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Summer Management Systems in the Manawatu

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Preface

This publication reports the results of an investigation into summer management practices on Manawatu dairy farms. The author, Mr K. Bartlett, was seconded to Massey from the New Zealand Dairy Board Consulting Officer Service to fill a temporary position in Farm Management when Dr A. Wright was seconded to Ruakura Animal Research Centre for a year.

In this publication Mr Bartlett examines four summer management systems for Factory Supply Dairy Farms in the Manawatu. The summer period was chosen because in the last three dairy seasons in the Manawatu long dry summers have been experienced. These have meant a substantial fall in per cow production. In this study the Massey University No.4 Dairy Farm is used as a Case farm.

I hope that both dairy farmers and their advisers will find the study of some help in making decisions about summer feeding alternatives. Even if the particular examples discussed are not immediately applicable to other farms the methods of analysis used should be of help.

The assistance and co-operation of the New Zealand Dairy Board in making Mr Bartlett available is gratefully acknowledged.

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Without the willing assistance of all these people this publication would not have been possible.

SUMMER MANAGEMENT SYSTEMS IN THE MANAWATU

Introduction

Manawatu farmers in the past three years have experienced long dry summers. The effect on dairy production in December, January, February and March has been drastic. Per cow production has fallen and many factory supply herds have been dried off early.

Thus dairy farmers, in particular, have renewed interest in various summer management systems for lactating cows.

Many people have advocated different management schemes to try to solve this summer problem. This paper attempts to evaluate the four most popular summer management schemes advocated. These are:

1. Grow a summer crop
2. Install an irrigation system
3. Feed concentrates
4. Reduce stocking rate.

The Massey No.4 Dairy is used as a 'Case Farm' in this paper.

Rainfall in the months of December to March has been well below average in the last three years. (Table 1)

The low rainfall during the months November to March has caused rapid maturation of pastures with a consequent decrease in nutritive value and pasture yield. This is shown in table 2.

TABLE 1: MANAWATU AVERAGE RAINFALL COMPARED WITH AVERAGE AT 1972-75

	Average Rainfall (29 yr. average)	Average 1972-75
November	79 mm	47.4 mm
December	104 mm	48.1 mm
January	84 mm	39.9 mm
February	69 mm	33.4 mm
March	74 mm	58.1 mm
April	74 mm	81.0 mm
May	86 mm	122.7 mm

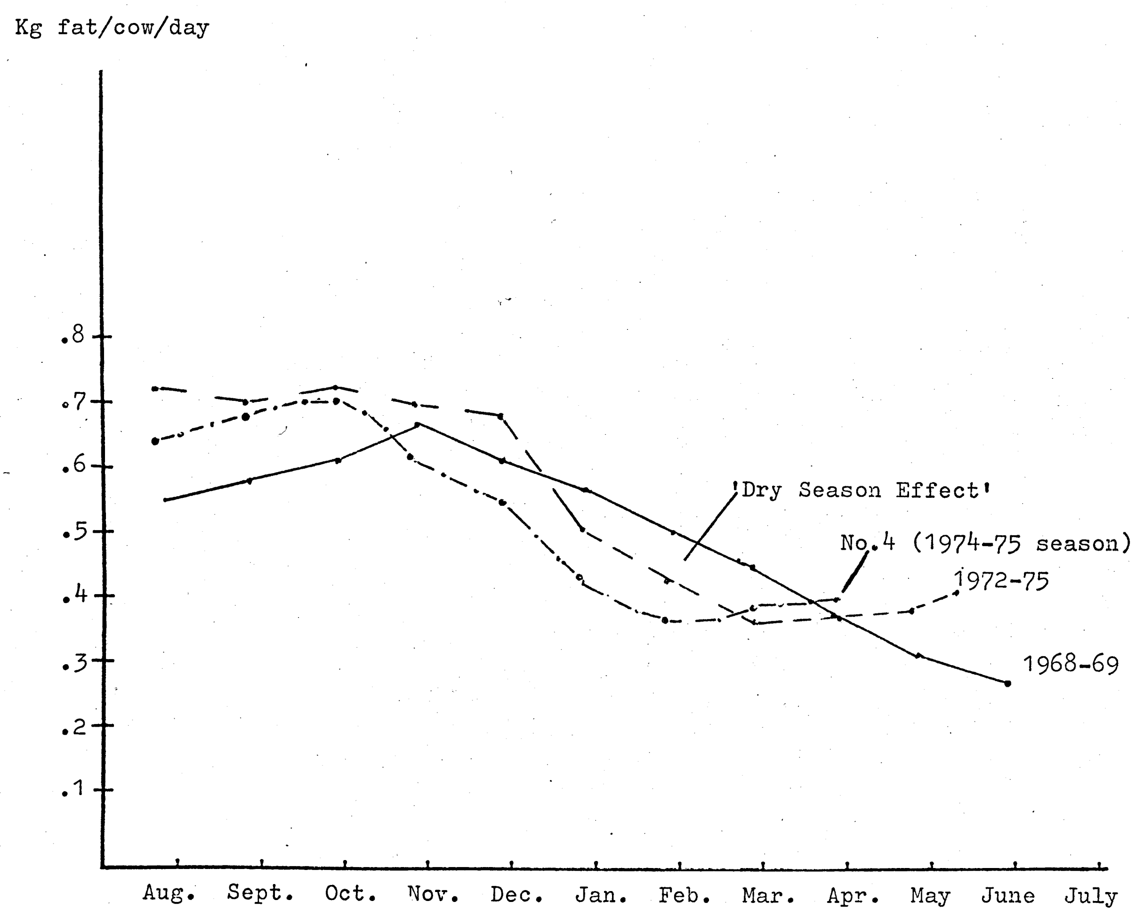
(Source: N.Z.Meteorological Service)

