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# THE INFLUENCE OF STUBBLE HEIGHT ON DIGESTIBILITY, INTAKE AND LIVELWEIGHT GAIN OF BEEF STEERS

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## SUMMARY

Liveweight gains of groups of 10 steers either grazing or pen-fed on pasture harvested to stubble heights of 8 and 20 cm were measured over 51 days. The depression in liveweight gain with reduced stubble height was similar in both cases. A decline in DM digestibility and intake could explain the difference in the pen-fed group but because of the possibility of this decline being due to soil contamination it was not possible to confirm that pasture availability was not influencing performance of the grazing group.

## INTRODUCTION

THE CONFLICT that exists between achieving a high per-animal performance and yet good utilization of the dry matter (DM) available for grazing reaches its most critical stage in the finishing beef animal. The quality as well as the quantity of the output (carcass weight) can decline. Consequently, it is important that there is a good understanding of the factors influencing the relationship between pasture utilization and the gain of beef animals.

From an animal production point of view the experimental approach to the problem has been either to control the DM on offer by altering the area available for grazing over a given time period (Wheeler *et al.*, 1963; Wilkinson and Prescott, 1970) or to graze an area until a particular residual DM or stubble height has been achieved. In most cases liveweight gain (LWG) has fallen progressively as the DM on offer declines or *utilization increases* (Tayler, 1966; Hodgson *et al.*, 1971). Sometimes this decline is due to a decline in DM intake owing to a reduction in availability (Wheeler *et al.*, 1963; Wilkinson and Prescott, 1970) but it can also be due to a combination of declining availability and pasture quality (Tayler, 1968; Hodgson *et al.*, 1971).

Tayler and Rudman (1965) have shown that, where the effect of differing availabilities is removed by cutting and feeding in yards, large differences in voluntary intake between pasture can

occur even at similar digestibilities. In an effort to isolate the separate contribution of availability and pasture quality on the performance of steers on a New Zealand pasture, the following work was undertaken.

#### ANIMALS AND METHODS

Forty 16-month-old Angus steers (280 kg LW) were randomly allocated to 4 treatment groups:

HSG — Grazing to a stubble height of 20 cm.

LSG — Grazing to a stubble height of 8 cm.

HSP — Fed in pens on pasture cut to 20 cm.

LSP — Fed in pens on pasture cut to 8 cm.

The high stubble height was chosen so as to achieve maximum per-animal output, LSP to measure the effect of feed quality on performance and LSG the combination of quality and availability.

The trial ran for 51 days, during November-December, and intakes of the penned groups recorded for 43 days. The grazing groups were slowly rotated (about 10 days per paddock) on unequal areas. The areas were adjusted to give as close as possible equal time per paddock and to achieve the desired stubble heights. Similar pasture (tall fescue, white clover) was cut to the desired heights and fed twice daily to the pen-fed groups.

Four steers (2 per treatment) which had been grazing with their respective treatments were penned in digestibility crates and used for a 10-day digestibility trial.

Chemical analyses of the feeds and faeces were carried out by the methods of Foncesbeck and Harris (1970) and *in vitro* digestibility determinations (Tilley and Terry, 1963) were conducted over the same period as in the *in vivo* digestibility.

#### RESULTS AND DISCUSSION

##### LIVEWEIGHT GAIN AND INTAKES

Table 1 shows the actual stubble heights achieved and the DM residue per hectare. The actual stubble heights achieved were slightly above that set for the LSG group and slightly below for the LSP group. The average DM available for grazing was extremely high at 6 800 kg/ha. By the end of the grazing period the pasture was well beyond what would normally be considered good pasture.

TABLE 1: STUBBLE HEIGHT AND DRY MATTER RESIDUES AFTER CUTTING OR GRAZING

|                       |      |      |      |      | Low<br>Stubble | High<br>Stubble |
|-----------------------|------|------|------|------|----------------|-----------------|
| Stubble heights (cm): |      |      |      |      |                |                 |
| Grazing               | .... | .... | .... | .... | 11             | 20              |
| Cutting               | .... | .... | .... | .... | 7              | 20              |
| DM residue (kg/ha):   |      |      |      |      |                |                 |
| Grazing               | .... | .... | .... | .... | 1760           | 3000            |
| Cutting               | .... | .... | .... | .... | 1160           | 3080            |

Liveweight gain, intake and digestibility data are presented in Table 2. There was a significant difference between all groups in liveweight gain, although the difference between the two stubble heights was only 0.21 kg/day in both the grazing and penned groups. The DOM intakes of 3.50 and 4.56 kg/day for the LSP and HSP groups agree fairly well with those predicted (3.87 and 4.40 kg/day, respectively) from the figures for maintenance and liveweight gain recommended for pen-fed steers by Joyce *et al.* (1975). The difference in intake therefore explains the difference in liveweight gain between the pen-fed groups. These intakes were independent of feed availability. If availability had been an important consideration in contributing to the difference between the grazing groups, a larger difference in liveweight gain would have been anticipated. The higher overall gains of the grazing groups probably reflected both a higher in-

