
   - Dry Season = 1008 lbs

2. Average daily yield of milk per cow
   - Wet Season = 15.1 lbs
   - Dry Season = 19.4 lbs

3. Cows No. 104 and 146 were common to both trials.

4. Cows No. 72, 111, 118, 146 and the dry cow were recorded individually in the wet season trial.

5. Cows No. 1, 61, 104, 146 and the dry cow were recorded individually in the dry season trial.


   In Trial No. 1 the grass was 'Stepped Up' previous to the seven day preliminary period. Cows were grazed over the area taking in the same amount of grass each day as would be taken in the experiment. Thus, in theory, the grass eaten each day by the experimental cattle was at the same stage of growth. In Trial No. 2, owing to a shortage of grass, this was not possible.

   However in both trials.....
However in both trials the amount of quality of pasture fed each day was very uniform.

7. Management of the Cattle

The cattle were taken in twice daily for milking, from approximately 5:30 a.m. to 7 a.m., and from 1 p.m. to 2:40 p.m. They were moved on to fresh pasture after each milking period. They had no lie back area, and the area given to them each time was varied with the estimated density of the pasture. No water was provided in the field. At 5:45 a.m. each day the chromic oxide was administered, and at 6 a.m. and 2 p.m. faecal samples were taken.

8. Climatic data

The temperature and Relative Humidity data is taken from the records kept at I.C.T.A. The intensity of sunlight, amount of cloud cover, and intensity and length of rain showers was recorded on the proformas used in recording grazing behaviour.

In both trials the grazing done at night was recorded (Crittenden, 1959). In the field, the data was recorded on proformas, and in the laboratory, the data was recorded on a chart with a scale of 1-30 cm. Each point on the chart represented 10 cm of pasture grazed. The length of each line was measured, and the area between any two lines was calculated using a planimeter. The area of each line was calculated by giving the \% variation from the mean.
RESULTS AND THE DISCUSSION OF RESULTS

The results and the discussion of them, are given under a series of headings - divided into four main sections.

SECTION A  HERD AND INDIVIDUAL BEHAVIOUR

1. General Behaviour

The herd grazed for an average of 7.2 hours per cow per day, and ruminated for an average of 8.5 hours per cow per day (averages for both trials.) These figures are on a par with results obtained previously from Holstein-Zebu cattle in Trinidad, but the Grazing/Ruminating ratio is rather lower than one would expect (it normally tends towards 1:1 in cattle).

During Trial 2 (dry season) the behaviour tended to follow the pattern previously shown (Thompson, 1959), with three grazing peaks - between 7 a.m. and noon, between 3 p.m. and sunset, and between 10 p.m. and midnight. In the wet season trial, the midnight grazing period was considerably reduced, and this corresponds to some extent with Truscott's (1958) findings when investigating the behaviour pattern of the College herd during the wet season. In both trials the grazing done at night was somewhat less than had previously been recorded (Truscott, 1958). In the wet season it was very low - 14% of the total (between 6 a.m. and 6 p.m.) and in the dry season somewhat higher - 30% of the total (between 6 a.m. and 6.40 p.m.) This reduction of night grazing may be partially explained by the fact that the herd was turned out early in the afternoon after milking, and thus had a fairly long continuous afternoon grazing period. By nightfall the fresh pasture was already well grazed, and this may have served to depress any tendency to prolonged night grazing.

2. Individual variation.

In Table II the individual averages for rumination and grazing are given for both trials. Some idea of the variation shown by these figures is demonstrated by giving the % variation from the herd average in each case.

TABLE II
To start with, it would be as well to point out that any statistical application of the variation of five chosen individuals to a herd of eleven is impossible. Any statistical assessment will only give the coefficient of variation for the five individuals, and thus will not be of any use in the analysis of overall averages. It might be suggested that in future work all the animals should be recorded individually.

Bearing this fact in mind, only tentative remarks can be made concerning individual variation in the two trials. There is some indication that in this case grazing times varied less (average 6%) than ruminating times (average 9%). This does not agree with Hancock's (1954) figures, which showed that in that case grazing times varied considerably more than ruminating times. In Trial I, the very large variation in the ruminating time of the dry cow may have been a reflection of lower appetite - but in Trial 2 the dry cow's ruminating times varied least of all.