TABLE 2: PASTURE DRY MATTER YIELD (kg/ha/day) IN A 'NORMAL SEASON' (1968-69) IN THE MANAWATU COMPARED WITH DM YIELD IN THE 'DRY SEASONS' (1971-75)

	Average DM (1968-69) (kg/ha/day)	Average DM (1971-74) (kg/ha/day)
November	70	69
December	32	40
January	42	21
February	56	13
March	46	20
April	28	28
May	21	24

(Source: R.Ball, pers.comm., C.W.Holmes et al., 1974)

The influence of low rainfall on milk production is shown in figure 1.



(Source: Wellington-Hawkes Bay Livestock Improvement Association)

FIGURE 1.

The information in figure 1 was obtained from herd test results. Records from the New Zealand Dairy Board were examined and seven farms were selected. These farms had had minimal stocking rate changes in the years used for comparison. All the farms are in one of the drier areas of the Manawatu.

If spring variations are eliminated so that summer losses show clearly the monthly drop in production in 1968-69 can be compared to the drop in 1972-75 season. The figure obtained will be called 'the dry season effect', and on a per cow basis is approximately 10 kg fat/cow.

CASE FARM STUDY - MASSEY NO.4 DAIRY UNIT

The Massey No.4 Dairy Unit (details of which are shown in table 3) has a summer feeding problem. This has resulted in low per cow performance (113 kg milkfat/cow in 213 days) and a large percentage of the herd being dried off early. (Table 5)

TABLE 3: PHYSICAL DETAILS OF MASSEY NO.4 DAIRY UNIT

Area (surveyed)	162.4 ha
In permanent pasture	146 ha
Used by the milking herd	146 ha
Situation	on the Shannon-Levin Highway (No.57) close to Massey University
Soil type	Tokomaru silt loam (must be intensively mole and tile drained because of poor natural drainage)
Contour	2 large flat terraces running north-south
Cowshed	36 bail rotary turnstyle
Paddocks	60 paddocks (2.43 ha)
Drainage done	89 ha (moles and tiles)
Water supply	8.75 mm PVC to all paddocks
Hay storage	3500 bales
Pastures	126 ha of improved species; balance is browntop dominant
Fertiliser	200 kg/ha superphosphate
Stock (1974-75)	320 milking stock (1 June) 80 yearlings
Water harvesting	30,000 cubic metres of water available; this could be used to irrigate 20 ha at 15 cm/ha.

(Source: K.Lowe)

Tables 4 and 5 show the monthly rainfall figures and the per cow performance respectively for the summer of 1974-75.

TABLE 4: MONTHLY RAINFALL FIGURES FOR SUMMER OF 1974-75

November 1974	53.1 mm
December 1974	77.9 mm
January 1975	37.7 mm
February 1975	29.6 mm
March 1975	53.2 mm
April 1975	71.4 mm
May 1975	129.5 mm

TABLE 5: PER COW PERFORMANCE FOR THE 1974-75 SEASON FOR THE NO.4 DAIRY HERD (HERD TEST RESULTS)

Month	No. of cows	Kg fat/cow/day
August	107	.65
September	253	.68
October	301	.70
November	306	.60
December	302	.54
January	299	.42
February	256	.39
March	212	.38
April	166	.36

(Source: Annual Herd Testing Returns)

Four alternative ways of solving the summer problem are looked at below:

1. Grow a summer crop of greenfeed maize
2. Irrigate pasture from water harvesting reservoirs
3. Feed concentrates (meal)
4. Reduce the stocking rate to 240 cows and conserve and feed grass silage.

Feed values of all the supplements considered are shown in Table 6.

TABLE 6: FOOD VALUES OF COMMON NEW ZEALAND FEEDSTUFFS

Feedstuff	D.M. Percentage	Metabolizable Energy (M.cal ME/kg DM)
Barley	87	3.1
Leafy pasture	20	2.5
Brown summer pasture	60	2.3
Greenfeed maize	21	2.2
Silage	20	2.3
Irrigated pasture	16	2.9

(Source: M.T. Jagusch, Food Requirements of Ruminants)

Bryant (1971) showed that, to obtain the maximum possible milk yield, when supplements were being fed, the supplement should not make up more than 25 percent of the ration. This experiment also showed that if the supplement was 75 percent of the total ration being fed, production was depressed.

