Drying off management and the use of management aids on seasonal supply dairy farms

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ABSTRACT

Computer-based decision support systems could provide an effective mechanism to facilitate technology transfer to farmers, and also improve the quality of their management decisions. The developers of computer systems, therefore, need to be cognisant of the constraints faced by farmers and the management methods that they use. To assist with the development of an expert system for the drying off decision a mail survey of 250 seasonal supply dairy farmers in five regions of New Zealand was undertaken during the 1992 winter to obtain information on management practices and decision aids used on farms. A response rate of 79% was achieved.

Most (69%) farmers dried off some cows before drying off the main herd on the basis of age and condition. Final drying off date was most often based on pasture availability, cow condition and/or the availability of supplements (85%). Mean pasture cover targets at drying off ranged from 1606 kg DM/ha in Northland to 2129 kg DM/ha in South Taranaki. Most farmers expected pasture cover to increase between drying off and calving. Only 22% of the farmers formally prepared a feed budget. A condition score target at drying off was given by 56% of the respondents (of which only 40% used a 1-10 scale). Computers were owned by 19% of the surveyed farmers. Inexperience with computers (60%), the cost of hardware (40%), lack of time to learn how to use computers (34%), no interest in computers (27%) and the belief that computers could not help management (27%) were cited as reasons for not owning a computer. The survey results indicate that computer-based decision support systems should be targetted initially at consultants who could provide a "bureau" type service to individual farmers. The present low level of formal feed budgeting limits the utility of decision-support systems that require objective farm data for developing grazing management recommendations.

Keywords: seasonal dairying, mail survey, management, computer use.

INTRODUCTION

The restructuring of State-funded extension organisations in New Zealand has important implications both for farmers and those providing advice to farmers. Implicit in the changes to extension funding are important assumptions about the willingness and ability of New Zealand farmers to pay for information (e.g. through private consultants) and the capacity of new, and generally smaller extension service groups, with less direct links to research organisations or library facilities, to remain abreast with new developments in technology and farming systems.

In the future an alternative source of management and technology advice may be available through computer-based expert systems technology (Gray *et al.*, 1992a). An expert system incorporates the knowledge of experts in an interactive program to work through typical farming decisions in a logical sequence. The result is a management recommendation that a farmer can then implement. The success of expert systems is dependent on whether the program is correctly targeted towards constraints to production and profit, and other factors such as the on-farm adoption rate and 'user-friendliness' of the software.

Research at Massey University has recently commenced to develop and evaluate an expert system to help dairy farmers with management decision-making in the summer-autumn period, and in particular the important decision of when to dry the herd off (Gray *et al.*, 1992b). It is important to confirm that the decision-making process for the model, which was derived from a series of interviews with four "expert" farmers, is consistent with that of the wider dairy farming population. A second requirement is to identify if, and in what form, farmers record the pasture and livestock data necessary to operate the expert system. A sample survey of seasonal dairy farmers in five geographically different farming areas in New Zealand was undertaken to obtain this information.

SURVEY METHOD

The names and addresses of dairy farmers in each of five areas - Northland (located within 100 km of Whangarei), the Waitoa and Te Aroha districts in the Waikato, South Taranaki, West Coast and Southland - were obtained through Dairy Board Consulting Officers and a dairy company field representative. After checking the supply lists for farms that were not suitable (e.g. those on winter milk), 50 farmers were

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selected for surveying by a systematic sampling procedure, where every n^{th} supplier on the supply list was chosen. A mail questionnaire was developed to obtain data on drying off management, general pasture and herd management, farmer beliefs about the importance of a range of dairy farm management options, milk production, herd size and milking area, and the use or non-use of computers. The questionnaire was pre-tested by four dairy farmers before being mailed in July with a stamped return-addressed envelope. The return-addressed envelope included a unique farm number that allowed follow up telephone contact with non-responding farmers. The response rate of 193 replies from 245 suitable farms was 79%.

Non-numeric responses and open-ended questions were coded for data analysis using the SPSSx (1988) program. Frequencies were calculated for non-parametric data and cross-tabulations were derived to describe differences in regional responses. Between region comparisons of numeric data were conducted using one-way analysis of variance and Duncan's test.