<table>
<thead>
<tr>
<th>Cow No.</th>
<th>Grazing/day (hrs)</th>
<th>% Variation</th>
<th>Rumin/day (hrs)</th>
<th>% Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Trial 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>6.6</td>
<td>3</td>
<td>7.6</td>
<td>9</td>
</tr>
<tr>
<td>111</td>
<td>6.3</td>
<td>2</td>
<td>7.7</td>
<td>9</td>
</tr>
<tr>
<td>118</td>
<td>6.9</td>
<td>8</td>
<td>9.3</td>
<td>16</td>
</tr>
<tr>
<td>146</td>
<td>7.0</td>
<td>9</td>
<td>8.2</td>
<td>0</td>
</tr>
<tr>
<td>Dry cow</td>
<td>6.9</td>
<td>8</td>
<td>6.7</td>
<td>23</td>
</tr>
<tr>
<td>Herd average</td>
<td>6.4</td>
<td>-</td>
<td>8.2</td>
<td>-</td>
</tr>
<tr>
<td>(b) Trial 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>8.4</td>
<td>5</td>
<td>9.1</td>
<td>5</td>
</tr>
<tr>
<td>104</td>
<td>8.5</td>
<td>8</td>
<td>9.3</td>
<td>9</td>
</tr>
<tr>
<td>146</td>
<td>8.0</td>
<td>0</td>
<td>9.4</td>
<td>10</td>
</tr>
<tr>
<td>Dry cow</td>
<td>7.6</td>
<td>8</td>
<td>8.4</td>
<td>4</td>
</tr>
<tr>
<td>Herd average</td>
<td>8.0</td>
<td>-</td>
<td>8.7</td>
<td>-</td>
</tr>
</tbody>
</table>
In the majority of the tables given later, individual results are not quoted. The dry cow is left out of all average herd results, which are quoted as a mean result for ten cows in milk.

3. Day to day variation

The day to day variation in the grazing behaviour of the herd is shown in Table III. The days are taken as 24 hour periods from 6 a.m.

<table>
<thead>
<tr>
<th>Day</th>
<th>Grazing</th>
<th>Ruminating</th>
<th>Idling</th>
<th>Rumin. : Grazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>25th Nov. - 28th Nov. (Wet Season)</td>
<td>5.2</td>
<td>2.2</td>
<td>8.9</td>
<td>1.56 : 1</td>
</tr>
<tr>
<td>II</td>
<td>7.4</td>
<td>7.2</td>
<td>9.4</td>
<td>0.96 : 1</td>
</tr>
<tr>
<td>III</td>
<td>5.8</td>
<td>8.6</td>
<td>9.6</td>
<td>1.48 : 1</td>
</tr>
<tr>
<td>Mean</td>
<td>6.3</td>
<td>8.3</td>
<td>9.3</td>
<td>1.33 : 1</td>
</tr>
<tr>
<td>14th Mar. - 17th Mar. (Dry Season)</td>
<td>8.2</td>
<td>8.6</td>
<td>7.2</td>
<td>1.05 : 1</td>
</tr>
<tr>
<td>II</td>
<td>8.1</td>
<td>9.2</td>
<td>6.7</td>
<td>1.12 : 1</td>
</tr>
<tr>
<td>III</td>
<td>8.1</td>
<td>8.7</td>
<td>7.2</td>
<td>1.08 : 1</td>
</tr>
<tr>
<td>Mean</td>
<td>8.1</td>
<td>8.8</td>
<td>7.0</td>
<td>1.08 : 1</td>
</tr>
</tbody>
</table>

... over 5% variation from the mean.
... over 10% variation from the mean.

It is obvious from these figures that the behaviour in the wet season was far more variable from day to day than it was in the dry season. The reasons for this are not easy to find. Thompson (1959) working in the wet season found considerable day to day variation in the first of his trials but much less in his second, and the climate was similar over both periods. In this case there was considerable variation in the weather over trial 1. On the first day it was wet, on the second dry, and on the third showery. The behaviour showed a cyclical effect, grazing being low on the first and third days, and ............
third days, and high on the second day. Rumination showed the reverse curve and these variations are reflected in a very variable R/G ratio. It is interesting to note that despite this wide fluctuation in grazing and ruminating times, idling time remained fairly constant.