The effect of supplementation, at rates between 25 and 75 percent, on milk yield is not known. In a drought situation it is impossible to supply 75 percent of the ration in grass. (See Table 2). Thus, it has been assumed that all supplements will supply 50 percent of the ration, and at this level of supplementation milk production will be maintained. Fifty percent of the ration required in the summer period would be approximately 5 kg DM/cow.

1. GREENFEED MAIZE

The two most common reasons for growing greenfeed maize are:

1. To try to maintain per cow production over the summer months (January to March).
2. To maintain cow body weight and build up a 'feed bank' in the autumn for the winter.

These two reasons require completely different management decisions to be made at planting and harvesting time. Both of these will be discussed and a partial budget for each presented.

In the case of (1), feeding of the crop usually starts when pasture growth declines (see Table 2). This means that a large area of maize will have to be planted at different sowing dates so that the crop remains palatable.

The second reason requires a prediction of the date rain will fall and the period of time over which maize will be fed.

When these decisions are made, the area required and the planting date can be calculated.

Greenfeed maize grown to maintain per cow production

It is assumed that feeding will start when the 'dry season' effect reduces per cow production. In figure 1, the effect of the dry season is shown to start in the middle of December and continues until the end of March (100 days).

The following husbandry practices are essential to get a high yielding maize crop.

Seedbed preparation

1. From sod-bound browntop (Agrostis tenuis). Plough three weeks before sowing; disc and harrow to form a reasonable fine friable weed-free seed bed.
2. From a ryegrass sward (Lolium). Direct drill using 'paraquat' (2 litres/ha).

Sowing time.

Greenfeed maize takes approximately 65 days from sowing before it is ready to breakfeed. With the large area needed here, it would be best to have three sowing dates:

1 sowing on the 15 October (5 ha).
2 sowings 10 days apart starting November 10, each of 8 ha.

There would be a slight risk of poor germination with the early sowing date if soil temperatures are low.

Sowing method and rate.

Seed to be drilled in 15 cm rows, using treated 'Greenfeed Maize' seed. This is second generation seed of a grain maize hybrid usually W575, XL45 or PX610.

The sowing rate is 220 kg/ha for cultivated ground and 240 kg/ha for direct drilling. This rate gives an established plant population of 350 000 plants/hectare or 380 000 plants/hectare respectively.

Fertilizer.

Browntop pastures (Agrostis tenuis): drill with 100 kg/ha of diammonium phosphate.
Ryegrass pasture (Lolium): drill with 200 kg/ha of superphosphate.

Weed control.

Because of high plant density weed control should not be necessary.

Pest control.

Army caterpillar: because of a predator wasp (Apanteles ruficrus) chemical control should not be necessary.

Stem weevil : Browntop pasture (Agrostis tenuis): With thorough cultivation and a three-week fallow period chemical control should not be necessary.
Ryegrass pasture (Lolium) : With a later sowing date (after 10th November) expensive chemical control should not be required. However, if control is necessary use 'Lennate' at 2.8 litres/ha. at emergence.
N.B. In the following examples it is assumed that chemical control of Stem Weevile is not necessary.

Area required.

The average greenfeed maize yield of the district is 9000 kg DM/ha. (P. Mathews, pers.comm.)

$$\therefore \quad \text{Area Required} = \frac{\text{days feeding x amount/cow x no. of cows}}{\text{yield of maize}}$$

$$= \frac{100 \times 5 \times 320}{9000}$$

$$= 18 \text{ ha.}$$

Jagusch (1974) has shown that the utilization of greenfeed maize, grazed in situ is between 85-95 percent. Assuming an 85 percent utilization, the area required is 21 ha.

Method of feeding

Long narrow strips of maize would be cut daily and break fed. This shaped break allows easy access by cows and limits fouling of the feed by dung and urine. The area required by the 320 cows would be 0.2 ha/day. The cows would be left on this area for 12 hours per day. This simplifies management and lengthens the pasture grazing rotation.

Costs/ha. of growing greenfeed maize.

For Browntop pastures (Agrostis tenuis)

Ploughing	$15
Discing	$ 5
Harrowing	$ 5
Seed cost	$47.55
Fertilizer D.A.P.	$12.60
Sowing	$ 6.50
Total Cost	$91.65

For Ryegrass Pastures (Lolium sp)

Seed cost 240 kg/ha	$54.36	
Fertilizer (Super)	$ 5.46	
Paraquot (2 litres/ha)	$16.70	(includes spraying)
Direct drill	$12.50	
Total Cost	$89.02	

(Source: M.A.F. Publication, Resource Economics. Section, Technical Paper No. 1/75).

Returns from Greenfeed Maize.

Assuming that the greenfeed maize supplement will totally eliminate the 'dry season effect', a partial budget can be drawn up. This is shown in table 7.