RESULTS AND DISCUSSION

Farmer and farm description

The average age of the responding farmers was 39 ± 0.7 (mean ± SEM) years. Farmers in the Waitoa district were significantly younger (34 ± 0.9 yrs) than those in the other survey regions, and this was reflected by a shorter period of farming experience (15 vs 18-20 years). The majority (68%) of the farmers were owner-operators, but sharemilkers (28%) and other (managers, lessee) farm positions were also represented by the survey. Sharemilkers (n = 51) were significantly younger than farm owners (32 ± 0.9 vs 42 ± 0.8 yrs; $P<0.05$) over the five regions in the study.

The median milk production per farm was 23,325, 24,412 and 26,230 kg milkfat (MF) in the 1989/90, 1990/91 and 1991/92 seasons, respectively (Table 1). The mean production data for the 1989/90 and 1990/91 seasons were similar to the corresponding national averages (LIC, 1992). Farm production was highest in the Waitoa and South Taranaki areas, and similar for the West Coast and Southland. Milk production per hectare and stocking rate was highest in the Waitoa district during the 1990/91 and 1991/92 seasons. This corresponds with the overall results for the South Waikato district which had the highest average district MF production in New Zealand during the 1990/91 season (LIC, 1992). Milkfat per cow on the surveyed farms was similar to the national average (151 vs 147 kg MF/cow in 1989/90 and 149 vs 148 kg MF/cow in 1990/91, LIC, 1992). Corresponding survey and national values for stocking rate were 2.53 vs 2.4 cows/hectare (1989/90) and 2.56 vs 2.4 cows/hectare (1990/91); and for milkfat per hectare 376 vs 352 kg (1989/90) and 382 vs 351 kg (1990/91). This comparison suggests that the farms of the survey respondents were up to 8% greater than the national averages for farm size and milk production. This relatively small difference indicates that the survey results can, with due regard to the data in question, be extrapolated to the wider dairy farming population in New Zealand.

TABLE 1: *Milk production (per farm, cow and hectare) herd size, milking area and stocking rate by region.*

Parameter	Region					n	Mean ± SEM	Median
	Nthld	Waitoa	Sth Tar.	West Coast	Sthld			
Milkfat to factory (kg)								
1989	23842^{a}	27711^{ab}	29143^{b}	22089^{a}	22740^{a}	164	25145 ± 817	23325
1990	24913^{b}	31176^{a}	28443^{ab}	23587^{b}	24621^{b}	181	26525 ± 829	24412
1991	26462^{ab}	30429^{ab}	31619^{a}	24797^{b}	25053^{b}	183	27678 ± 862	26230
Herd size (cows)								
1989	183^{ab}	197^{a}	179^{ab}	154^{bc}	137^{c}	163	170 ± 73	159
1990	187^{a}	196^{a}	184^{a}	168^{ab}	147^{b}	183	177 ± 73	168
1991	198^{a}	200^{a}	185^{ab}	166^{ab}	155^{b}	187	181 ± 75	170
Milking area (ha)								
1989	79^{b}	63^{a}	60^{a}	84^{b}	68^{a}	168	71 ± 29	67
1990	83^{b}	60^{a}	62^{a}	89^{b}	70^{a}	183	73 ± 30	69
1991	85^{b}	64^{a}	64^{a}	90^{b}	72^{a}	186	75 ± 32	72
Milkfat/cow (kg)								
1989	129^{a}	142^{b}	161^{c}	144^{b}	180^{d}	164	151 ± 27	158
1990	131^{a}	159^{bc}	153^{bc}	142^{b}	178^{bd}	180	152 ± 26	151
1991	131^{a}	155^{b}	169^{bc}	150^{b}	172^{bc}	183	155 ± 27	149
Milkfat/ha (kg)								
1989	313^{b}	468^{c}	479^{c}	268^{a}	349^{b}	163	376 ± 115	367
1990	304^{a}	532^{c}	454^{b}	275^{a}	353^{b}	179	382 ± 121	366
1991	318^{a}	512^{b}	495^{b}	284^{a}	353^{c}	182	392 ± 130	378
Stocking rate (cows/ha)								
1989	2.40^{b}	3.30^{d}	2.95^{c}	1.87^{a}	2.04^{a}	167	2.51 ± 0.73	2.53
1990	2.30^{b}	3.38^{d}	2.94^{c}	1.95^{a}	2.08^{a}	181	2.52 ± 0.69	2.56
1991	2.40^{c}	3.27^{e}	2.91^{d}	1.90^{a}	2.15^{b}	186	2.53 ± 0.69	2.54

^{a,b,c,d} Means in the same row with different superscripts differ at $P<0.05$.

