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MANAGEMENT EFFECTS ON PRODUCTIVITY OF SOUTHERN NORTH ISLAND HILL COUNTRY

D. A. GRANT*, M. G. LAMBERT and M. C. GUY
Grasslands Division, DSIR, Palmerston North

SUMMARY

A brief description of the Ballantrae hill country pasture management experiment is given. The major trends in system function and productivity 2½ years after the application of grazing management and fertilizer treatments are outlined, and their significance in relation to hill country farming is discussed.

INTRODUCTION

The steep slopes and variation in aspect found in hill country have a unique effect on the biological and management processes associated with its farming, and limit the application of research results derived from flat and downland sites. Despite this, and despite the fact that it represents 36% of New Zealand's pastoral resource, there is a critical lack of quantitative information on soil/pasture/animal interactions for farmed hill country.

This paper outlines a large-scale pasture management experiment in progress at Ballantrae, a hill country research station in the southern Ruahine range.

EXPERIMENTAL

The experiment was set up to examine the effects of three grazing managements and two fertilizer input regimes on legume vigour, and the function and level of productivity of the different pasture/animal systems as a whole. The treatments outlined in Tables 1 and 2 began in June 1975.

The animals within each treatment are used to give an integrated measure of treatment effects. Stock numbers per farmlet are adjusted in response to differences between farmlets in liveweight and feed on offer. The objective is to achieve full utilization of feed while maintaining stock in the various treatments at the same liveweight. The annual liveweight profiles for breeding stock suggested by Hight (1968) and Jagusch and Coop (1971) are used as targets. In practice stocking rate adjustments

*Present address: Kaweka Road, R.D. 6, Taihape.

over the spring period are difficult because of mothering problems so most adjustments occur from February through to August. Differential spring-early summer feed situations between treatments and years are catered for by adjusting weaning date and the time at which young stock and culls are removed. In favourable years additional dry cattle are brought in for clean-up grazing.

The experiment covers 100 ha, and wintered approximately 1000 stock units (s.u.) in 1977. It involves some 7 or 8 staff in its field operation and measurement.

The measurement programme involves detailed monitoring of soil, pasture and animal parameters.

Before the experiment began, the area was typical low-producing browntop/moss/flatweed dominant hill country. The area had not been topdressed in known history, Olsen P status being about 6 ppm and pH about 5. A mixture of white, red and subterranean clover (*Trifolium repens*, *T. pratense*, *T. subterraneum*) and *Lotus pedunculatus* was oversown in autumn 1974 and two 250 kg/ha applications of superphosphate made in 1973-4. Stock carrying capacity in June 1975 was 6 to 7 s.u./ha.

TRENDS

To date the main treatment effect in this experiment has been in response to the high fertilizer regime, although stocking rate on the low fertilizer farmlets has risen to approximately 9.4 s.u./ha (winter 1977). The high fertilizer farmlets in 1977 wintered about 11.6 s.u./ha and are still on an upward trend as indicated by current higher bodyweights and greater quantities of feed on offer. Pasture production from frame enclosures for the year ending August 1977 was about 50% higher under the high fertilizer regime (Table 3).

Grazing management has had little effect on stocking rate or pasture production. It appears that animal performance has been more difficult to maintain under rotational sheep grazing systems than with conventional management units operating at similar levels. However, this has to be confirmed by a thorough analysis of the data.

Botanical composition has responded to both fertilizer regime and grazing management. The high fertilizer regimes have increased ryegrass and white clover growth overall but with a strong management interaction. Rotational grazing with cattle favoured white clover production and reduced the production of low-fertility-tolerant grasses, such as browntop (*Agrostis*

TABLE 1: FERTILIZER TREATMENTS (1975-78 total, kg/ha)

| <i>Regime</i> | <i>Superphosphate</i> | <i>Lime</i> | <i>Nitrogen</i> | <i>Mo</i> | <i>Farmlets</i> |
|---------------|-----------------------|-------------|-----------------|-----------|-----------------|
| High | 2255 | 1250 | 20 | trace | 5 |
| Low | 375 | 0 | 0 | trace | 5 |

TABLE 2: GRAZING MANAGEMENT TREATMENTS

| <i>Treatment</i> | <i>Description</i> | <i>Farmlets</i> |
|------------------|--|-----------------|
| Typical | Romney ewes + 10% s.u. dry cattle. Set-stocked Jun.-Feb. Block grazed on 4-5 paddocks Feb.-Jun. | 6 |
| Rotate Sheep | Romney ewes + 10% s.u. dry cattle. Rotated mid-Oct.-mid-Aug. Shift 3 × per week. Rotation length 20 days spring, 60 days winter. Set-stocked lambing to docking. | 2 |
| Rotate Cattle | Angus cows. Rotated all year including calving. Shifted 3 × per week. Rotation length 30 days spring, 60-70 days winter. | 2 |