TABLE 7: PARTIAL BUDGET FOR FEEDING GREENFEED MAIZE TO LACTATING DAIRY COWS

Total extra milkfat from the maize	320 x 10.0 kg	= 3220 kg
Value of extra milkfat	3220 x 136 cents/kg	= $4379
Costs of growing greenfeed maize	$91.65/ha	
	$91.65 x 21 ha	$1925
Feeding		
Tractor & mower (10 minutes/day at $5.00/hr)		= 83 cents/day
	For 100 days	= $83
Opportunity cost		
Loss of 21 ha of pasture for 7 months		
215 kg/ha (table 2) x 21 ha		= 4515 kg DM
4515 kg DM average digestibility of 65%		= 2935 kg DDM
Utilization of 70%		= 2054 kg utilizable DDM
From Hutton (1974) 25 kg DDM produces 1 kg milkfat in late lactation		
∴ milkfat lost		= 82 kg
∴ value of milkfat not produced from grass at 136 cents/kg		= $111

Cost of regrassing/ha:

Ploughing	$15	
Discing	$ 5	
Harrowing	$ 5	
*Seed cost	$26	
Fertilizer D.A.P.	$12.60	
Sowing	$ 6.50	
Total cost/ha		= $70.10/ha

∴ Total cost of growing greenfeed maize & regrassing 21 ha:

Growing greenfeed maize	= $1925
Feeding maize	$125
Opportunity cost	$111
Regrassing	$1472
Total costs	= $3633

Gain from feeding greenfeed maize = $746 or $35.52/ha.

(Source: Lincoln College Farm Budget Manual. 1974)

* Seed mixture: 11 kg/ha of 'Grasslands Ruanui'
5 kg/ha of 'Grasslands Ariki'
3 kg/ha of 'Grasslands Apanui'
2 kg/ha of 'Grasslands Huia'
2 kg/ha of 'Grasslands Hamua'.

This analysis of the feeding of greenfeed maize shows a financial gain. However the main benefits of feeding greenfeed maize are the intangible benefits shown below:

the possibility of a carry over effect,
heifers being fed better,
milkers maintaining liveweight.

It is difficult to place monetary values on these factors but they could increase the following season's production substantially.

Growing maize to maintain cow body weight and to help build up a feed 'bank' for the winter

The management decision to make here is when the crop will be fed and for how long. In this exercise it is assumed that significant rain falls at the end of March and that greenfeed maize is fed from the 20th February to the end of March (40 days). The total amount of dry matter required for that period is:

days x no. of cows x amount/cow = 40 x 256 x 10 = 102 400 kg DM.

The greenfeed maize crop will supply 50 percent of the ration or 51 200 kg DM. The average crop yield of the district is 9000 kg/ha DM. Of this 7600 kg/ha DM will be utilized. The area needed will be approximately 7 ha. Planting date will be the 10th December. The method of feeding will be similar to that discussed on page 7.

Costs: 7 x $89.02 = $623.

Returns from 7 ha of greenfeed maize.
Assuming that the greenfeed maize supplement will totally eliminate the dry season effect for the 6 weeks it is fed (from the 2nd period in February to the last period in March - 40 days), a partial budget can be drawn up. This is shown in table 8.

TABLE 8: PARTIAL BUDGET FOR GROWING 7 HA OF GREENFEED MAIZE

Total extra milkfat from the greenfeed (from figure 1)		= 256 x 4.3 kg
		= 1100 kg
Value of extra milkfat		= 1100 x 136 cents/kg
		= $1496
Costs growing greenfeed maize:		
(Direct drilling)	= $89.02/ha	
	7 x $89.02	= $623.
Feeding:		
Tractor & mower (10 minutes/day at $5.00/hr)		= 83 cents/day
	For 40 days	= $33

continued over ...

TABLE 8 - CONTINUED

Opportunity cost:

Loss of 7 ha of pasture for 5 months

215 kg/ha (table 2) x 7	= 1505 kg DM
1505 kg DM average digestibility of 65%	= 978 kg DDM
Utilization of 70%	= 685 kg utilized DDM
From Hutton (1974) 25 kg DDM produces 1 kg milkfat in late lactation	
∴ milkfat lost	= 27 kg
Value of this milkfat at 136 cents/kg	= $36.72
Cost of regrassing 7 ha	= $70.10 x 7
	= $490
Costs of growing 7 ha of greenfeed maize & regrassing it	= $1182.72

∴ Profit from greenfeed maize = $313.28 or $44.75/ha.

In this example there is a considerable financial gain.

Accurate prediction of the date when rain falls plus the use of yield information and the fact that 50 percent of the cow's ration is going to be in the form of the supplement, helps the management decision of when to start feeding the crop. This in turn affects the profitability (see partial budget below). Budget 1 (a) assumes that the maize is planted on the 20th November and will be fed for 60 days. The area needed will be approximately 11 ha. (Fed from 1st period in February to the last period of March - 60 days).

<u>Partial Budget 1 (a) for Growing 11 ha of Greenfeed Maize</u>

(sowing date 20th November)

Total extra milkfat from the greenfeed (figure 1)		= 256 x 5.4
		= 1382 kg
Value of extra milkfat	1382 x 136	= 1880
Costs for growing 11 ha		= $979
Feeding costs for 60 days		= $ 50
Opportunity cost for 11 ha		= $ 57.70
Cost of regrassing 11 ha		= $771
Total costs for growing 11 ha of greenfeed maize and regrassing		= $1858

Profit from maize = $22 or $2.00/ha.

