UTILIZATION OF SOWN PASTURES FOR BEEF PRODUCTION IN CENTRAL QUEENSLAND

M. K. WEGENER*, T. H. RUDDER* and B. G. MAYER†

Summary
Relationships between annual rainfall, stocking rate and beef production per unit area were used to assess likely productivity of sown pastures on Central Queensland brigalow soils. By allowing for probabilities of rainfall occurrence at three locations in the region, long-term average gross margins were estimated for two management strategies—(a) varying stocking rates according to seasonal conditions, and (b) constant stocking rates with hand feeding to meet feed deficiencies. Varying stocking rates which was employed by graziers was slightly more profitable.

I. INTRODUCTION
Wide variations in productivity have been observed for Rhodes grass (*Chloris gayana*), buffel grass (*Cenchrus ciliaris*) and green panic (*Panicum maximum* var *trichoglume*) pastures sown into the ash of Brigalow (*Acacia harpophylla*) scrub after clearing and burning. Anon (1963), Stubbs and Mayer (1966) and Round (1966) report that carcass production from these Central Queensland pastures ranged from 23.7 kg to 88.6 kg/ha (21.1 lb to 79.0 lb/acre). Stocking rates varied from 0.25 beasts to 1 beast/ha (0.1 to 0.4 beasts/acre).

Coaldrake and Smith (1967) obtained yields of 132 kg/ha (118 lb/acre) on pastures sown into cultivated land and stocked at a rate of 1 beast/ha (0.4 beasts/acre).

It is difficult to estimate likely profitability of sown pastures from the published data. In this paper, an attempt is made to quantify the relationships between beef production, stocking rates and rainfall as a basis for predicting economic returns from steers grazing sown pastures in the Central Queensland brigalow region.

II. METHODS
Weight changes and stocking rates of steers grazing sown pastures at Marlborough (Stubbs and Mayer 1966; Rudder and Mayer, unpublished data) were combined with data reported by Round (1966) and from the Brigalow Research

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Station, Theodore (Rynne, unpublished data), to give estimates of beef production at different stocking rates. Results from these experiments were used only when they could be related to rainfall records.

Least-squares regression techniques were used to relate stocking rate to beef production per animal and per unit area, and to rainfall. In relating stocking rate to rainfall, data from experiments where stocking rates were pre-determined without reference to seasonal conditions were excluded.

Annual gross margins (gross income — direct variable costs) were estimated for each stocking rate assuming a price per kg dressed weight of $0.51 ($23.00/100 lb). Variable costs per beast included labour $0.37, dipping $0.40, tick fever vaccine $0.20, commission on sales $4.20, transport $6.00 and other selling costs $0.83.

Rainfall probabilities were calculated from data for the Banana, Emerald and Nebo rainfall recording centres (Anon 1967). This allowed estimation of long term annual gross margins for two alternative strategies of pasture utilization —

(a) Varying stocking rate between years according to the relationship between stocking rate and rainfall.

(b) Constant stocking rate with provision for hand-feeding to enable normal marketing during years of inadequate rainfall. The highest gross margin, adjusted for feeding costs, consequently determined the optimum constant stocking rate. Feeding costs of $0.51/kg ($23.10/100 lb) dressed weight were derived from Arbuckle’s (1960) estimates, assuming hay and grain supplements cost $39.37/ton ($40/ton).

III. RESULTS

(a) Regression Equations

The regression equations relating beef production per beast (Bₜ), production per unit area (Bₕ) and rainfall (W) to stocking rate (S) were respectively:

\[ Bₜ = 85.11 + 9.56 S \]
\[ Bₕ = 39.69 - 7.60 S \]
\[ S = 4.47 - 0.002 W \]

\( R^2 = 0.384 \) \( \) \( (i) \)
\( R^2 = 0.885 \) \( \) \( (ii) \)
\( R^2 = 0.784 \) \( \) \( (iii) \)

Fisher’s test on R, the regression coefficient and F test for each equation were significant at the 0.05 per cent level. The variables Bₜ and Bₕ were measured in kg/beast and kg/ha respectively. S was measured as ha/beast and W was annual rainfall in mm.

Equation (i) indicates that 38.4 per cent of the variation in annual growth rate/beast could be attributed to change in stocking rate, while 88.5 per cent of the variation in production per acre was related to stocking rate change in equation (ii). Intensity of stocking varied directly with rainfall, that is, as rainfall increased area per beast was reduced.
Fig. 1.—Linear regression of annual beef production per unit area by stocking rate.

Corresponding equations in Imperial units (lb/beast, lb/ac, ac/beast and in.) were:

$$B_n = 187.64 - 8.53 S \quad (iv)$$
$$B_s = 87.50 - 6.78 S \quad (v)$$
$$S = 11.05 - 0.13 W \quad (vi)$$

The data and regression lines for equations (ii) and (iii) are illustrated graphically in Figures 1 and 2.

Fig. 2.—Linear regression of annual rainfall by stocking rate.
TABLE 1

*Derivation of gross margins and optimum constant stocking rate — Banana*

<table>
<thead>
<tr>
<th>Stocking Rate area/beast (ha)</th>
<th>Carcass Beef (kg/ha)</th>
<th>Beef (lb/ac)</th>
<th>Gross Margin ($/ha)</th>
<th>Gross Margin ($/ac)</th>
<th>Feeding Costs ($/ha)</th>
<th>Feeding Costs ($/ac)</th>
<th>Adjusted Gross Margin ($/ha)</th>
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(b) Gross Margins

Long term average annual gross margins with varying stocking rates were $16.68/ha ($6.75/ac) at Banana, $15.52/ha ($6.28/ac) at Emerald, and $17.67/ha ($7.15/ac) at Nebo.

Optimum constant stocking rates and corresponding average gross margins were:

- Banana 2.43 ha (6ac) /beast, Gross margin $16.36/ha ($6.62/ac)
- Emerald 2.83 ha (7ac) /beast, Gross margin $14.63/ha ($5.92/ac)
- Nebo 2.43 ha (6ac) /beast, Gross margin $16.70/ha ($6.76/ac)

Derivation of these values for the Banana location is illustrated in Table 1. Differences between strategies and locations in average annual gross margins did not reach statistical significance.

IV. DISCUSSION

Because of its low predictive value, the relationship between stocking rate and mean animal performance was not used for the subsequent estimates. The poor correlation in this case may be attributed to an industry policy of stocking at a rate which enables cattle to reach saleable condition at the normal marketing age. Extremely low or high stocking rates, in particular those levels which might result in depression of individual animal performance, were accordingly not represented in the data from commercial properties.

The high correlation between beef production per acre and stocking rate is consistent with the thesis of stocking so as to obtain relatively uniform performance per animal. The relationship between stocking rate and rainfall suggests that these graziers also varied stocking rate with forage supply.

Demonstration of the statistical significance of differences which may be real and of biological and economic significance is difficult in studies of this type. In view of this, the consistent advantage of varying stocking rates over constant stocking may be accepted as tentative evidence that varying stocking is the more profitable strategy. This inference is also supported by the apparently successful use of this procedure by producers.

In the absence of more reliable estimates, these relationships between rainfall, stocking rate and beef production per unit area may serve as guides to utilization methods for sown pastures and their profitability in the Central Queensland Brigalow area. For any particular application, adjustment may be necessary to include relevant values for prices and rainfall probabilities. It will also be apparent that only slight changes in the direction of higher beef and/or lower feed prices would be necessary for constant stocking with intermittent hand feeding to become more profitable than variable stocking.

V. ACKNOWLEDGMENTS

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VI. REFERENCES


