INTERRELATIONSHIPS BETWEEN SOMATIC CELL COUNTS, PRODUCTION, AGE AND MASTITIS ORGANISMS IN INDIVIDUAL COWS

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SUMMARY

Results from repeated somatic cell counts on individual cows were examined from 60 herds. The age effect on cell counts was studied and Production Index was related to cell count levels and age. Six herds were used to study effects of dry cow therapy on cell counts and also for milk bacteriological studies.

Cell counts increased with age, as did the incidence of mastitis pathogens. Older cows with high cell counts had lower production than those with low cell counts. No significant differences occurred in cell counts between cows treated and not treated at drying off.

INTRODUCTION

Somatic cell counting has been widely used in New Zealand in the diagnosis of subclinical mastitis (Brookbanks, 1973; Elliott *et al.*, 1966). Routine counting of somatic cells in bulk milk samples was promoted (Milne *et al.*, 1977) and is now common practice in New Zealand. The California Mastitis Test has been used by veterinarians (Moller, 1978) and farmers alike as an indirect method of cell counting to identify infected quarters in individual cows. Many countries have introduced cell counting programmes using automated laboratory equipment for testing milk.

The following study examined 60 production-tested herds using the milk somatic cell counting service provided by the Wellington-Hawke's Bay Livestock Improvement Association (LIA). This paper is a preliminary report of a project to examine repeated somatic cell counts on individual cows. Part of the study examines the effect on cell counts of treating cows with antibiotics at drying off.

EXPERIMENTAL

Individual cows have been cell counted three times per season, using composite cow milk samples collected for production testing under the LIA "self-sample" scheme. Cell counting was per-

formed using the automated Fossamatic Cell Counter (Foss Electric Co., Denmark; Heeschen, 1975).

Six self-sample herds not using the cell count option were also tested. These farmers did not receive their cell count results last season (1977-8). The cows were divided randomly in each herd, and at the end of the season half the herd was treated with "Combisec Dry Cow" antibiotic (Pfizer & Co.), while the remainder were untreated as controls. These six herds are referred to as "phantom" herds. Cell counting is continuing on phantom herds this season, and 35% of cows have been sampled once for mastitis bacteriology studies. A second sampling of the same cows has not yet been completed.

Each individual cell count was scored 0, 1, 2 or 3; the maximum cell count values for the four scores were (cells per ml $\times 10^3$) 299, 499, 999 and >999, respectively. With three results for each cow per season, the total possible score values range from 0 to 9.

RESULTS AND DISCUSSION

Table 1 demonstrates the relationship between the scoring system and real cell count values. The relationship is approximately linear up to score 6, with scores 1 to 6 equalling a real

TABLE 1: GEOMETRIC MEAN CELL COUNT OF PHANTOM AND NON-PHANTOM HERD COWS RELATED TO TOTAL CELL COUNT SCORE FROM THREE TESTS

Cell Count Score	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Phantom herd cows										
Geometric mean cell count $\times 10^3$/ml	114	195	241	333	457	597	734	996	1256	1825
S.D.	45	62	74	91	68	103	144	170	467	449
Non-phantom herd cows										
Geometric mean cell count $\times 10^3$/ml	106	202	245	340	460	585	720	892	1392	1775
S.D.	45	54	71	88	80	120	113	125	534	531
Mean cell count $\times 10^3$/ml	110	198	243	337	458	591	727	944	1324	1800

Total $n = 2443$

cell count of approximately 10^5 times their own value. There were no major difference in values between phantom and non-phantom herd cows.

A study of bulk milk cell counts during the 1978-9 season from 1029 Manawatu herds showed that 72% of herds in the LIA cow cell counting scheme had bulk milk cell counts below 300 000 cells/ml, compared with 59% of all herds. It indicates that herds joining the LIA scheme have lower than average levels of subclinical mastitis.