There is also a small financial gain in budget 1 (a). If only 7 ha of greenfeed maize is grown, the financial gain is quite considerable. Thus the recommendation is to grow 7 ha of greenfeed maize, planting it on the 10th December. (By pasture growth figures, DM production in a dry year is starting to decline by then).

The feeding period will be 40 days. If the feeding time is shorter than this in a dry season the supplement would not be effective.

The main benefit of this use of a summer supplement is that the length of the summer grazing rotation can be doubled without the use of winter supplements and/or with minimal loss of per cow production. This longer rotation means that the pasture response to rain will be quicker than if the farm was on a short rotation.

Other benefits accrue to: fewer cows being dried off,
heifers being fed better,
milkers maintaining liveweight.

2. <u>IRRIGATE PASTURE FROM WATER HARVESTING RESERVOIRS</u>

The quantity of water available for irrigation is 30,000 cubic metres: this is held in three reservoirs. The 20 ha available for irrigation will receive 150 mm of water in three applications (50 mm/application) over a period of 2 months. The irrigation interval will be 20 days and on this basis it will be necessary to apply 50 mm on a hectare in one 6 hour hand shift.

Table 2 shows that water application in 'dry years' would have to start in November. Because of the water limitations irrigation would finish late December.

The extra dry matter that would be obtained from these three irrigations can be calculated from the information in table 9.

TABLE 9: IRRIGATION RESULTS FOR NO.1 DAIRY FARM (APRIL-MARCH INCLUSIVE, 1973-74)

	Control	Water 660.4 mm applied
Total grass grown kg DM/ha	13 442	17 377
kg extra DM grown/cubic metre		6
cow grazing days obtained per hectare (13 month period)	158	211

(Source: C.W. Holmes *et al.*, 1974)

Extra dry matter grown = response x water applied x area
= 6 x 152.4 mm x 20
= 18 288 kg DM over 20 ha or 914 kg/ha.

For each irrigation interval there will be an extra 304 kg DM/ha available.

The management of the irrigated pasture would be to use it as a supplement. This would mean giving the herd sufficient area, so that they would not have to harvest more than 50 percent of the pasture offered in 2½ hours following morning milking. This would ensure maximum intake and help pasture recovery. (See table 10)

TABLE 10: FOURTEEN DAY'S REGROWTH AFTER CUTTING TO TWO HEIGHTS IN SPRING

Cutting treatment	Yield (kg DM/ha)
1 layer of leaves left	540
Enough leaf left to fully use most light	1330

(Source: R.Brougham, 1973)

Table 10 illustrates how important grazing pressure is on pasture recovery. With high grazing pressure (summer overgrazing) a 300 percent decrease in pasture recovery occurs.

This means that anything that can be done to prevent this overgrazing would be extremely beneficial to consequent pasture recovery, and hence total DM production on the whole season and subsequent seasons.

The area needed for 320 cows can be obtained by extrapolating J.Wheeler et al., 1972 results obtained at Massey. In this trial 16 cows required 0.08 ha/day of irrigated pasture. The herd of 320 cows would require approximately 1.6 ha/day. Theoretically this sould give them an intake of 4 kg DM/day/cow of irrigated pasture. Costs/ha for irrigation are shown in table 11.

TABLE 11: IRRIGATION COSTS/HA OPERATING COST
It is assumed the farm labour does the work.

Type	Capital cost $	Power 1c/unit	R. & M. est.	Total Annual
Hand move	$300-400	10	1	11

(Source: F.Phillips, F.A.O.Ag. Engineering)

Annual costs are:	Interest $8000 at 8%	640
	Depreciation at 10%	800
	Operating costs	220
	Total costs	1660

Returns from irrigation.
Using the information from figure 1 the theoretical gain from irrigation can be calculated and presented as a partial budget. (See table 12)

TABLE 12: PARTIAL BUDGET FOR IRRIGATING 20 HA OF PASTURE

Total extra milkfat from irrigation 320 x 1.8 kg (figure 1)	= 576 kg milkfat
Value of extra milkfat 576 x 136 cents/kg	= $783
Annual cost of irrigation	= $1660
Loss from irrigation	= $877 or $44/ha.

The limiting factor with the irrigation system described is that there is not sufficient water available to continue irrigating during the months of January, February and March.

If the irrigation water is used on pasture to feed milking cows there is a large financial loss, for the amount of capital invested. Also, in practice, feeding a large number of cows on a small area of irrigated pasture could introduce management problems relating to rotation length for the irrigated area, and the fact that the cows may not eat the non-irrigated pasture.

Another use of the water is to irrigate 20 hectares of pastures and use this area to rear young stock. By this method the heifers could be kept on the farm and should be well grown and of 'adequate' liveweight to be wintered more easily than at present. (20 ha could be pasture-sprayed for eczema control in the young stock). A partial budget for keeping the heifers on irrigated grass can be drawn up.

