GRASS SPECIES, FODDER CONSERVATION AND STOCKING RATE EFFECTS ON NITROGEN FERTILIZED SUB-TROPICAL PASTURES.

R.J. JONES*

Summary

Two pastures, one of Nandi setaria and the other of Samford rhodes grass, each fertilized annually with 336 kg N/ha and grazed continuously by cattle at two stocking rates (3.75 and 5.0 beast/ha after the first year), were compared under two management systems for four years.

The control system had no supplements of any kind. In a conservation treatment excess summer forage was made into hay and fed back in the dry winter season. Neither the grass species treatments nor the stocking rate significantly influenced LWG/ha. Mean gains for the control and conservation treatments were 489 and 556 kg/ha/annum. However, an interaction of Block x System resulted from an absence of response to conservation on the hill slope and a 22% response to conservation on the more frost susceptible alluvial terrace.

I. INTRODUCTION

Large increases in the yield of tropical grasses have resulted from the use of nitrogen fertilizer at the C.S.I.R.O. Samford Pasture Research Station (Henzell 1963). Much of the extra production, however, occurs in the summer wet season. The object of the work reported here was to measure animal production from the most promising grasses evaluated in earlier small sward experiments and to assess the value of conserving some of the summer flush of grass and feeding it back in the winter dry season.

II. MATERIALS AND METHODS

The experiment was located on the C.S.I.R.O. Pasture Research Station, Samford (lat. 27° 22'S, long. 152° 53'E, altitude 50 m, annual rainfall 1150 mm) in the two blocks: A, a hill slope of about 3% on red and yellow podzolic soils developed on metamorphic rocks, and B, a level secondary terrace on gleyed podzolic and prairie-like soils developed on Samford Creek alluvium (Thompson and Murtha 1960).

The areas had been cleared from woodland for many years and carried a natural pasture of blue couch (Digitaria didactyla), carpet grass (Axonopus spp.), paspalum (Paspalum dilatatum) and some rhodes grass (Chloris gayana). The land was ploughed, fertilized and sown to the improved pastures as described earlier (Jones 1966).

The experiment was a 2^3 factorial of grass species, stocking rates and management systems. The grass species compared were Setaria anceps cv. Nandi and Chloris gayana cv. Samford, the stocking rates were a moderate and a high rate see below and the management systems were a control and a conservation system in which excess summer feed was conserved and fed back in the same paddocks in the winter dry season.

Pasture area was varied to obtain the stocking rate treatments. For

* C.S.I.R.O., Division of Tropical Agronomy, Townsville, Qld. 4810.
the first year 1962-63, two animals per paddock were used to give stocking
rates of 2.50 and 3.33 beasts/ha. In the following three years three
animals per paddock were used to give stocking rates of 3.75 and 5.0
beasts/ha.

The pasture management adopted before this experiment began in
November 1962 has already been described (Jones 1966). Subsequently the
paddocks received annually 250 kg superphosphate and 125 kg KCl/ha in
spring and 336 kg N/ha as urea in four equal applications.

The pastures were grazed continuously at the predetermined stocking
rates except for a period of six months on Block A when one of the three
animals was removed during the drought in 1965. Hay was made in the
conserved paddocks without subdivisinal fencing and without removing the
stock. The excess feed was mown, cured and baled in the paddock and then
stored in a barn until fed in troughs in the paddocks during the
following winter. Hay was cut on 16 Dec. and 12 Mar., 22 Feb., 11 Jan.,
and 4 Apr. for the four years. After the first year, all the hay made was
fed. Cattle were changed annually in November/December and replaced by a
new group of Hereford yearlings. Animals were weighed fortnightly or
monthly; ticks and intestinal parasites were controlled. The experiment
was terminated in January 1967 after 50 months of grazing.

III. RESULTS

(a) Animal gains

Mean results for the four years showed that no treatment interactions
were significant ($P>0.05$), but there was a significant Block x System
interaction ($P<0.05$) which necessitated an adjustment to the error mean
square in the analysis of variance.