It is doubtful in fact, whether the day to day variations in this trial can be directly attributed to the weather factor, as the actual grazing patterns varied very little. There could have been a cyclical effect induced by some factor before the start of the experiment. It is more likely however that the moisture load on the grass acted as a determining factor in governing the appetite in the animals, and this may well have varied from day to day, depending on rainfall. From a practical point of view it would lead to the suggestion that in any trial not involving climate, variation from day to day may be less if it is done in the dry season.

SECTION B WET AND DRY SEASON VARIATION

1. Climate

The average climatic data for the three days of each trial is given in Table IV. As has already been mentioned, the weather during Trial 1 varied considerably. As however the data on behaviour is used as an average over the three days (partly in order to remove variation due to weather) it is considered adequate to present the climatic data as an average for each period. In the consideration of patterns of behaviour, the weather is discussed in more detail.

| Table IV |
### TABLE IV  Climatic data for both trials (3 day averages)

<table>
<thead>
<tr>
<th></th>
<th>Wet season</th>
<th>Dry Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Temp.</td>
<td>86°F</td>
<td>90°F</td>
</tr>
<tr>
<td>Minimum Temp.</td>
<td>69°F</td>
<td>69°F</td>
</tr>
<tr>
<td>% of day with complete cloud cover</td>
<td>30%</td>
<td>11%</td>
</tr>
<tr>
<td>% of day with partial cloud cover</td>
<td>20%</td>
<td>55%</td>
</tr>
<tr>
<td>% time with heavy rain</td>
<td>3.4%</td>
<td>0%</td>
</tr>
<tr>
<td>% time with light rain</td>
<td>1.8%</td>
<td>0%</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>87%</td>
<td>67%</td>
</tr>
</tbody>
</table>

### Wet Season vs. Dry Season

It is interesting to note that in the wet season trial it only rained for 5.2% of the time, and that of this, 3.6% was on the first day and the rest on the last day. In a general comparison, the complete cloud cover was much longer during the day (sunrise to sunset) in the wet season trial but a partial cover existed for over half the time in the dry season. The average maximum temperature was 4°F greater in the dry season - but surprisingly enough, the average minimum temperatures were the same. The average Relative Humidities vary by 20% as would be expected.

2. **Wet and Dry Season differences in behaviour.**

In comparing the grazing behaviour in the wet and dry season trials, it would be as well to remember that there are in fact three variables: -

a/ **Season** - under discussion.

b/ **The cows used** - although from the same herd, only two of the cows used appear in both trials.

c/ **The pasture.**

No evaluation can be made of the variation due to the fact that different cattle were used. Some estimation was made on the length and density of pasture in the wet and dry season (under Experimental Method and Techniques).
One of the most important factors in variation of the pasture was the variation in Dry Matter percentage. This was measured daily at 7 a.m. and is shown below as an average for each trial:

**Wet Season** 21.5% D.M.

**Dry Season** 47.2% D.M.

It has been suggested by Duckworth (1953) that when the D.M. % falls below 25%, the water load of the grass will act as a limiting factor in D.M. uptake - and thus affect grazing behaviour. This is discussed later when comparing D.M. intake figures for the wet and dry season.

Turning again to a consideration of differences in grazing behaviour between wet and dry season trials, they are in fact quite marked - Table V.

<table>
<thead>
<tr>
<th></th>
<th>Grazing</th>
<th>Ruminating</th>
<th>Idling</th>
<th>Ruminating : Grazing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wet season</strong></td>
<td>6.4</td>
<td>8.3</td>
<td>9.3</td>
<td>1.33 : 1</td>
</tr>
<tr>
<td><strong>Dry season</strong></td>
<td>8.1</td>
<td>8.8</td>
<td>7.1</td>
<td>1.08 : 1</td>
</tr>
</tbody>
</table>

If it is considered that a comparison of ruminating times is in this case more likely to give an idea of comparative dry matter intake (the cattle and pasture being different) then there is some evidence that in the dry season the cows ate more than in the wet season in terms of dry matter. It could be inferred that the differences in ruminating times was due to a higher fibre content of the grass in the dry season, but the actual dry matter intake figures (Section D) show that this was not so. The discrepancy between grazing times is even greater than that between ruminating times, and it could be suggested that during the dry season the cows had to graze longer to obtain the same amount of food. However the variation introduced by using different cows makes this a doubtful deduction - Hancock states that up to 30% of the variation may be due to individuality.