TABLE 2: PRODUCTION INDEX, CELL COUNT AND AGE INTERACTIONS

Cell Count	*2 yr*		*3 yr*		*4–8 yr*		*>8 yr*	
Score	% *Cows*	*PI*	% *Cows*	*PI*	% *Cows*	*PI*	% *Cows*	*PI*
0 – 2	92	104.8	88	108.6	70	105.1	44	96.4
3 – 4	5	101.7	9	104.4	17	103.5	17	105.8
5 – 7	3	112.9	2	110.1	9	100.7	23	98.8
8 – 9	0	—	1	99.3	4	95.9	16	91.2
	n = 414		n = 408		n = 1257		n = 198	

In Table 2 the production index (PI), total cell count score and age of 2277 cows are examined. (The production index is a countrywide ranking (mean = 100) of a production record after correcting for calving date, age, breed and herd environment.) The sample includes phantom and non-phantom herd cows; the data were obtained over the 1977-8 dairy season.

Age effects on cell count are apparent in Table 2. The percentage of cows with low cell counts that score 0 to 2 was reduced from 92% of 2-year-olds to 44% of "old" cows. There are no 2-year-olds and only 1% of 3-year-olds with high cell counts scoring 8 to 9, compared with 16% of "old" cows in this category. Natzke and Everett (1972) reported that uninfected cows showed only a slight increase in cell count with age.

In Table 2 the effects of cell counts on PI are not clear cut in the 2- and 3-year-olds because of insufficient numbers of cows in the high cell count groups. However, between score groups 0 to 2 and 3 to 4 there was a drop in PI of 3.1 in the 2-year-olds and 4.2 in the 3-year-olds. In the 4- to 8-year-old group there was a consistent drop in PI as cell counts increased. Cows with cell count scores between 0 and 2 showed a PI advantage of 9.2

TABLE 3: COW AGE RELATED TO THE INCIDENCE OF MASTITIS PATHOGENS

	2	*3*	*4*	*5*	*6*	*7*	*8*	*>8*
	%	%	%	%	%	%	%	%
Primary pathogens	6	11	22	15	21	43	40	34
Secondary pathogens	34	32	28	44	26	43	33	34
Non-infected	60	57	50	41	53	14	27	32

$n = 331$.

compared with those with scores between 8 and 9. The 4- to 8-year-old cows represent 55% of the total sample. In the old cows the high cell count group scoring 8 to 9 had the lowest PI, although there was no production trend between other cell count groups.

In Table 3 the primary pathogens were predominantly haemolytic *Staphylococcus aureus* and *Streptococcus* organisms. Secondary pathogens were predominantly *Corynebacterium bovis* and *Micrococcus,* which are generally harmless commensals. There was an increase in cows infected with primary pathogens as age increased, and a decrease in non-infected quarters as age increased. Although bacteriological sampling has not been completed in this study, it shows that more older cows are infected with primary pathogens. The decrease in infected old cows is very likely due to culling. Reichmuth *et al.* (1976) suggest that as the probability of cows being infected increases, so will the cell level — and this is a function of age. The cell count/age interaction (Table 1) would appear to be associated with a higher incidence of true mastitis infection in older cows.

Table 4 demonstrates the higher cell count levels in cows infected with primary pathogens compared with the lower cell counts of non-infected cows.

TABLE 4: COW CELL COUNTS RELATED TO MASTITIS PATHOGENS

Cow Cell Count $\times 10^3$	*0 – 200*		*201 – 500*		*501 – 1000*		*>1000*	
	No.	%	*No.*	%	*No.*	%	*No.*	%
Primary pathogens	14	6	24	39	16	72	25	92
Secondary pathogens	73	34	21	33	5	23	—	—
Non-infected	131	60	18	28	1	5	2	8

TABLE 5: EFFECTS OF DRY COW THERAPY ON CELL COUNTS

	Total Infections,[1] *End of 77/78 Season*	*Total Infections, Start of 78/79 Season*	*New Infections, Start of 78/79 Season*	*Uncured Start of 78/79 Season*
Controls	18%	10%	6%	29%
Treated	27%	12%	2½%	37%
P	<0.05	n.s.	n.s.	n.s.

[1] Cows with cell counts > 300 000 cells/ml referred to as infected.

Table 5 indicates that there are no significant differences between controls and treated cows in new infection rate, uncured cows or total infections in the season after treatment with dry cow therapy. New infections and reinfections may have occurred around calving and these would not be affected by dry cow therapy. Because of the low infection status of phantom herd there were low numbers in the infected groups.

The high rate (71%) of spontaneous cures in the control group is an interesting feature that has been observed in other trials over the last two seasons.

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