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AN EXAMINATION OF MANAGERIAL PRACTICES ON A HIGH PRODUCING DAIRY FARM IN RELATION TO EXPERIMENTAL RESULTS

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SUMMARY

The pasture management practices of a high producing commercial dairy farm are examined in the light of experimental evidence on the efficacy of the practices. The factors considered to be primarily responsible for the high level of production are: first, the very high level of pasture growth and relatively good seasonal distribution of this growth; secondly, the very high stocking rate, ensuring good pasture utilization associated with a low level of conservation. However, farm experience suggests that a lower stocking rate/high conservation system can result in similar animal output.

INTRODUCTION

A feature of dairy production is the wide variation in the level of production achieved by individual farmers. Some farmers achieve twice the regional average production per hectare. Various factors to account for high production obtained on individual farms have been proposed by Campbell *et al.* (1977), Hutton (1977), and others.

One such farm is that of B. N. Davis at Ngarua, where production has been over 500 kg milk fat/ha in several years. This has been achieved without undue cost. This paper attempts to define factors in production, management and utilization of pasture that could be responsible for this success. Milking and other stock husbandry operations were always carried out carefully, but their possible effects on production are not discussed. The herd has been artificially bred for a number of generations.

THE FARM AND FARMING PRACTICES

PHYSICAL AND CLIMATIC FEATURES

The farm is a family property of 62 ha which B. N. Davis started sharemilking on in 1954 and purchased in 1961. At this

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time 120 cows produced about 18.600 kg milk fat. Some important features of management and performance in recent years are summarized in Table 1, contrasted where possible with that on other farms in the Auckland region (Clifford, 1967; Hutton, 1977; N.Z.D.B., 1971-6).

The contour of the property is flat, and the soils, though subject to some surface flooding, are reasonably free draining and are well serviced by open drains. No regrassing has been done in the past 20 years and the pastures are dense and vigorous with white clover and ryegrass as major components.

Rainfall has ranged from 966 to 1273 mm/year, and adequate amounts fall in all seasons apart from the variable summer period (January-March, 133 to 391 mm in the 1972-8 period).

FERTILIZER AND STOCKING RATES

Fertilizer was applied at the rate of 750 to 1000 kg 30% potassic super/ha from 1971 to 1976, but was reduced to 500 kg/ha in 1977 and 1978 because soil test values had been in the range 32 to 73 for P, 6 to 16 for K, and 7 to 19 for Mg. Seventy tonnes of lime were spread in 1972 and 50 t in 1977 when the pH and Ca levels were 5.7 to 6.2 and 10 to 16, respectively.

Stocking rates (cows/total area) have been very much higher than those on the South Auckland farms (cows/effective area) and clearly above the rates recorded for high-producing farms by Clifford (1967) and Hutton (1977) (Table 1). The objective in running such numbers has been to utilize most of the pasture at a young stage of growth.

LEVEL OF CONSERVATION, WINTER FEEDING AND PASTURE MANAGEMENT

Because of the high rate of stocking, the relatively small amounts of surplus feed available, the desire to have pasture con-

TABLE 1: FEATURES OF MANAGEMENT AND PERFORMANCE IN THE PERIOD 1971-2/1977-8 CONTRASTED WITH SURVEYS OF OTHER AUCKLAND FARMS

	<i>Davis</i>	<i>Clifford</i> (1967)	<i>Hutton</i> (1977)	<i>NZDB</i> (1971-6)
Milking cows/ha	3.06-3.95	2.80	3.00-3.06	2.03-2.06
Milk fat/cow (kg)	147-166	161-164	157-163	123-145
Milk fat/ha (kg)	470-600	430-450	469-485	254-306
Hay conserved/cow (bales)	2-13	23	10-29	

sumed directly, and the experience gained that only small amounts of supplements are needed in the winter, conservation levels have been low by normal standards and by those on the farms surveyed by Clifford (1967) and Hutton (1977) (Table 1).

The objective of winter management is to treat pastures so that they will grow at maximum rates in the spring as well as in the winter. The management aims to leave plants in a growing state at all times. To avoid pugging in wet weather, cows are shifted up to three times a day; a back fence is used continuously and overgrazing avoided; vehicles are not driven on regrowth. Day-to-day management has to be flexible, and pastures have to be regularly inspected to assess rates of regrowth. If the growth rate is slow, supplements are used to allow the rotation to be slowed down while ensuring adequate nutrition. Nitrogenous fertilizers may also be applied.

