VARIATION IN GRASSLAND PRODUCTION IN THE NORTH ISLAND WITH PARTICULAR REFERENCE TO **TARANAKI**

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Abstract

Variation in levels of annual dry matter production is discussed for the North Island. On average most sites on flatland farms are capable of producing at least 9000 kg DM ha-r under fortnightly and 11000 kg DM ha-r under monthly cutting, These yields arc slightly lower than yields recorded on experimental farms.

Variation in seasonal patterns of pasture production is compared between districts. The major geographical effect on pasture growth is related to climate and the water holding capacity of the soil. Within district variation is considered in detail for Taranaki (Waimate West and Stratford). Pasture growth in spring is strongly correlated with daily maximum air temperature (r^2 = 0.73***) and accumulated heat units (> 6°C) for 10cm soil temperature (r^2 = 0.91 ***). Pasture growth rates were at least 25% higher in spring with a cutting interval of four weeks than with two weeks.

The use of rate of growth data from standardized MAF trials for feed budgeting purposes is discussed.

INTRODUCTION

A joint Agronomy Society-Animal Production Society symposium (1978) identified the seasonality of pasture production as a major constraint for animal production. To optimise pasture production, utilisation and ultimately animal production it is necessa.·y to have long term information on pasture production patterns, preferably under several levels of utilisation. Since summaries on seasonal distribution of pasture production were initiated (Radcliffe 1974), MAF has continued to expand the number of areas from which pasture measurements are regularly obtained by the same standard procedure to fill the demand for basic information on the pasture production potential of pasture land for different regions.

Estimates of expected pasture growth rates are useful for deciding on stocking rates, lambing, calving dates and feed budgeting. For many management decisions it is essential to consider variation in pasture growth rates, as large fluctuations occur between seasons of the year, between years and between areas.

This paper illustrates differences and similarities in seasonal growth patterns within the North Island and describes the influence of climate, soil and cutting interval on year to year variations in pasture production. The pastures under discussion are unirrigated ryegrass/ white clover pastures under rotational grazing with dairy cattle or sheep. The cutting technique has

TABLE 1: ANNUAL DRY MATTER YIELDS (kg ha-t) IN THE NORTH ISLAND.

	Sites	Soil Type	Period of Measurement	Mean	Range
	Northland				
I.	Kaiwa ka	Waikare Clay	1966-71	I 1480 (3w)*	9040-I 1780
2.	Kaikohe	Kiripaka Silt Loam	1968-72	10900 (3w)	9640-I 1400
3.	Kapiro	Okaihau Gravelly Friable Clay	1966-7 I	9970 (3w)	6360-I 1280
4.	Opuawhanga	Rangiroa Clay	1967-72	9400 (3w)	8180-I 1090
6.	Kaikohe	Awarua Clay	1966-7 I	8810 (3w)	6920-I 0080
6.	Kaikohe	Awarua Clay	1966-72	7010 (3w)	6670- 9120
7.	Kaiwaka	Wharekohe Silt Loam	1971-74	10640 (4w)	8500-I 1000
	North Auckland				
8.	Mangere	Ohaewai Bouldery Silt Loam	1971-77	10160 (2w)	8010-12000
9.	Waitakururu	Hauraki Peaty Clay	1974-77	I 1160 (2w)	11080-I 1930
				14530 (4w)	13730-15870
	Waikato				
10.	Cambridge	Horotiu Fine Sandy Loam	1978-80	9950 (17d)	9390-10500
1 I.	Gordonton	Te Kowhai Silt Loam	1978-80	9360 (14d)	9170- 9550
12.	Matamata	Waihou Fine Sandy Loam	1978-80	9650 (18d)	9480- 9820
13.	Waitoa	Waitoa Sandy Loam	1978-80	8930 (14d)	8450- 9400
14.	Tirau	Tirau Fine Sandy Loam	1978-80	10380 (14d)	9580-I 1180
15.	Ohaupo	Ohaupo Sandy Loam	1978-80	9150 (14d)	8040-10250
	Rotorua- Taupo Region				
16.	Wairakei (flats)	Atiamuri Sand	1964-7 I	5750 (2w)	4320- 7900
17.	Wairakei (hill)	Oruanui Sand	1964-7 1	9050 (2w)	6970-I 1050
18.	Wharepaina	Taupo Sandy Silt	1975-79	10060 (2w)	9040-I 1700
19.	Tikitere	Rotomahana Shallow Sandy Loam	1973-79	9040 (2w)	8000-I 1200