Drying off management

The majority (69%) of farmers in each of the regions dried the herd off in stages rather than all at once. Cows were dried off prior to the main herd, often because they were first calvers or older cows in low condition with poor milk production (93%). Culling (1.5%) and the availability of pasture (1.5%), or a combination of these variables with cow condition and level of milk production were also considered by some farmers when drying off cows prior to the main herd. The main reason why herds were dried off in 1992 are listed in Table 2. The dominant influences on the drying off decision were the availability of pasture, or the availability of pasture plus average cow condition, weather conditions and the level of per cow milk production. The last day of milk collection was an important reason for drying off some herds in the two South Island regions. The factors prompting drying off were consistent with those reported by the expert farmers interviewed by Gray *et al.*, (1992b).

The drying off date was significantly earlier in Northland in 1990, 1991 and 1992 than in the other regions (Table 3). West Coast and Southland drying off dates were about two weeks later than those for Waitoa and South Taranaki, which were similar. The planned start to calving (PSC) in Northland was also earlier ($P<0.05$) than in Waitoa and South Taranaki, and as a consequence there was a smaller difference in the length of time cows were in milk. The PSC dates over the three years showed a slight trend towards earlier calving in each of the regions. The transfer of North Island cows to new Southland dairy farms probably contributed to the earlier PSC in this region in 1992.

Farmers rated pasture available at calving followed by cow condition at calving as having the largest influence on milk production during the first 8 weeks of lactation while drying off date received the lowest average rating. Thus,

TABLE 2: Reasons (% responses) why herds were dried off in 1992 (n = 193).

Reason	Northland	Waitoa	Sth Tar.	West Coast	Sthld	Total
Availability of pasture	20.0	36.1	42.9	36.8	43.6	36
Pasture and average cow condition	55.0	36.1	20.0	28.9	17.9	31
Pasture availability, weather conditions, milk production	17.5	19.4	22.9	15.8	12.8	18
Last day tanker collection	0.0	0.0	0.0	7.9	10.3	4
Other	7.5[a]	8.4	14.2	10.6	15.4	11

[a] Including: A combination of the factors listed above or the start of school holidays (1.1%), or the availability of off-farm grazing (0.5%).

TABLE 3: Mean drying off, planned start to calving dates and "dried off" interval (mean ± sd) in 1989, 1990 and 1991 in the five survey regions. The derived maximum average lactation length for the 1990/91 and 1991/92 seasons are also shown. Figures in brackets are the number of cases.

	Year 1990	1991	1992
Drying off date (date ± days)			
Northland	28 April ± 18[a]	21 April ± 24[a]	9 April ± 16[a]
Waitoa	5 May ± 13[b]	11 May ± 9[b]	30 April ± 11[b]
Sth Taranaki	6 May ± 11[b]	4 May ± 9[c]	3 May ± 10[b]
West Coast	20 May ± 10[c]	13 May ± 11[b]	19 May ± 10[cd]
Southland	21 May ± 10[c]	17 May ± 11[b]	13 May ± 15[c]
Mean	9 May ± 17(160)	7 May ± 15(175)	7 May ± 19(186)
Planned start to calving (date ± days)			
Northland	19 July ± 7[a]	17 July ± 10[a]	15 July ± 7[a]
Waitoa	29 July ± 7[b]	28 July ± 7[b]	27 July ± 7[b]
Sth Taranaki	25 July ± 9[b]	23 July ± 7[b]	23 July ± 10[c]
West Coast	24 August ± 9[c]	24 August ± 8[c]	21 August ± 7[d]
Southland	23 August ± 10[c]	23 August ± 10[c]	21 August ± 9[d]
Mean	5 August ± 17(178)	5 August ± 17(184)	5 August ± 17(189)
Dried off interval (days)			
Northland	81 ± 14[a]	87 ± 24[b]	97 ± 16[c]
Waitoa	85 ± 14[a]	77 ± 10[a]	86 ± 11[b]
Sth Taranaki	79 ± 13[a]	81 ± 12[ab]	79 ± 13[a]
West Coast	96 ± 13[b]	101 ± 14[c]	94 ± 13[c]
Southland	94 ± 14[b]	96 ± 15[c]	100 ± 17[c]
Mean	87 ± 15(157)	88 ± 18(172)	91 ± 16(184)
Maximum lactation (days)[1]			
Northland		274 ± 22[a]	267 ± 15[a]
Waitoa		286 ± 11[b]	279 ± 10[b]
Sth Taranaki		283 ± 12[b]	286 ± 12[bc]
West Coast		263 ± 14[c]	271 ± 13[a]
Southland		295 ± 15[c]	265 ± 18[a]
Mean		275 ± 18(167)	274 ± 16(179)

[a,b,c,d] Means in the same column with different superscripts differ at $P<0.05$.