In practice the winter rotation, usually starting in early June, varies from 40 to 60 days according to climatic conditions. The factors of overriding importance are plant growth rate and utilization levels.

SPRING AND SUMMER PASTURE MANAGEMENT

A basic 20-25 day rotation on 24 hours/paddock is used. The aim is to fully feed the herd on highly digestible pasture and to leave the plants in a state which allows maximum growth rates.

Two types of topping are practised. The "main top" is to eliminate the older decaying tissue at the base of the pastures, and to achieve this a rotary slasher is set low, *i.e.*, at hay mowing height. This main top accounts for the first surplus seen in spring, a surplus which is regarded as often being short-lived.

The later toppings are designed to eliminate seed heads and to attempt to keep plants in a growing state. For these the mower is set so as to just remove the seed heads.

The main topping starts in September-October and the process continues throughout the season until strong vegetative growth is obtained, often in the autumn.

LENGTH OF LACTATION

This is governed solely by cow condition. Feed supply does not influence drying-off date at all. If there is grass available it is used to produce milk fat provided cow condition is adequate. Autumn pasture is not rationed and the 20-25 day rotation is maintained until drying off. The electric fence is then used to start the winter rotation.

EXPERIMENTAL EVIDENCE RELATING TO MANAGEMENT PROCEDURES

PASTURE PRODUCTION AND UTILIZATION

Although no information on pasture production is available, the fertility, rainfall, pasture appearance and pasture recovery data (Table 4) all indicate that the quantity of pasture grown/ha on this property is relatively very high, giving the potential for very high yields of milk and milk constituents.

The stocking rate of 3.9 cows/ha is high relative to experimental as well as commercial farm standards, and in view of the results of these experimental comparisons (Table 2) it is probable that the number of cows carried has been sufficient to ensure high feed utilization and high milk fat/ha.

At such a stocking rate, individual cow feeding will be restricted for times throughout the year. That this has been so is reflected in the moderate milk-fat output per cow (147 to 166 kg) and the relatively light condition of 4.0-4.5 grade for the majority of dry cows in mid-August, 1978. However, the extended drought of 1978 accentuated late-winter feeding problems in that year and probably adversely affected cow condition.

LEVEL OF CONSERVATION

The alternatives of conserving large or smaller quantities of spring pasture have been examined by Young (cited by Campbell and Clayton, 1966) with dairy cows, Reardon (1971) and Taylor and Scales (1978) with fattening beef animals, and at Winchmore (Hayman, 1978) and in Australia (Hutchinson, 1973; Egan *et al.*, 1977) with sheep. The results with cattle were all similar, in that greater winter but lower spring gains or milk production were obtained on the farmlets on which more conservation had taken place. Total yearly production was slightly lower at the higher conservation level. Similar results were obtained with sheep at Winchmore and in the Australian work. Conservation had little effect at low stocking rates, was of benefit at moderate stocking rates, and markedly reduced production at high rates of stocking.

At the rate of stocking employed on this farm, the low conservation system is, on available evidence, the most suitable. However, milk-fat outputs of over 600 kg/ha have been obtained on other commercial farms using a lower stocking rate (about 3.2 cows/ha) and a high conservation system, and experimental

TABLE 2: STOCKING RATE AND MILK FAT/HA (kg)

Location and Duration of Trials	Stocking Rate (cows/grazed ha)														Other Treatments
	2.2	2.3	2.4	2.5	2.8	2.9	3.0	3.2	3.7	3.8	4.1	4.2	4.9	5.6	
Waimate West ¹ 3 years				383						513					No potassic fertilizer Potassic fertilizer (250 kg K/ha)
				393						557					Low phosphate (500 kg P/ha)
Waimate West ¹ 4 years								464					573		High phosphate (1000 kg P/ha)
								469					587		No nitrogen
Massey Univ. ² 1 year								475				525			No nitrogen
									530			530			Nitrogen (794 kg/ha)
Ruakura ³ 2 years		441			502							564	680		Controlled grazing (1st two years)
			472						534						Controlled grazing (2nd two years)
	405					472									Uncontrolled grazing (1st two years)
		420					427								Uncontrolled grazing (2nd two years)
Ruakura ⁴ 3 years				332							462				
Ruakura ⁵ 2 years										513	524				12-day rotation
										482	527				24-day rotation
Ruakura ⁶ 3 years										490	546				Non-irrigated
											621		660		Irrigated

Reference notes:

¹ MAF Soil and Field Res. Org. Repts.