The reason ............
The reason for the increased ruminating time (and associated increase in dry matter intake) in the dry season, is presumably the factor mentioned by Duckworth (1958) — the high water load on the grass in the wet season. If, as has already been suggested, the day to day variation in the wet season was due to water load, it could be assumed that in prolonged wet periods, the intake of the cows would be considerably reduced. However where, as in this case, dry days occur, the cows may make up for some of the loss (second day of the wet season trial). To what extent the dew load is responsible for the limitation in intake, and how much is due to the actual moisture percentage of the herbage, was not determined.

3. Variation in Behaviour pattern between wet and dry seasons.

A comparison of behaviour patterns in the wet and dry seasons is shown in the histogram in Figure I. It would have been preferable to have used average figures for each trial to give the histogram readings. However unavoidable factors, such as loss of cows for serving, and also a considerable variation in milking times, made it more expedient to use representative days. For this purpose the last day in each trial was chosen. A brief summary is given below of the weather during each of these days.

A. Weather during the last day of Trial 1.
The early morning was clear, but it later clouded over and between 10 a.m. and 11 a.m. there was 20 mins. heavy rain. It remained cloudy, and at 2 p.m. there was another 30 mins. heavy rain (cows inside for milking). The skies then cleared and the late afternoon was hot with a slight breeze. The sky was clear all night, but at about 3.30 a.m. a mist settled making it quite cold. The mist rose again at about 5 a.m. The Relative Humidity averaged 75% over the whole 24 hours.

B. Weather during the last day of Trial 2.
There was partial cloud all day, with however some very hot periods — especially between 2 p.m. and 4 p.m. A stiff breeze blew all through the day from the east. The night was clear, becoming chilly towards morning. The Relative Humidity averaged 62% over the 24 hours.

In Trial 1 .......

In Trial 2 .......

In Trial 3 ........
In Trial 1 the cows were inside for milking from 5.30 a.m. to 6.25 a.m. and from 1.30 p.m. to 3.00 p.m. In Trial 2 they were inside from 5.30 a.m. to 7.00 a.m. and from 1.30 p.m. to 2.30 p.m.

Both histograms do in fact show very similar patterns of behaviour apart from the almost complete lack of night grazing in the wet season.

In the preceding two nights of the wet season trial, the grazing had in fact been slightly more, but not nearly as much as in the dry season. The reason for the overall shortage of night grazing has already been discussed.

Why there should have been less in the wet season than in the dry could well have been because of the shorter total grazing time of the wet season.

The cattle did not graze over the hottest portion of the day - about 11 a.m. to 3 p.m. - but if they could fulfill their daily requirements during the morning and afternoon grazing periods, there would be no need for prolonged night grazing.

No definite effects of climatic stress can be observed. As has already been mentioned, the cattle did not do much grazing over the midday period. However in the wet season trial this period was cloudy. This midday period may be more a rest and ruminating period than a climatic effect. The hot spell between 2 p.m. and 4 p.m. in the dry season, is linked with a later peak in the afternoon grazing period - but again this may be due to the later onset of darkness. The general lack of climatic effects agrees with previous conclusions made about the behaviour of Holstein-Zebu cattle in Trinidad.

SECTION C INVESTIGATION OF VARIATION IN FREQUENCY OF BITES

During Trial 1 the measurement of intensity of grazing (as indicated by frequency of bite) was carried out mainly in order to discover what data could be obtained using that particular technique. It was found that taking the number of bites for one minute in every twelve minutes was not enough to give a sufficient variation in grazing time at the same intensity.
to give a representative average, nor to give any idea of variation in
the frequency over each grazing period. Therefore the sample was increased
to one minute in every eight minutes, and this was found to be sufficient.
Three cows were recorded in each trial - each over a period of 24 hours.

1. Variation between cows.

In Table VI the average numbers of bites per minute over the 24 hour
period for each are given.

<table>
<thead>
<tr>
<th>TABLE VI</th>
<th>Average numbers of bites per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cow</td>
</tr>
<tr>
<td>(a) Trial 1</td>
<td></td>
</tr>
<tr>
<td>111</td>
<td></td>
</tr>
<tr>
<td>113</td>
<td></td>
</tr>
<tr>
<td>146</td>
<td></td>
</tr>
<tr>
<td>(b) Trial 2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>104</td>
<td></td>
</tr>
<tr>
<td>146</td>
<td></td>
</tr>
</tbody>
</table>

These few figures show a variation from the mean of 11% in the wet
season trial and 14% in the dry season trial. It is obvious therefore, that
as Hancock (1953) pointed out, this will be the cause of a large amount of
the variation in grazing time between individuals with a similar appetite.
A means of eradicating this variation is to measure grazing time as the
total number of bites rather than as total grazing time. This will require
the measuring of bites per minute for each cow over what is considered to be
a representative grazing period. What would constitute a representative
sample is not known. If each cow has to be recorded over a full 24 hours,
then it may well make any grazing behaviour trial too cumbersome to
be of any use. If however a single grazing period is sufficient, then
the inclusion of some measurement of bites per minute, as a means of recording
grazing as total number of bites, is to be recommended.