	Taranaki				
20.	Waimate West	Egmont Brown Loam	1973-80	10420 (2w)	8840-11600
21.	Stratford	Stratford Coarse Sandy Loam	1973-80	13120 (4w)	11270-14630
21.	Stratford	Stratford Coarse Sandy Loam	1973-80	9800 (2w)	8770-10830
				12120 (4w)	10950-13220
	Hawkes Bay				
22.	Takapau	Takapau Silt Loam	1974-80	10410 (2w)	8670-12050
				12840 (4w)	10900-14870
	Wairarapa				
23.	Masterton	Kokotau Silt Loam	1973-78	10730 (2w)	8560-12670
				11590 (4w)	10650-13350
24.	Masterton	Kokotau Silt Loam	1973-78	8570 (2w)	7940-9150
				10050 (4w)	9250-11040

* Cutting interval in days (d) or weeks (w).

been described by Lynch (1966) and Radcliffe (1974). No nitrogen was used in these trials.

RESULTS

ANNUAL PRODUCTION and VARIABILITY (Table 1)

The standard cutting technique and relatively uniform management of pastures in this series of trials allows annual production from scattered sites to be compared. On average most sites throughout the North Island are capable of producing at least 9000 kg DM ha^{-1} under fortnightlyand 11000 kg DM ha^{-1} under monthly cutting.

An equally important consideration of annual yield is its variation from year to year under similar management. This variation can be very large amounting to 10004000 kg DM ha^{-1} in year to year production.

MEAN SEASONAL PATTERNS OF PASTURE GROWTH

Fig. 1 illustrates the patterns of DM production with fortnightly and monthly cutting at a number of sites in the North Island. Fig. 2 shows a typical example of the difference in pattern of production with fortnightly and monthly cutting intervals (Waimate West).

The notable feature in spring is that the average production potential is remarkably similar throughout the North Island with monthly cutting. The difference between sites in growth rates from August to October, a period mostly without moisture stress, is of the order of IO-15 kg DM ha^{-1} day^{-1}.

From these data some generalisation can be made for average growth rates under the two cutting regimes over the spring period:

Production (by DM ha^{-1} day^{-1})

Cutting Intervals	Fortnightly	Monthly
August	20	25 (+25%)
September	40	55 (+37%)
October	55	70 (+27%)

The important point is that pasture growth rates are at least 25% higher in spring with a cutting interval of four weeks rather than two weeks with the largest differences when pasture growth rates are high.

The largest differences between sites occur in summer-autumn and are caused by regional differences in rainfall over this period.