² Holmes and Wheeler (1973).

³ McMeekan and Walshe (1963).

⁴ Hancock (1954).

⁵ Bryant and Parker (1971).

⁶ Hutton (1975).

work is needed to define optimum stocking rates and conservation levels.

GRAZING MANAGEMENT

The basic 20-25 day, spring-summer-autumn rotation used is likely to be as effective as a shorter rotation length (Bryant and Parker, 1971), and in association with limited and relatively early conservation, and extensive topping, results in large quantities of fodder of high digestibility being available at each grazing until moisture deficits severely affect growth.

Very little is known of the effects of frequency and intensity of autumn-winter grazing on pasture production. The oft-quoted result of Brougham (1956) in which pasture grazed three times produced about 70% more dry matter than one grazed after 18 weeks of spelling is just an estimate of production based on an autumn-date-of-closure trial using a 1-year-old pasture sown to Manawa ryegrass and clovers.

In studies where frequencies of defoliations in winter were compared, Scott (1973) obtained no increase in dry matter production from two vs. one defoliation, but significant increases of 23 and 21%, respectively, from three vs. one and three vs. two defoliations. The maximum difference was 380 kg dry matter/ha accumulating over the total period 15 March to 19 July.

However, in a nitrogen application trial at Invermay, yields from two cuts over the period April to September gave 20% more dry matter than three cuts, and one cut gave 13% more than two (Scott, 1963).

In an animal grazing trial at Winchmore (Scales and Taylor, 1977), pastures grazed twice at 60-day intervals out-produced those grazed once by 770 kg DM/ha, and the respective cattle growth rates of 0.29 and 0.22 kg/day gave the two-rotation beasts an 8 kg liveweight advantage by the end of winter.

At Ruakura (Scott, 1964), Wallace obtained a 0.7 kg milk fat/cow increase in production in 3 years from an early (April-June) feeding-out system which involved restricting the cows to about 25% of the farm during this period, in comparison with a late feeding-out system (June-August) in which 75% of the farm was grazed in late autumn-early winter.

Preliminary data on the influence of autumn-winter grazing method on feed availability throughout winter are available from a current experiment at the Nutrition Centre, Ruakura. These are shown in Tables 3 and 4. Also shown are available data from

TABLE 3: PASTURE YIELDS (kg DM/ha) AND DRY MATTER INTAKES (kg/cow/day)

	Fast Rotation			Slow Rotation		
	Pre-grazing Yield	Post-grazing Yield	Pasture DM Intake	Pre-grazing Yield	Post-grazing Yield	Pasture DM Intake
Mid-May	2439	1540	5.8	2614	900	3.2
Jun	2356	1398	4.2	2719	783	3.9
Jul	2218	1065	5.6	3185	1370	5.3
Aug	1831	919	7.2	2833	1517	8.3
Sep	2272	1604	11.9	2266	1700	10.1
Oct	3414	1826	15.8	3478	1980	13.2

the Davis farm, where the dry cows were grazed at approximately 250 cows/ha/day, giving rotation lengths of about 55 days, a rate similar to the Fast Rotation group. The Slow Rotation cows were grazed on a 100-120 day rotation. Mean calving dates were similar for the three herds.

With the Slow Rotation, intake was initially restricted and post-grazing yields were low, but gradually there was an increase in the amount of pasture on offer, post-grazing yields, and pasture intakes. In contrast, the amount of feed on offer declined, and pasture intakes were relatively static over the winter under Fast Rotation. This is also reflected in mean farm cover of pasture for the two Rotation farmlets and Davis farm, and pasture intakes on Davis farm in the 1978 winter.

These data indicate that at high stocking rates pasture availability and intake are likely to be static or to decline under a fast rotation system where such a rotation commences in late

TABLE 4: MONTHLY FIGURES OF MEAN FARM COVER (kg DM/ha) AND APPARENT INTAKE OF COWS (kg DM/cow/day) ON THE DAVIS FARM

	Mean Farm Cover			Intake	
	Fast Rotn	Slow Rotn	Davis Farm	Dry	Milking
Mid-May	1763	1949			
Jun	1807	2240			
Jul	1636	2037	1376	4.2	
Aug	1693	1933	1330	3.6	8.0
Sep	1677	1818	1819	5.2	6.7
Oct	2177	2257	2336		14.9 ¹

¹Estimate.