TABLE 13: PARTIAL BUDGET FOR KEEPING HEIFERS ON IRRIGATED PASTURE

Annual cost of irrigation	= $1660
Facial excema control (2 sprays by contractors)	= $400
Cost of grazing heifers (off the farm) = 60 heifers at $20/head	= $1200
∴ Irrigation cost	= $860 or $43/ha.

There is still a financial loss from irrigation, but other benefits hard to assess financially are:

- healthy young stock (free from eczema)
- heifers of 'adequate' body weight for winter
- sparing of winter feed to 'build up' poorly grown heifers.

A more profitable use of the irrigation water (irrigation of a crop) is discussed later.

3. FEED CONCENTRATES TO HOLD PER COW PRODUCTION

Many workers have shown that when pasture is limited a response in animal production to supplementary feeding can be expected. Bryant et al. (1961), in Virginia used one group of cows (top grazers) to graze approximately 50 percent of available herbage, and a following group (bottom grazers) to graze the remainder. Half of each group were offered a supplement of 1 lb shelled maize for every 8 lb milk produced (0.45 kg/2.82 litres milk). The 'top grazers' gave a mean daily milk yield of 36.2 lb (15.98 litres) against 28.7 lb (12.67 litres) for the 'bottom grazers'. The effect of offering supplements to cows on restricted pasture (bottom grazers) was to make their milk yields similar to those of the unsupplemented 'top grazers'.

Holmes et al. (1966) compared the production from 2 grazing systems (i) normal strip-grazing without concentrates, and (ii) strip-grazing in which the same number of cows (9) as in (i) were allowed only half the area of pasture allocated daily to the first group but were given concentrates. The experiment lasted for a period of 112 days from mid May to September, and the groups of cows were changed from one treatment to the other every 28 days according to a double-reversal design. A fairly high stocking rate of 1.7 cows/acre (4.2/ha) was used with (i). The concentrates offered to the cows with (ii) provided $\frac{1}{3}$ of the expected daily intake of digestible organic matter of each cow (11 lb barley daily [5.0 kg]). There was no significant difference between treatments in the mean FCM yields/cow, although the mean butterfat content was significantly higher on the pastures only treatment than with restricted pasture plus concentrates. The grazing only treatment produced/acre 194 cow-grazing days and 585 gal. milk (80.25 cow-grazing days and 2660 litres/ha) while the restricted area plus concentrates produced 388 cow-grazing days and 1243 gal. milk/acre of grass (160.74 cow-grazing days and 5650 litres milk/ha). It was shown that the total intake of digestible organic matter differed little between the treatments. Thus, the giving of concentrates equalized the nutrient intake of both groups which provides the explanation for the non-significant difference between the treatments in production/cow. The results of both these experiments show that animal production can be maintained when there is a considerable restriction of pasture intake and concentrates offered.

In the Manawatu, the cheapest supplement available is barley ($90/tonne). Castle (1967) showed that feeding 3 lb barley (1.36 kg) gave a response of 6.5 lb milk (2.87 litres).

Method of feeding.

The meal will be fed on sheets of old corrugated iron in the paddock, once daily after the morning milking.

Costs.
Meal costs $90/tonne ($2.05/bushell contract price 1974-75).
Expected response/kg = 2.1 litres (Castle, 1967).

In this example it is assumed that the herd obtains 50 percent of their requirements from pasture.

From the information given in table 14 one can calculate how much meal is needed to maintain production similar to the 1968-69 season.

TABLE 14: TOTAL DAILY REQUIREMENTS FOR A DAIRY COW (KG DOM)

Month	Total (kg DOM)	Total kg DM
August	5.5	7.7
September	8.9	12.7
October	9.1	13.0
November	9.4	13.4
December	9.1	14.0
January	8.2	13.7
February	8.2	13.7
March	7.8	13.0
April	7.8	13.0

(Source: J.B.Hutton, 1962)

For January: amount of dry matter (DM) required (kg) = 320 x 13.7 x 31 = 135 904 kg
For February: amount of DM required (kg) = 320 x 13.7 x 28 = 122 752 kg
For March: amount of DM required (kg) = 320 x 13.0 x 31 = 128 960 kg
Total amount of DM required = 387 616 kg
Amount of DM from pasture = 193 808 kg
Amount required from meal = 193 808 kg.

The quality of the dry matter in the meal is higher than that from pasture (see table 6) so the meal requirement (kg DM) will be lower than the amount required from pasture

= 149 083 kg

tonnes of meal required = 149 tonne or 466 kg/cow.

The meal is fed over 90 days so 5 kg/cow/day would have to be fed.

Table 15 shows a partial budget on meal feeding.

TABLE 15: PARTIAL BUDGET FOR MEAL FEEDING

Total extra milkfat from meal feeding 320 x 7.0 kg	=	2240 kg
Value of extra milkfat 2240 x 136 cents/kg	=	$3046
Cost of meal 149 tonne at $90/tonne	=	$13,410
Loss from meal = $10,000 or $31.20/cow.		