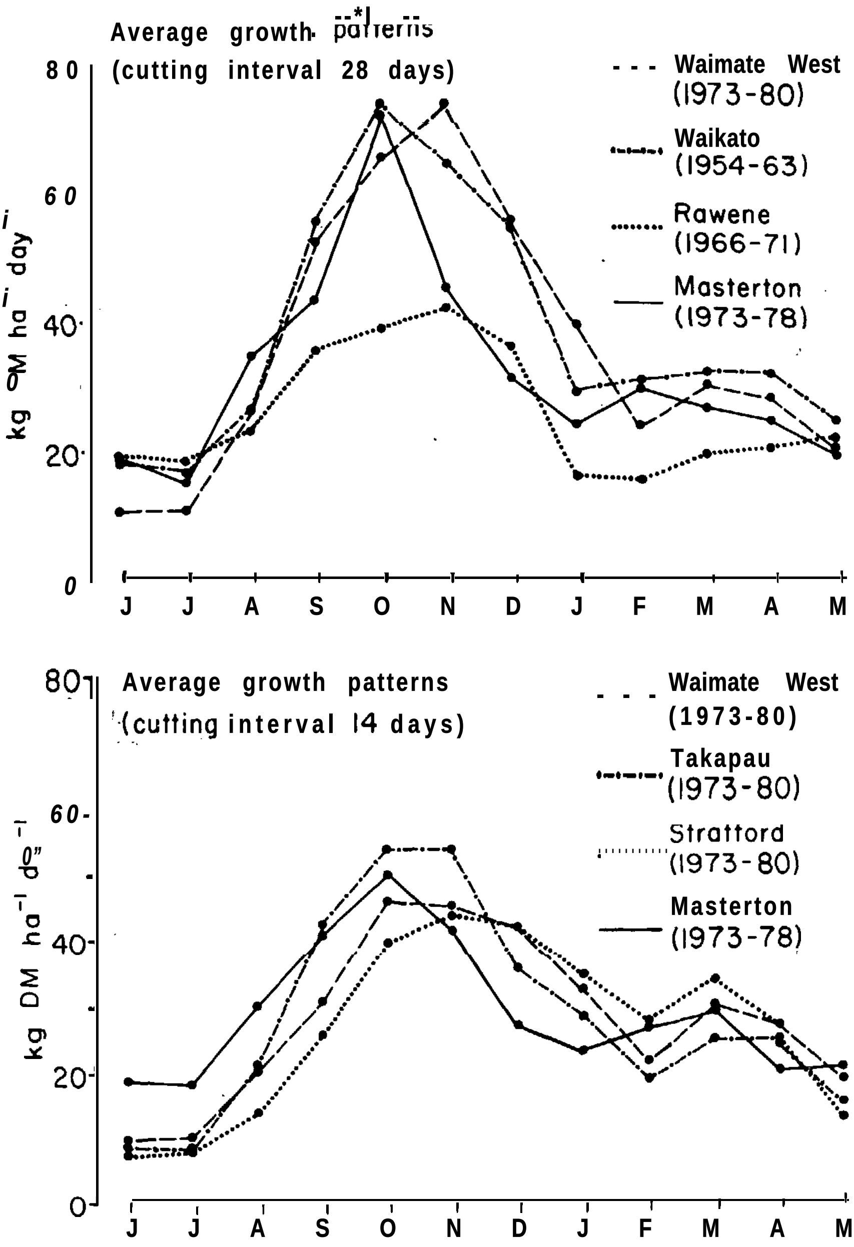

FIG. 1: *Seasonal distribution of pasture growth at a number of sites in the North Island.*