May/early June. The system could regularly require substantial inputs of supplementary feed in late pregnancy and early lactation. This occurred in the 1978 winter on the Davis farm. In mid-August, for instance, the dry cows received about 3 kg hay/cow/day in addition to pasture.

The very rapid early spring growth on the Davis farm is apparent from data in Table 4, which shows that mean farm cover in October was higher than on the Ruakura farmlets after having been appreciably lower in August. On farms where such rapid growth does not occur, a fast rotation system could result in severe feed shortages in early spring.

On the evidence available at present, a fast winter rotation may result in more pasture growth than a slow rotation, and the average digestibility of the pasture fed may be higher. However, there is likely to be less pasture available in late winter, and supplements, generally of low digestibility, will often be required. Overall, the influence of winter rotation on animal production is likely to be small.

While Campbell (1966), Brougham *et al.* (1975) and McQueen (1970) found little or no reduction in pasture or animal production when a greater degree of winter treading of pastures was imposed, Edmond (1966) and Brown (1968) found treading to have marked detrimental effects on pasture growth, particularly on short pastures. The methods adopted on the Davis farm for minimizing treading or pugging damage probably have a beneficial influence on production.

TOPPING

No work is known on the specific effects of topping of grazed pastures on either pasture or animal production. However, considerable work has been done with grass species on the influence of defoliation in spring and summer on such matters as tiller production, carbohydrate reserves, photosynthetic efficiency, the distribution of photosynthetic assimilates and root growth.

The two types of topping described (low-cut main top and high-cut seed heads) could have a number of effects. The main top could lead to an increase in the number of vegetative tillers and a decrease in leaf and sheath lengths, thus resulting in a denser sward. Reducing the effects of shading could also enhance tiller production (Mitchell and Coles, 1955). On the other hand, reproductive apices could be at mowing level, and if so the tillers could continue to develop in a leafless condition or could die

(Davies, 1978). As a flowering sward has high and sustained efficiency (Leafe *et al.*, 1974), it is by no means certain that the main topping procedure used will have beneficial effects overall.

It is also possible that a similar effect to main topping on the Davis farm could be obtained by conserving more pasture.

The effects of seed-head topping on pasture or animal production are likewise not known. The side effect of preventing weeds from seeding should be beneficial, and it is interesting that there is no apparent decline in the vigour and perenniality of the pastures, despite extremely little reseeding over a number of years.

While information on the value of topping is lacking, it is considered that the practice is unlikely to have a major influence on production in view of the relatively small effect of overall grazing management procedures (McMeekan and Walshe, 1963), plus the fact that any beneficial influences are frequently likely to be short-lived because of subsequent moisture deficiencies.

LENGTH OF LACTATION

Campbell and Bryant (1978) have discussed the desirability of drying off in relation to cow condition and feed supplies, and while Davis uses the same criteria, different standards appear to be used by Campbell and Clayton at No. 2 Dairy, Ruakura, and by Davis, such that in a low-moisture year the No. 2 Dairy cows are dry for about 1 month more than are Davis's.

No direct experimental data are available on the effect of date of drying off on current and future production. The whole subject is very complex in a grassland feeding situation, for not only will the optimum decision in a particular year depend on a knowledge of the efficiency with which feed is used for milk production and body tissue formation, and of the importance of the latter, but also on pasture growth in the period from drying off to the onset of spring growth, a factor which cannot be estimated with accuracy.

As relatively efficient responses are obtained by light-conditioned cows to extra feed inputs in late pregnancy (Scott, 1979), in contrast to inefficient production responses in mid- to late-pregnancy (Bryant, 1978), it may be that production is somewhat penalized on the Davis farm in years such as 1978 when autumn growth is poor and the herd is milked to within 60 days of the start of calving.

CONCLUSION

While it is likely that alternative stocking rates and methods of pasture and grazing management could be used with similar success, it is recognized that this farm is operated in a most efficient manner, particularly in terms of the net cash returns obtained, which are over twice as high per hectare as on average South Auckland dairy farms.

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