Similarly the .......
Similarly the intensity of sampling may be important. If 1 minute in 12 minutes is used (as in Trial 1) then 3 cows can be recorded over any one sample period by one person (where behaviour is recorded at 4 minute intervals.) If 1 minute in every 8 minutes is used as in Trial 2, then only 2 cows can be recorded - but a shorter sample period may be required. As is indicated in Table VI, increasing the intensity of sampling from 1 in 12 to 1 in 8, has nearly doubled the number of readings obtained.

Table VII shows the use of total number of bites per day in recording grazing behaviour.

<table>
<thead>
<tr>
<th>Cow</th>
<th>Av. Nos of bites/day (100's)</th>
<th>Rumin/day (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial 1</td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>143.6</td>
<td>7.7</td>
</tr>
<tr>
<td>118</td>
<td>198.6</td>
<td>9.3</td>
</tr>
<tr>
<td>146</td>
<td>180.6</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>Trial 2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>198.1</td>
<td>9.5</td>
</tr>
<tr>
<td>104</td>
<td>183.6</td>
<td>9.3</td>
</tr>
<tr>
<td>146</td>
<td>141.6</td>
<td>9.4</td>
</tr>
</tbody>
</table>

This table shows a better relation between the amounts of grazing and ruminating within each trial than was shown by using the total grazing time. Any comparison between seasons must involve the dry matter percentage of the grass. This is discussed in the next section (Section D). One assumption made using numbers of bites to record grazing amounts is that the size of bite taken by any one cow is not dependent on the frequency of bite. This may not be the case.

2. Variation between seasons.

It is fairly safe to assume that any variation between the two trials is due to ........
id due to one of three factors:

1. A difference in cows.
2. A difference in pasture.
3. A pasture/cow interaction.

In this case there is no means of separating the three factors. In general the rate of grazing seems to be less in the dry season when the sward was shorter (this being the opposite of the findings of Johnstone-Wallace and Kennedy (1953)). However the sward was sparser and also more selection probably took place.

Cow No. 146 took part in both trials, and here any variation is due to the last two factors only. In the wet season she grazed on the average at 43 bites per minute, and in the dry season at 29 bites per minute. This is a very large variation and emphasizes the effect of the pasture on frequency of bite. It also shows another inadequacy in the use of total grazing time — where the same cows but different pastures are involved.

3. Variation within grazing cycles.

No evidence was found of any falling off in the number of bites per minute over each grazing period — as mentioned by Hancock (1953), although the variation within periods was large (up to 30%). What was noticed, was that towards the end of each grazing period, cows would increasingly stand, or walk about between spells of grazing. (From the point of view of recording of behaviour, it is assumed that these spells of rest will be included in the normal 4 minute records.)

Nor was there any evidence of a falling off in frequency of bite between periods when cows were on the same pasture, as was noticed by Goldson (1960). However in this case, where the cows were moved twice each day, the evidence was rather sparse.
The comparison of total grazing and ruminating times with estimated dry matter intake is shown in Table VIII. It was found impossible to estimate when the amounts of dry matter measured in the faeces, had in fact been eaten. Work already done on faecal markers has shown that the residue from food eaten on one day may be excreted over a fairly long period (up to 92 hours) and that the time of peak excretion will vary with the composition of the diet. Therefore the dry matter was estimated by averaging the five dry matter results for consecutive days beginning on the second day of the behaviour trial. This, it was hoped, would give the best estimation of the average amounts of dry matter consumed on the three days of the trial. Thus no comparison of Dry Matter intake and behaviour on particular days can be made. In the dry season trial, when behaviour varied very little, this does not matter, but in the wet season, when behaviour varied to a much greater extent from day to day, it is unfortunate.

Table VIII: Comparison of Dry Matter intake and animal behaviour.