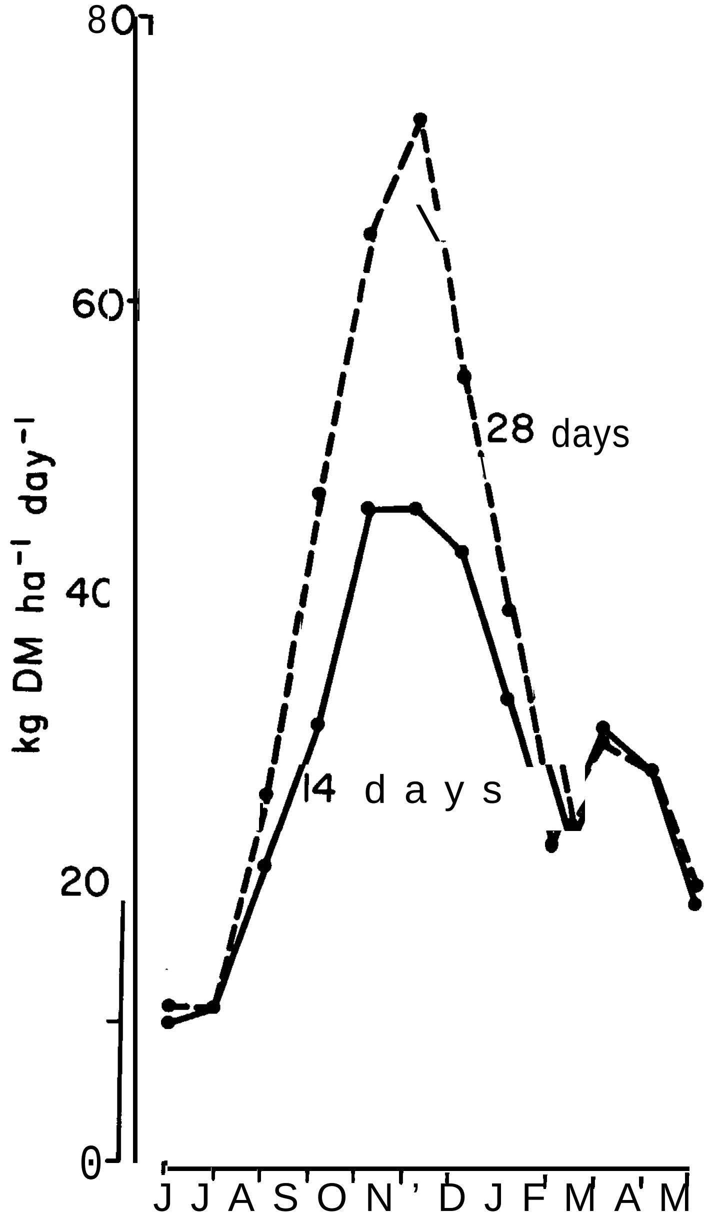

FIG. 2: *Seasonal distribution of pasture growrh with fortnight/y and monthly cutting at Waimate West. (1973-80).*

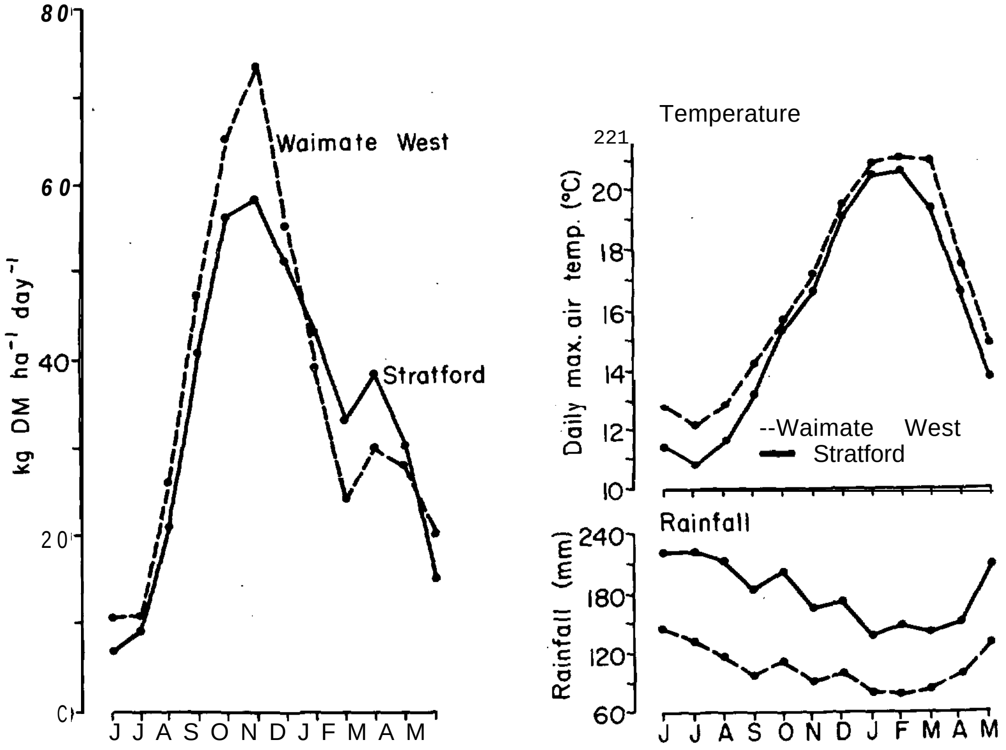

FIG. 3: Mean seasonal growth rates and long term rainfalland mean air temperatures (1941-70) at Stratford and Waimate West.