The advantage of meal feeding is its flexibility; if it is needed, it is easily obtained.

The loss supports Hutton's and Parker's (1967) recommendation that supplements should be used to minimise losses in periods of genuine feed shortage when there is a reasonable chance for subsequent recovery of grass growth.

4. REDUCE STOCKING RATE TO 240 COWS

With the lower stocking rate, it can be assumed that summer milk production would follow a normal season's production (1968-69). The average per cow production of the 1968-69 season was 269 lb fat/cow (122 kg fat/cow). (N.Z.Dairy Board 47th Farm Production Report) In the 1975-76 season with a stocking rate of approximately 1.4 cows/hectare self contained the average per cow production of the smaller herd will be higher than the Manawatu average. (Manawatu average stocking rate 1.8 cows/ hectare self contained. (N.Z.Dairy Board, 1973)).

Returns from 320 cows are shown in table 16.

TABLE 16: RETURNS FROM HIGH STOCKING RATE

Butterfat similar to 1974-75 season		=	36 280 kg
36 280 kg at 136 cents/kg		=	$49,342
Grazing off.	80 heifers at $20/head	=	$1,600
	80 calves at $16 plus their grazing as heifers at $20	=	$2,880
Buying in an extra 2800 bales of hay		=	$2,800
Total income		=	$42,062

Returns from lower stocking rate (240 cows self contained) are shown in table 17.

TABLE 17: RETURNS FROM LOWER STOCKING RATE

240 cows at 145 kg fat/cow	=	34 830 kg
34 830 kg at 136 cents/kg	=	$47,368
No. grazing off. 60 heifers at $20/head	=	$1,200
62 calves at $18/calf plus their grazing as heifers at $20/head	=	$2,356
Only need to buy in 1000 bales of hay = saving of	=	$1,800
Total income	=	$52,724

In the above example hay is being bought because some silage was made to feed in the dry summer, to keep all the cows milking.

In this example the lower stocking rate gives a short term monetary advantage of $10,722. The disadvantage of the low stocking rate is that any pasture development is very slow.

Levy and Sears (1951) demonstrated the beneficial effects stock dung and urine returns has on low producing swards. Edmonds (1960) showed that maximum trampling over short periods of time can markably change the botanical composition of pastures.

At a stocking rate of less than 1.4 cows per hectare (self contained) it would be nearly impossible to keep control of the browntop (Agrostic tenuis) dominant pastures. Improved pastures (Lolium sp and Trifolium repens) at this low stocking rate would soon become browntop dominant again. At low stocking rates it would be necessary to invest in more machinery to try to achieve some pasture control. On a farm that relies on salaried employees the maintenance cost usually makes this uneconomic. Thus in the long term the lower stocking rate would not be advantageous to the No.4 Dairy Farm.

MANAGEMENT SYSTEM FOR CASE FARM

On any seasonal dairy farm it is impossible to isolate a summer feeding problem from the critical feeding time of six weeks before and after calving.

Hutton (1972) stated that 'undoubtedly the manner in which a cow is fed before calving sets a ceiling on the production peak she is capable of reaching in early lactation and hence her total performance'. It has also been shown by Hutton (1963) that efficiency of conversion of feed energy to milk energy was highest in early lactation. (Thirty percent immediately following calving). The efficiency then drops two percentage units each month, so in the summer period (January-February) efficiency is approximately 19 percent. Thus if the cows are not at their maximum possible production when they are at their highest efficiency, i.e. early lactation, summer supplementation will not give its maximum return.

Spring production levels that can be achieved by following the wintering system of Hutton (1971) are shown in table 18.

TABLE 18: SPRING PRODUCTION LEVELS FOR DAIRY COWS OF 370 KG LIVEWEIGHT

Months following calving	kg fat/cow/day
1	.77
2	.79
3	.78
4	.73

If the above production levels are not being reached in the spring, the major problem area is not the summer, but the spring. Because cows are the most efficient in the spring, maximum possible effort should be directed towards realizing this potential production.

For the case farm used in this study, spring production is below potential because of feed stress. This farm is still in the development phase, with some of the pasture being browntop dominant. (Agrostis tenuis) The dry matter production from these pastures is similar to perennial ryegrass swards in the late spring-early summer. (Harris and Thomas, 1972) However the ryegrass sward has a large growth advantage in the winter-early spring, and in the late summer-early autumn period over the browntop dominant sward.

The winter-early spring period is the most critical feeding period on a seasonal dairy farm. *Any summer feeding scheme for the Case Farm must look at the spring as well as the summer*. A management system that utilizes all No.4 Dairy resources, and will increase the feed supply for the critical period of winter, early spring and summer is given below. A similar system was used successfully by the 'Awaroa Demonstration Farm' of the Rangitaikei Plains Dairy Company in the 1974-75 season.

The system is to use the 20 ha available for irrigation to grow maize for greenfeed and silage. Yields of 25 000 kg DM/ha are obtained from irrigated maize (J.P.Kerr, *pers.comm.*) if the maize is grown for silage. The summer supplementation will be used to lengthen the rotation, and will be fed for 40 days so the area required for greenfeed maize would be 7 ha. Thirteen ha could be used for maize grown for silage. This would yield:

13 x 25 000 = 325 000 kg DM.