[1] Maximum lactation = drying off date - planned start to calving. This calculation is a regional average.

farmers perceived factors close to the time of early lactation as having the largest influence on milk production, even though the drying off decision and subsequent winter management may have heavily influenced pasture reserves and cow condition at calving. A regional breakdown of the influence of drying off on early lactation indicated that South Taranaki farmers believed that this management decision was more important than those in the other regions, especially in Southland where 13% of the farmers scored drying off as having no influence on early lactation milk production. This regional difference may be attributable to the relatively shorter dry interval in South Taranaki (Table 3).

Pasture targets and feed budgeting

Pasture cover and rotation length targets for the five surveyed regions are presented in Table 4. Pasture cover targets at drying off were on average 334 kg DM/ha lower than those specified for the commencement of calving. The average drying off target pasture cover of South Taranaki farmers was most similar to that used by the Manawatu 'expert' farmers (Gray *et al.*, 1992b). Thus farmers, except on the West Coast, generally expected pasture cover to accumulate over the winter period at rates varying from 4 to 6 kg DM/ha/day during the dry interval. To achieve this rate of net pasture accumulation at the stocking rates reported would require a high level of supplementation, use of nitrogen, grazing off of livestock or a combination of these management options. It is doubtful, therefore, that the targets are achieved, especially as only 22% of the farmers prepared a formal (i.e. written) feed budget which would allow progress towards the target to be monitored.

Although the number of farmers able to specify rotation lengths was low, the average rotation length decreased, as expected, from the time the herd was dried off until 6 weeks after calving, but did not show the increase in length that could be expected from north to south in association with cooler winter temperatures, *ceteris paribus*. A similar comment applies to the pasture cover targets which were higher in South Taranaki than for the West Coast or Southland for each of the dates targets were requested for. The lower stocking rate (Table 1) and the later start to calving (Table 3) in the South Island regions would both allow a lower level of pasture cover to be adopted at drying off, but this effect is likely to be countered to varying extents by the lower winter growth rates of pastures in these areas.

The West Coast dairy farmers surveyed expected a net accumulation of pasture from the start of calving to 6 to 8 weeks post-calving. This suggests that either the mean stocking rate could be increased, or that the mean herd calving date could be brought forward for West Coast farms.

Cow condition scoring

Cows were condition scored most frequently during the winter and spring, but a large group of farmers never scored cows at all during one or more of the seasons (29%), particularly summer (42%). Condition scoring was least widely practised in Southland. District regional differences in the method used to condition score cows were reported (Table 5). The recommended 1 to 10 scale, described by Scott and Smeaton (1980), was used by 40% of the farmers, with the highest level of adoption being in Northland. This was often combined with an informal, but less systematic, visual assessment of cow condition, which was most popular in South Taranaki and Southland. Interestingly, 17% of respondents used a 1 to 5 scoring scale (one of the options listed in the question), but their target condition scores at drying off and the commencement of calving were similar to those using the 1 to 10 scale. Drying off condition score (CS) targets were 0.5 to 1.0 unit lower than those desired at calving as Gray *et al.*, (1992b) had identified. The need for farmers, on average, to both increase cow condition and accumulate pasture cover by calving (as noted previously) suggests an inconsistency in the management targets reported and is an area where the expert system could assist management to appreciate the interactions between pasture cover and cow condition at drying off and subsequent herd and pasture performance.

Management decision aids

Daily milkfat, or milk solids production was derived from the 10-day factory returns by between 70 and 84% of the farmers in the surveyed regions. Some farmers indicated that MF/ha and a cumulative MF production curve were also derived. This was regarded by the 'expert' farmers as a vital source of information for decision making during the autumn (Gray *et al.*, 1993). Pregnancy and herd testing had been used by 84 and 65% of the farmers during the previous two milking seasons. However, pregnancy testing was usually restricted to late cows, likely cull cows or to animals that the

TABLE 4: Regional pasture cover (kg DM/ha) and rotation length (days) targets. Figures in brackets are the number of responses.