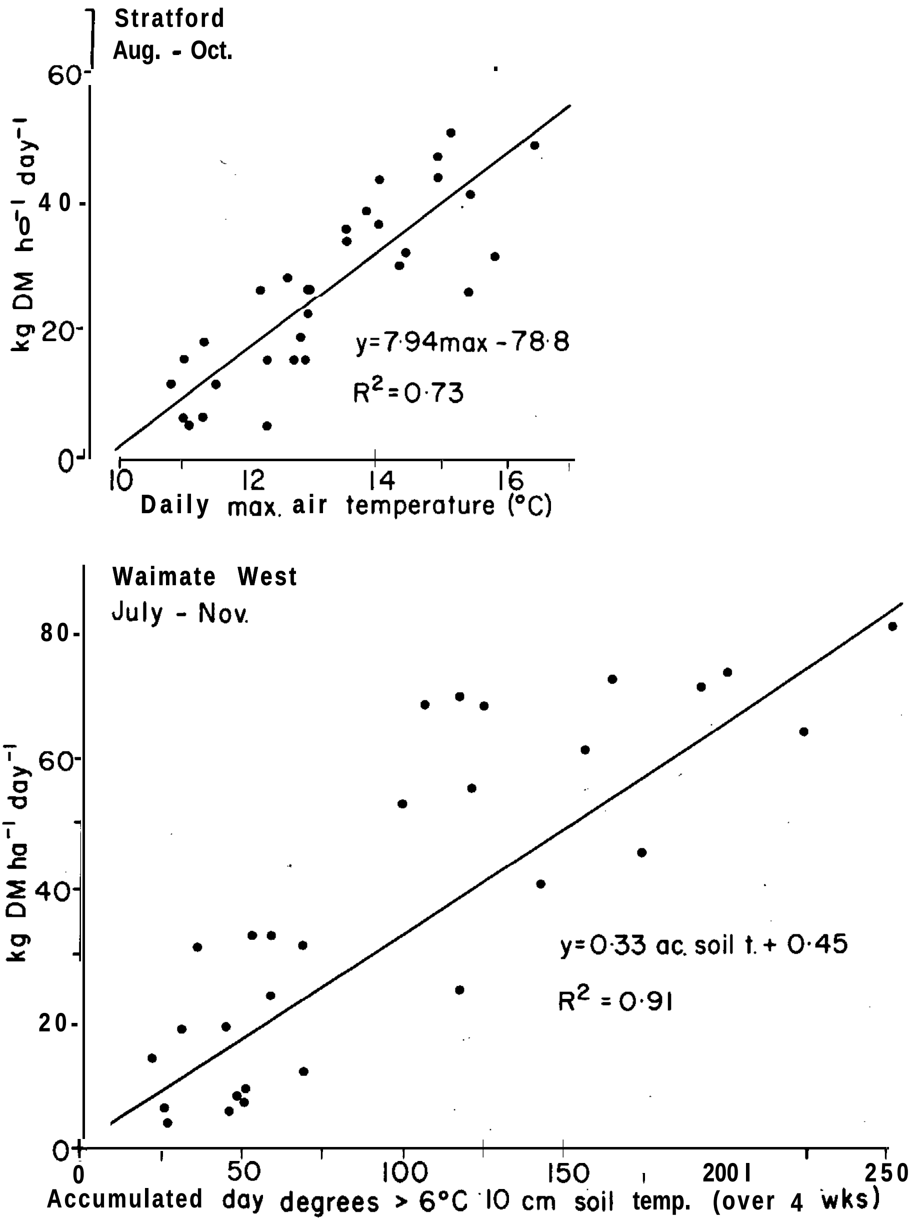

FIG. 4: *The effect of daily maximum air temperature and accumulated day degrees above 6” C IO cm soil temperature on pasture growth.*