TABLE 3: THE EFFECTS OF FERTILIZER LEVEL ON PASTURE PRODUCTION, STOCKING RATE, ANIMAL LIVELWEIGHT, AND FEED ON OFFER

| | Low Fertilizer | High Fertilizer |
|---|----------------|-----------------|
| Pasture production (kg DM/ha) ¹ | 6200 | 9200 |
| Stocking rate ² | 9.4 | 11.6 |
| Mean liveweight (kg) ¹ : | | |
| Ewes | 51.4 | 52.4 |
| Cows | 404 | 416 |
| Feed on offer (kg DM/ha) ³ | 423 | 459 |

¹ Sep. 1976-Aug. 1977.

² s.u./ha assuming 1 breeding cow = 6 s.u. and 1 18-month steer = 4 s.u.

³ At July 1977.

tenuis), relative to comparable fertilizer regimes in the first 18 months of the trial. Under the high fertilizer regime, in the past 12 months white clover growth has been similar across grazing managements but under rotational cattle grazing there has been a considerable increase in perennial ryegrass growth.

SIGNIFICANCE

The response of poor hill country pasture to fertilizer is well known. Production levels obtained at Ballantrae are still well below the 14.8 s.u./ha optimum achieved by Suckling (1975) but ahead of the 8.2 s.u./effective ha average for North Island hard hill country (NZMWBS, 1977). The question remains as to the level of pasture production and stocking rate at which the high input treatments will stabilize, what topdressing is required to maintain such production, and what the economics of such inputs are as compared with the low input system.

The increase in carrying capacity on the low fertilizer farmlets over and above the pre-trial baseline of 6 to 7 s.u./ha is probably partly due to further small inputs of superphosphate and addition of Mo, but in large measure to more complete utilization of feed grown through closer subdivision.

Of particular interest is the pasture renovation effect demonstrated by rotational cattle grazing. Coupled where necessary with oversowing of improved pasture species and correction of nutrient limitations, such a system may enable ryegrass/white clover pasture to become more widespread on unploughable hill country with advantages in maintenance of feed quality in late spring-summer, and better seasonal distribution of feed supplies

relative to browntop-dominant swards (Lancashire and Ulyatt, 1974; Harris *et al.*, 1973). However, to date no obvious increases in stocking rate or pasture production have accrued to this treatment at Ballantrae.

In considering pasture renovation through grazing management, the Ballantrae trial provides little information on grazing pressure effects and none on seasonal interactions. Similar results to those measured over 2½ years of rotational cattle grazing at Ballantrae may possibly be achieved in one winter season of strip grazing on autumn-saved pasture. Such responses have been demonstrated under dairy farming situations in Taranaki (Parker and Willis, 1973). One could imagine the use of such a system on unploughable hill country, a block being treated each winter, and a circuit of the farm completed in, say, 10 years. Perhaps the lack of change in pasture composition under rotational sheep grazing at Ballantrae is a result of maximum grazing pressures not exceeding 300 s.u./ha to date.

The place of N fertilizer in stimulating changes in pasture composition and maintaining it over future years also requires investigation.

The most controversial aspect of the results, in the light of the current upsurge in interest in rotational grazing on hill country, is the lack of response so far to rotational grazing with sheep in terms of pasture production, botanical composition changes, stock performance and carrying capacity when compared with typical management. Since advantages for rotational grazing reported in the literature seem to be demonstrated mainly at high stocking rates, the apparent lack of response at Ballantrae may reflect the relatively low stocking rate. The lack of response to rotational grazing may also reflect full utilization of feed in all treatments. There is no carryover of rank, low quality, browntop-dominant herbage into the winter on set-stocked treatments. Pastures are maintaining fresh growth over their whole area under all managements. As higher stocking rates are achieved in response to soil fertility build-up, and if improved grasses with higher winter growth potential become more dominant in the pastures, significant advantages from rotationally grazed sheep may be recorded at Ballantrae.

These results are tentative and based on 2½ years' measurement of changes which are still in progress. If over the next few years some of the principles involved are established, a contribution will have been made to the understanding of pasture and animal production on unploughable hill country.

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