TABLE 2: LIVEWEIGHT GAIN, INTAKE AND DIGESTIBILITY OF PASTURE BY STEERS

|                                |      |      |      |      | Low<br>Stubble | High<br>Stubble |
|--------------------------------|------|------|------|------|----------------|-----------------|
| Liveweight gain (kg/day):      |      |      |      |      |                |                 |
| Grazing                        | .... | .... | .... | .... | 1.10           | 1.32            |
| Penned                         | .... | .... | .... | .... | 0.59           | 0.80            |
| Intake:                        |      |      |      |      |                |                 |
| DM/head/day (kg)               | .... | .... | .... | .... | 6.02           | 7.09            |
| DM/kg LW (g)                   | .... | .... | .... | .... | 206            | 236             |
| DOM kg                         | .... | .... | .... | .... | 3.50           | 4.56            |
| <i>In vivo</i> digestibility:  |      |      |      |      |                |                 |
| DM (%)                         | .... | .... | .... | .... | 63.6           | 71.4            |
| OM (%)                         | .... | .... | .... | .... | 71.8           | 73.2            |
| <i>In vitro</i> digestibility: |      |      |      |      |                |                 |
| DM (%)                         | .... | .... | .... | .... | 65.6           | 71.9            |

take due to greater selectivity by the animals than was possible in the pens and also the slightly higher stubble height of grazed versus cut low stubble (LS) pasture.

#### CHEMICAL COMPOSITION OF PASTURE AND FAECES

The chemical composition of the two pastures showed that LS pasture had a higher cell wall content with a higher insoluble ash content than high stubble (HS) pasture (Table 3). The most striking feature of the table is the exceptionally high faecal ash

TABLE 3: CHEMICAL COMPOSITION OF THE PASTURE FED TO AND FAECES FROM STEERS USED FOR DIGESTIBILITY MEASUREMENT

|                    | Low Stubble |        | High Stubble |        |
|--------------------|-------------|--------|--------------|--------|
|                    | Pasture     | Faeces | Pasture      | Faeces |
| Dry matter (%)     | 29.8        | 18.6   | 28.2         | 15.0   |
| As % DM:           |             |        |              |        |
| Cell wall          | 53.4        | 67.8   | 48.0         | 62.5   |
| Cellulose          | 22.4        | 13.7   | 22.0         | 20.0   |
| Hemicellulose      | 17.4        | 14.8   | 17.7         | 17.1   |
| Lignin             | 5.3         | 12.0   | 5.4          | 15.1   |
| Acid insoluble ash | 8.3         | 27.8   | 2.9          | 10.3   |
| Total ash          | 18.9        | 37.3   | 12.1         | 17.5   |

content of the animals on the LS pasture. This is the explanation of the large difference of 8% in DM digestibility between the HS and LS pasture being reduced to a much smaller difference in OM digestibility and is presumably the result of soil contamination, part of which could have occurred during harvesting.

#### SOIL INTAKES

If the faecal ash figures obtained in the present *in vitro* digestibility are applied to the relationship between faecal ash and faecal soil content established by Healy (1968) then intakes of 0.16 and 0.69 kg of soil/head/day can be calculated for the HSP and LSP groups. While there is a four-fold difference, the high intake does not approach that achieved by dairy cows (Healy, 1968) but presumably was sufficient to cause a reduction in DM intake through its effect on DM digestibility.

There does not appear to be any specific work examining the effect of soil ingested on voluntary intake, and this may well be another factor involved in reducing intake when stubble height is reduced. Drew (1967) showed that the intake of hoggets graz-

ing swedes was lower towards the end of a break, even though the percentage digestible energy did not fall. Healy and Drew (1968) subsequently showed that the soil intake of these hoggets was greatest towards the end of the swede breaks.

Unfortunately, it is not possible to estimate the soil intakes of the two grazing groups to ascertain whether a similar level of soil contamination was in fact responsible for the decline in intake in the LSG group. It is possible, during mechanical harvesting of the pasture, that additional soil contamination mainly by dust took place and that this was more severe in the LSP group. It is not possible to be confident that the decline in performance of the LSG group was in fact due mainly to a decrease in intake because of a lower DM digestibility, owing to the possible complication of soil contamination. The 3 000 kg DM/ha which remained after grazing for the HS group is well above that expected to restrict liveweight gain (Tayler, 1966) but the residue of 1 700 kg DM/ha for the LS is within the range considered by other workers to limit availability (Tayler, 1966) not less than 1 900 kg OM/ha, Wheeler *et al.* (1963) at 1 100 kg DM/ha.

### CONCLUSIONS

Owing to the possibility of soil contamination during harvesting of the pasture fed to the penned cattle in this trial, it is not possible to confirm that the similar decline in liveweight gain between the HS and LS groups in both the grazing and pen-fed groups is in fact due to a decline in DM digestibility and hence intake and not a consequence of feed availability.

However, it has raised the question of the possible significance of soil contamination on the performance of finishing steers grazing in the windier, drier areas of the country.

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