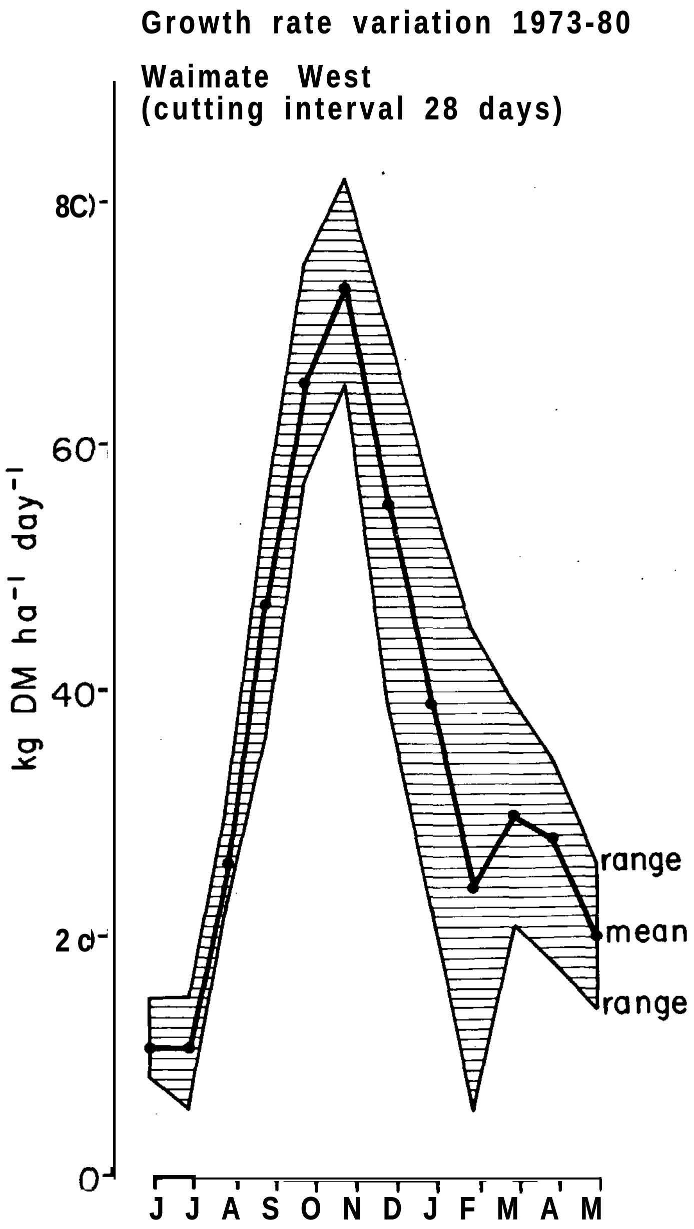

FIG. *5: Variation in seasonal growth rates at Waimate West.*

WITHIN DISTRICT VARIATION OF PATTERNS OF PASTURE GROWTH IN TRRANAKI

The difference in seasonal patterns of pasture production at Waimate West (98 m a.s.l.) and Stratford (31 I m a.s.l.) is related to climatic differences associated with altitude (Fig. 3). While higher year round temperatures accounted for greater winter and spring growth at Waimate West better rainfall resulted in higher summer and autumn production at Stratford. As part of a more comprehensive study aimed at establishing potential herbage production levels throughout New Zealand in relation to radiation, temperature and moisture availability, regression analyses were carried out on these data in order to determine which environmental factors are responsible for year to year variations in DM production at different times of the year. Typical examples illustrating the major influence of climate on growth rates are shown in Fig. 4. Here 73% of the variation in spring growth rates can be explained by daily maximum air temperature in the screen (at 1.2 m above ground level). A change of 1 °C in daily maximum air temperature results in a change of 8 kg DM ha-'day-1 in growth rates. With a longer spelling interval, growth rates ranging from 10 kg DM ha-'day-1 in July to 70 kg DM ha-¹ day-' in November are strongly correlated with accumulated day degrees above 6" C 10cm soil temperature. This weather parameter is strongly correlated with solar radiation.