	Pasture target at:							
	Drying off		Calving		Post-calving			
Region	kg DM/ha	days	kg DM/ha	days	kg DM/ha	days		
Northland	1606[a] (8)	40 (2)	2085[b] (23)	- (0)	1750[b] (12)	21 (1)		
Waitoa	1795[b] (10)	94 (7)	2277[bc] (11)	36 (5)	1807[b] (7)	25 (10)		
Sth Taranaki	2129[c] (10)	55 (4)	2450[c] (8)	66 (2)	2266[a] (10)	25 (4)		
West Coast	1855[a] (8)	91 (8)	1822[a] (9)	58 (6)	2000[a] (8)	28 (9)		
Southland	1619[b] (7)	42 (1)	2083[ab] (9)	85 (2)	1533[b] (3)	23 (3)		
Mean (total)	1795 (43)	78 (22)	2129 (60)	55 (15)	1923	26 (27)		
SEM	51	7	43	9	61			

[a,b]Means in the same column with different superscripts differ at P<0.05.

TABLE 5: Condition scoring methods by region (% respondents using each alternative, n=193).

Region	Condition Scoring Method			
	Visual	1 to 10 scale	1 to 5 scale	Other
Northland	28[a]	58	23	2
Waitoa	44	33	28	0
Sth Taranaki	59	33	10	3
West Coast	39	33	21	8
Southland	59	44	5	0
Survey average	46	40	17	2[b]

[a] Percentage of respondents within a region who indicated they were using this method.
More than one method was used by farmers in some cases.
[b] This includes scoring scales with an upper value lying between 5 and 10.

farmer was not sure had conceived. Herd testing was adopted by 46% of the West Coast farmers, in contrast to 82% in South Taranaki and 65% of the farmers overall. The reasons for the regional disparity in the use of herd testing was not able to be determined, but it may relate to differences in the financial position of the respondents during 1990/91 when MF prices were at a low level. Both pregnancy and herd testing data could be incorporated into the expert system model to guide autumn management decisions. Climate data was not widely collected (maximum of 41% of the respondents in South Taranaki), despite weather conditions clearly having a significant impact on pasture growth and hence herd productivity throughout New Zealand. Rainfall was least often recorded on the West Coast (probably reflecting the relatively high and evenly distributed rainfall of this region). With the exception of Northland (20%) soil temperatures were recorded by 3-8% of the respondents in the remaining regions. Climate data would provide a means for forecasting short-term pasture growth in the expert system model.

Computers and their use

The percentage of farmers making regular use of computers in their farm business was 30% in Northland, 11% in Waitoa, 8% in Taranaki, 21% on the West Coast and 12% in Southland ($P<0.05$); to give an overall survey average of 17%. Thirty five farmers (19%) owned a computer and printer (27 were IBM or IBM compatible, 4 were Apple-based systems, the remainder were Commodores or Amigas). One farmer used a dairy farm simulation program (UDDER) by working closely with a local consultant. In most cases computer work was completed by the respondent (73% of the computer owners), their spouse (48%), an accountant (40%) or a consultant (21%). The main tasks computers were used for were recording income and expenditure, letter and report writing, education and games, and financial planning. These results are similar to those described by Nuthall (1992) in a more comprehensive survey of computer use by New Zealand farmers.

Farmers in the survey who owned computers were not significantly younger, and in 1991/92 did not have higher levels of total milk production, larger farms or more cows than those who did not own a computer. However, the overall highest educational qualification of computer owners was higher than non-owners ($\chi^2 <0.05$) and more computer owners prepared a formal pasture feed budget than those without this technology (32 vs 21%, $\chi^2 <0.05$). A number of the respondents indicated that they planned to buy a computer once discretionary cash was available. Farmers who did not own computers indicated that lack of experience (mentioned by 60% of the respondents), cost of computers (40%), lack of time to learn how to use computers (34%), lack of confidence to learn (22%), and no interest in computers (27%) or of no perceived help to management (27%) as reasons why they did not use computers on their farms. These findings suggest that an expert system should be formatted to minimise operation time and learning requirements.

CONCLUSIONS

The results from the regional survey of seasonal supply dairy farmers have confirmed most aspects of the general framework used by the Manawatu 'expert farmers' for managing the drying off decision (Gray *et al.*, 1992b). However, many dairy farmers indicated that they only use visual procedures to assess pastures and cow condition. Calibrating these informal estimates with objective measures in the expert system will be necessary, and is a topic that requires further study. The low, but increasing rate of computer usage on farms, indicates that an expert system for dairy farmers should initially be targetted at consultants who could provide a bureau service for individual clients.

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