<table>
<thead>
<tr>
<th>Cow</th>
<th>Grazing/day (hrs)</th>
<th>Rumin/day (hrs)</th>
<th>D.M. intake/day (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Wet Season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>6.6</td>
<td>7.6</td>
<td>27.1</td>
</tr>
<tr>
<td>111</td>
<td>6.3</td>
<td>7.7</td>
<td>24.1</td>
</tr>
<tr>
<td>118</td>
<td>6.9</td>
<td>9.2</td>
<td>33.1</td>
</tr>
<tr>
<td>146</td>
<td>7.0</td>
<td>8.2</td>
<td>31.0</td>
</tr>
<tr>
<td>Herd mean</td>
<td>6.4</td>
<td>8.3</td>
<td>29.3</td>
</tr>
<tr>
<td>(b)</td>
<td>Dry Season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8.7</td>
<td>9.5</td>
<td>44.5</td>
</tr>
<tr>
<td>61</td>
<td>8.4</td>
<td>9.1</td>
<td>39.9</td>
</tr>
<tr>
<td>104</td>
<td>8.5</td>
<td>9.3</td>
<td>38.2</td>
</tr>
<tr>
<td>146</td>
<td>8.0</td>
<td>9.4</td>
<td>33.1</td>
</tr>
<tr>
<td>Herd Mean</td>
<td>8.1</td>
<td>8.8</td>
<td>38.1</td>
</tr>
</tbody>
</table>
The following general points emerge from Table VIII:

1. There is a wide variation in Dry Matter intake between cows within each trial. This can be partially explained by different production and maintenance requirements. The remaining variation must be due to experimental error, and possibly a carry over effect of Dry Matter from one period to another (daily totals for any one cow varied by as much as 100%).

2. The general intake of Dry Matter in the dry season was considerably greater than in the wet season. The most likely reason for this has already been discussed in Section B - this being the water load on the grass.

Turning to the actual relation of Dry Matter intake to Ruminating time, there is a small positive relation. Figure II, Graph A shows the general tendency of ruminating time to rise with increasing Dry Matter intake. This would appear to indicate that any differences, other than total Dry Matter, of the pasture eaten, have not affected ruminating time to any great extent.

It is important to note that the cows were not the same in both trials (except No. 146). Thus the cow/pasture interaction and the individual variation cannot be ascertained. It is presumably mainly due to these two factors that the points are rather scattered. However when it is considered that both cows and pasture varied, the correlation of estimated Dry Matter intake and ruminating time is greater than might be expected, and leads to the suggestion that where fewer variables are involved, comparison of ruminating times may give a fair indication of Dry Matter intake. On this point however it should be noted that although the correlation exists, the slope of the graph shows that a small change in ruminating time indicates quite a large change in Dry Matter intake. The relation is of the order of 5lbs of Dry Matter for every 30 minutes of ruminating. Any small differences in ruminating time however cannot be definitely attributed to changes in

Dry Matter ...........
FIGURE II

BEHAVIOUR AND DRY MATTER RELATIONSHIPS

A. RUMINATION

![Graph showing rumination data with symbols for wet and dry seasons.]

B. NUMBER OF BITES

![Graph showing number of bites data with symbols for wet and dry seasons.]
Dry Matter, but may be caused by genotype/environment interactions. Nor is the grazing behaviour trial in itself a sensitive enough test to reveal small differences in intake.

Considering the relation of amount of grazing to Dry Matter intake, it is evident from Table VIII that grazing times as such bear little or no relation to intake. This, as shown in Section C, is to some extent due to variation in the number of bites taken per minute. In Table IX the relation is shown giving grazing as total number of bites/day for the six cows recorded.

**TABLE IX** Relation of D.M. Intake/day to Total Nos. of bites/day.

<table>
<thead>
<tr>
<th>Cow</th>
<th>Nos of bites/day (100's)</th>
<th>D.M./day (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Wet Season</td>
<td>143.6</td>
<td>24.1</td>
</tr>
<tr>
<td>111</td>
<td>198.6</td>
<td>33.1</td>
</tr>
<tr>
<td>118</td>
<td>180.6</td>
<td>31.0</td>
</tr>
<tr>
<td>(b) Dry Season</td>
<td>198.1</td>
<td>44.5</td>
</tr>
<tr>
<td>104</td>
<td>183.6</td>
<td>38.2</td>
</tr>
<tr>
<td>146</td>
<td>141.6</td>
<td>33.1</td>
</tr>
</tbody>
</table>

In Figure II, Graph B, these points are plotted. There are far too few points to make any definite conclusions. However the following tentative remarks can be made:

1. Within each trial, there appears to be a positive relationship between Dry Matter intake/day and number of bites/day.
2. Owing to the difference in Dry Matter percentage in the grass, there is no relationship shown between the two trials.
3. The slope of both lines showing the relationship within trials is the same. They indicate a constant correlation of about 51bs of Dry Matter for every 500 bites.