The variation in growth rates at Waimate West due to climate is shown in Fig. 5. A comparison of this figure with Fig. 2 shows that the effect of cutting interval on growth rates was larger than climatic 'effects over the July-November period. There was high variability in growth rates from December to March arising from moisture stress. The largest variation was recorded in February when growth rates varied from 10 kg DM ha-¹ to 40 kg DM ha-¹ day-l.

DISCUSSION

The paper particularly highlights the fact that year to year and site variation in pasture growth can be very large. Thus planning at individual farm level must take full account of this variation and obviously targets cannot always be fully achieved. Average annual production however, falls within a fairly narrow range. Lower annual production can be related to soils with lower water holding capacity (e.g. Atiamuri sand: Baars et al., 1975, McQueen and Baars, 1980) or nitrogen deficiency, as illustrated by the low growth rates at Rawene (Fig. 1). Piggot (1977) recorded an increase of 40% in annual dry matter production of 10640 kg DM ha-r following application of 360 kg N/ha in split dressings on a Waikare clay at Kaiwaka in Northland.

The highest yields of up to 14500 kg DM/ha have been recorded under monthly cutting where pasture was probably not always at a suitable length to make optimum utilisation of the available light. These levels of annual production are still below the ceilings (17-18000 kg DM ha-¹ annum) which can be reached by intensively designed pasture management systems (Jagusch et al., 1978, Baars et *a/.,* 1981).

Campbell (1979) in support of his claim that most South Auckland dairy farms are understocked estimated that in most of the South Auckland area the dry matter production must lie between 11000 and 14000 kg DM ha-i and is therefore capable of supporting at least 3.5 milking cows ha-i. It is often stated that DM production on the experimental farms at Ruakura is higher than on commercial farms. The presented data show that production levels are only slightly lower than Campbell's estimates. South Auckland figures are in fact probably conservative because it has been shown by Hutton (1973, 1976) that production figures of 16-l 7000 kg DM/ ha can be obtained from swards with a high paspalum content.

The size of the difference between growth patterns at Stratford and Waimate West in Taranaki emphasizes the importance of local weather conditions on growth rates. Most of the variation in pasture growth can be explained by.the weather. Differences between seasonal pasture production patterns were larger with fortnightly cutting, showing the more pronounced effect of weather variables on shorter swards. The size of response in growth rates to daily maximum air temperature and day degrees above 6°C for 10 cm soil temperature of sites in Taranaki are similar to those recorded for ryegrass dominant pastures in the Waikato (Baars and Waller 1979).

The agronomic data in this paper suggest that longer rotation than 10-12 days, as commonly employed on many Waikato dairy farms would result in earlier and higher spring production.

Decisions in farm management on the basis of average rates of growth are quite normal and appropriate for a first appraisal of seasonal effects. However, the pasture growth rates which can be supplied by MAF are site specific and adjustments have to be made for climatic conditions. We now have more quantitative information on which climate parameters have most influence on pasture production throughout New Zealand (Baars and Waller 1979, Radcliffe, 1980). This information can be used to make growth rate adjustments or for calculations of expected pasture growth rates. On an individual farm basis it would be desirable to make regular estimates of the feed supply for direct comparison with past years and/ or to construct growth curves for the best and poorer paddocks. Systems of visual assessment could be used to good advantage. Use of these procedures would lead to more rational decisions in farm management.

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