In hay equivalents this is equal to about 8000 bales. This large amount of dry matter is available to feed to dry or lactating dairy cows when the quantity of available pasture is limiting body weight gain or milk production. Maize silage's main advantage to No.4 Dairy is that the whole operation of planting and harvesting can be done by local contractors who have specialized maize gear, and because the maize plant can be ensiled between the range of 30 to 35 percent DM, harvesting time is not too critical. In this example a winter crop will not be grown after the maize.

Storage.

The method of storage will be in bunkers (construction method and size given below).

Bunkers. Each side consists of a row of 3 m treated pine poles set in the ground 2 metres apart leaving 2 metres above the ground.
A railway sleeper is used as a strong post at either end, stayed with a wire tie-back.
Each pole has a piece of old post 3 m long buried just below the surface against its outside face to help take outward pressure.
Two widths of high tensile fence netting are stretched inside the poles, and anchored to a dead man. The netting is covered first with scrim and then polythene.
The size of the bunker would need to be approximately 3 metres high, 12 metres wide, and 29 metres long. This height and width allows for using a tractor trailer and front-end loader for feeding out. Costs are shown in table 19.

TABLE 19: THE APPROXIMATE COST OF THE BUNKER FOR MAIZE SILAGE STORAGE

16 3 metre poles at $7.50 each	=	$120.00
4 railway sleepers at $4.00 each	=	16.00
20 new stays at $1.30 each	=	26.00
High tensile netting (1 roll)	=	36.00
2 rolls of polythene at $38.00/roll	=	76.00
Scrim	=	20.00
Total Cost	=	$294.00

(Source: M.A.F. Publication, Resource Economics Section, Technical Paper No.1/75)

The life expectancy of this type of bunker is about 8 years.
Yearly cost = $37.00.
Costs of growing and harvesting maize silage for the first year are shown in table 20:

TABLE 20: MAIZE SILAGE COST/HECTARE

Ploughing (contract)	=	$17.29
Cultivation (contract)	=	14.82
Seed	=	29.64
Fertilizer	=	11.12
Sowing	=	12.35
Weed control	=	25.94
Side dressing of Urea (includes application cost)	=	34.58
Harvesting (paddock to bunker)	=	138.32
Tractor plus man at bunker	=	14.82
Polythene covers	=	19.76
Metal for stack (to weigh down polythene)	=	1.24
		$319.88

(Source: R.Halford, pers.comm.)

Irrigation cost/13 ha	=	$1895
(see table 11) cost/ha	=	$767
Cost/kg DM	=	4 cents/kg.

The relatively low cost of the maize silage per kg DM compared to bought in hay at $1.00/bale (18 kg DM/bale = 6 cents/kg DM) should make the irrigated maize silage system feasible while No.4 Dairy is in a developing phase. If a continual maize silage cropping programme is practiced, fertilizer requirements will increase, as will the cost of weed and pest control. This will mean an increase in the cost of maize silage per kilogramme of dry matter.

Methods of feeding maize silage.

The maize silage would be given as the sole night ration in a paddock near the cow-shed. It could be fed on the paddock, but preferably in cheap bins. This method of feeding means that the labour input is minimal and the ration can be fed out during the day. The equipment needed for feeding out would be a front end loader and trailer. Bryant (1971) showed that in early lactation dairy cows would produce equally well on maize silage and grass, if the maize silage did not make up a significant part of the ration.

CONCLUSIONS

For the 1974-75 dairy season it has been shown that the feeding of supplements in a dry summer is only marginally economic. This is in agreement with Hutton and Parker (1967) who stated that concentrates should be used to minimise losses not maximise returns. Table 21 shows the probability of a summer rainfall similar to that of 1974-75 reoccurring.

TABLE 21: PROBABILITY OF MONTHLY RAINFALL (43 YEARS RECORDS MASSEY DSIR)

	Range	Probability
November	50.8 - 76.19	.233
December	76.2 - 101.59	.139
January	25.4 - 50.79	.233
February	25.4 - 50.79	.209
March	50.8 - 76.19	.286
April	75.0 - 99.75	.139
May	100.0 - 124.75	.093

(Source: A.Wright, Monthly Rainfall Probabilities)

The probability of a summer similar to 1974-75 reoccurring is very low, (.0005). The fact that an 'average' summer in the Manawatu has considerably more rainfall than the 1974-75 could influence the decision whether to summer supplement or not.

Other factors that could influence this decision are:

1. The spring production levels the herd reaches. If these levels are not similar to the ones given in table 18, then the problem is a late winter, early spring one, not a summer one.

2. The psychological effect of the drought on the farmer and his family. This factor is very difficult to evaluate by anyone except the farmer.

If the decision is to summer supplement the most successful way of supplementation seems to be to grow a small area of greenfeed maize. This maize is then used to maintain cow body weight and to build up a 'feed bank' for the winter. Page 9 of this paper describes this procedure in detail.

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