It would be interesting to plot the wet matter intake per day against the number of bites.
number of bites per day. In this case however the determined moisture percentages of the grass appeared to involve fairly large errors, and also fluctuated widely from day to day and within days. It is suggested that the relation of wet matter intake to number of bites may be investigated in more detail.

}\end{itemize}

\begin{itemize}
\item The number of bites taken per minute appear to vary greatly between different laws, and in the one case recorded, between results for the same law on different pastures.
\item It is concluded that where either pasture or grass vary, no reliance can be placed on comparisons of total grazing time, but that comparisons of total numbers of bites may be useful.
\item The Relation of Grass Intake and Dry Matter Intake.
\item Existing time shows a small positive relation to Dry Matter intake - the relation being in the order of .015 lb. of Dry Matter in excess yielding one minute of this type.
\item Feeding time shows no relation to Dry Matter intake in this investigation.
\item There is some indication that where the pasture remains constant, total numbers of bites show a small positive relation to Dry Matter intake, but that varying dry matter percentage in the grass will impede any comparison of different pastures.
CONCLUSIONS

The following conclusions are made from the results of the investigation:

(a) Wet and Dry Season differences.
1. The Dry Matter intake in the Dry season appears to be considerably greater than in the wet season and this is reflected in longer grazing and ruminating times.
2. Behaviour in the Wet season appears to fluctuate more from day to day than in the Dry season.
3. Both the lower Dry Matter intake and the fluctuation in day to day behaviour in the wet season, are thought to be due to variations in water load on the grass.

(b) Frequency of Bites.
1. The number of bites taken per minute appears to vary greatly between different cows, and in the one case recorded, between results for the same cow on different pasture.
2. It is concluded that where either pasture or cows vary, no reliance can be placed on comparisons of total grazing time, but that comparisons of total numbers of bites may be useful.

(c) The Relation of Behaviour and Dry Matter intake.
1. Ruminating time shows a small positive relation to Dry Matter intake - the relation being in the order of 10lbs D.M./hour of Rumination in mature milking cows of this type.
2. Grazing time shows no relation to Dry Matter intake in this investigation.
3. There is some indication that where the pasture remains constant, total numbers of bites show a small positive relation to Dry Matter intake, but that varying Dry Matter percentage in the grass will impede any comparison of different pastures.
SUMMARY

1. Two 72 hour trials, one in the wet season and one in the Dry season, were carried out in conjunction with an experiment measuring Dry Matter intake, to investigate the relation of behaviour to Dry Matter intake. Ten cows in milk were used in both trials, the pasture being in both cases a fairly pure Pangola sward.

2. An investigation into the variation in number of bites taken per minute was carried out in both trials.

3. Some interpretation of the causes of variation in behaviour within and between the two trials is made, considering in particular the effect of climate.

4. The use and measurement of frequency of bites, and some indications of the causes of variation in the number of bites taken per minute are discussed.

5. The relation of Dry Matter intake to Grazing Behaviour shown in the investigation is discussed with particular reference to rumination and total number of bites per day.

6. The author concludes that both rumination and number of bites per day show a positive correlation to Dry Matter intake, but that the relation of number of bites will vary with the moisture percentage of the herbage.
REFERENCES

ALLEN A., (1951) D.T.A. Report i.C.T.A.
JOHNSTONE-WALLACE and KENNEDY K. (1944) J. Agric. Sci. 34, 199.
The author wishes to thank his Supervisor, Mr. R. Houghton, for help given during the experiment and guidance in interpreting results. He also wishes to thank Messrs. Groom and Barrett for their assistance and for the use of their Dry Matter Intake results. The aid of the other members of the Cattle Watching team—Dr. Wilson and Messrs. Houghton, Gregg, Cadogan, Allen, Goldson, and Outram—was much appreciated.