Stocking rate had the greatest effect on gains/animal (26.7% higher
at the moderate stocking rate) but had no significant effect on gains/ha
(Table 1). Conservation and subsequent feeding back improved mean gains/
animal by 12.3% and mean gains/ha by 13.6%. There was no difference
between the grasses, in animal production (Table 1).

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>GRASSES</th>
<th>STOCKING RATES</th>
<th>SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setaria</td>
<td>135 (529)</td>
<td>Moderate 149 (511) Control 126 (489)</td>
</tr>
<tr>
<td>Rhodes</td>
<td>132 (516)</td>
<td>High 118 (535) Conservation 141 (556)</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

The Block x System interaction arose from the absence of response to
conservation on Block A and a marked effect of conservation on animal
gain of over 20% on Block B (Table 2). Overall the gains on Block B were
greater than on Block A but gains/ha on conserved treatments were 42%
greater compared with a difference of only 15% for the control treatments
(Table 2).

On both blocks the control animals gained at a faster rate than the
animals on the conserved treatments until July and the commencement of
hay feeding. Thereafter the controls lost weight for a period of three
months (Block A) or 4 months (Block B) before gaining weight again in
late spring and early summer. Animals fed hay in winter maintained...
weight or gained slightly and their spring and early summer gain was similar to the controls (Figure 1).

Response to conservation over the four years was -12.2%, +49.1%, +10.5% and +9.4%. Only the response in the second year was significant ($P < 0.01$).

(b) Hay yields

Stocking rate had the major effect on hay yields. Mean yields for the moderate and high stocking rates were 3.09 and 1.84t/ha/yr ($P < 0.05$). The grass effect and the grass x stocking rate interaction were not significant. Mean hay yields were 1.17t/ha/yr higher on Block B, than on Block A. Hays averaged 1.46% N, 0.23% P and 1.61% N, 0.26% P for the setaria and rhodes respectively.
IV. DISCUSSION

The stocking rates used in the experiment appeared to span the 'optimum' since the gains/ha were similar at the two stocking rates. Predictions of the optimum stocking rate and maximum gain/ha were 4.88 beasts/ha and 590 kg/ha respectively (Jones and Sandland 1974). The gain/ha on the control treatment in Block A of 456 kg is very similar to that of 486 kg obtained with Nandi setaria on a similar site, fertilized in the same way and stocked at 5 beasts/ha (Jones 1974).

The similar animal performance from grasses which differed in habit, heading time, numbers of seed heads produced and feed intake in pens with sheep (R. Milford, personal communication) was interesting. The somewhat higher yields of pasture with setaria (about 10%) may have compensated for any difference in quality in favour of rhodes grass.

Clearly the benefit of conservation was determined by the year and the site. The very large response to conservation in the winter of 1963 was associated with early heavy frosts and heavy winter rain which caused the standing herbage to deteriorate rapidly. Under these conditions steers lost weight at a rate of 0.4 kg/day for about 100 days but all survived. Severe frosts on the alluvial flat not only killed the standing herbage, but also delayed growth each spring. As a result, control animals on the potentially higher yielding site lost weight rapidly and for a longer period than those on the hill slope. In addition, the higher hay yields on this site served to increase the differences between management systems.

Since the economics of producing beef from these pastures is marginal even with normal beef prices, it is unlikely that increased productivity of 24% due to conservation on the flat would lead to the adoption of this practice. It is also unlikely that nitrogen will be used for beef production when an alternative pasture based on Trifolium semipilosum cv. Safari can produce 466 kg LWG/ha/yr (194 kg/animal) without inputs of fertilizer nitrogen (Jones and Jones 1975).

V. ACKNOWLEDGEMENTS

A generous grant by I.C.I.A.N.Z. for studies on the utilization of nitrogen fertilized improved pastures for beef production is gratefully acknowledged. I thank also Mr. R.B. Waite and Mr. C.G. McDowall for technical assistance and Mr. K.P. Haydock C.S.I.R.O. Division of Mathematics and Statistics for statistical help.

VI. REFERENCES


