EFFECT OF ORAL ADMINISTRATION OF BIOSTART ON ADULT DAIRY COWS

Introduction

This is a preliminary report on the effects of drenching adult dairy cows with 15mls Biostart® at weekly intervals from calving for 21 weeks.
Two farms were enrolled with a combined maximum total of 676 cows at any one herd test.

Feeding regimes were similar. Both herds were fed a strictly pasture based diet with no supplements other than forage. Calving started in early to mid August.

Outcome variables measured were:

1. Milk production data:
    a. Daily MS kg. Measured over 3 herd tests, one in October, one in December, and one shortly after the drenching period had finished in February.
    b. SCC. As above.
2. Reproductive data:
    a. Days from PSM (planned start of mating) to conception
    b. Number of anoestrus cows treated
    c. 4 and 8 wk in calf rate (ICR)
3. Biochemical data:
    - Serum B12
    - Serum Se

Results were analysed both on a farm basis, and on an overall basis. Data was also broken down into ages and age groups. Farms were designated as follows:

Farm T: 291 cows; XB. Large number of cows <5yo (75%).

Farm Y: 395 cows; Jersey. Much higher proportion of older cows. (Only 56% <5yo).

Results

- ## 1a: Daily Milk Solids production

All data was collated from herd tests and screened for missing data and outliers. Days in milk (DIM) were calculated from given calving dates for each cow for each herd test.

An independent samples t-test was used to verify that the treatment and control groups were equivalent in regards to age, and to screen the data for effect patterns.

A univariate GLM was used (ANOVA) to analyse the data. For each outcome variable the fixed factor was given as treatment group; random factors included Age or Age stratified (Age2); and Farm where appropriate; covariates were DIM and DIM2; full interaction terms were included. The model was developed using a backward stepwise process, discarding variables with highest p values at each stage.

DIM and DIM2 were more likely to be used (lower p value) where the outcome variable was Oct MS rather than Dec MS.

Because the treatment effect was dramatically modified by age, such that cows over 5yo appear to be less affected, models were produced using all age groups and then cows under 5yo only. Models were also produced for each farm and then for all cows together, where Farm was introduced as a categorical variable. Farm therefore represents a range of factors such as breed, management, staff, geographical area and soil and pasture conditions.

Models therefore varied for each outcome variable depending on the relevant significance of the other factors and covariates. All p values given are from the GLM models and treatment effects are therefore calculated after correcting for any effect of age, DIM, Farm, or other significant factor.

For Farm Y, age was reclassified into broader categories. However, for Farm T where the age groups were limited, only older cows 5yo or over were grouped.

There was no difference in age groupings for either treatment or control group ($p = 0.376$), see Table i.

Table i: Age breakdown treatment and control groups

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
AGE	treatment	327	4.4343	2.34739	.12981
	control	359	4.2758	2.38225	.12573

Tables and Figures 1-3 show the data for daily MS production for all cows enrolled, and then for both farms combined. In the graphs and tables data with the same subscript are significant at $p < 0.05$; data with differing subscript are significant at $p < 0.10$.

Results

Table 1: Daily MS, all cows

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Ms/day Oct	treatment	297	1.6066a	.39099	.02269
	control	309	1.5266 a	.37567	.02137
Ms/day Dec	treatment	315	1.5528	.32068	.01807
	control	339	1.4942	.33494	.01819
Ms/day Feb	treatment	323	1.4728	.31316	.01742
	control	353	1.4255	.33618	.01789

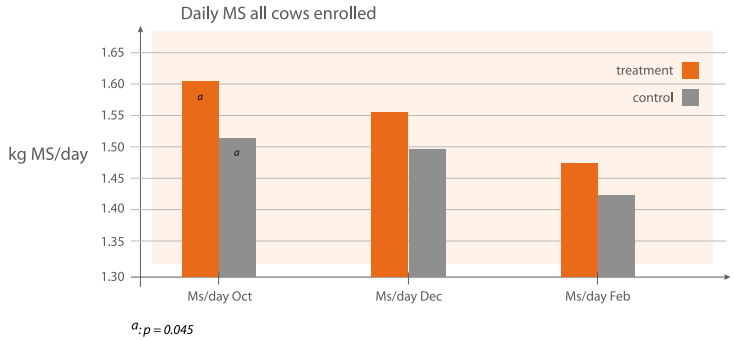
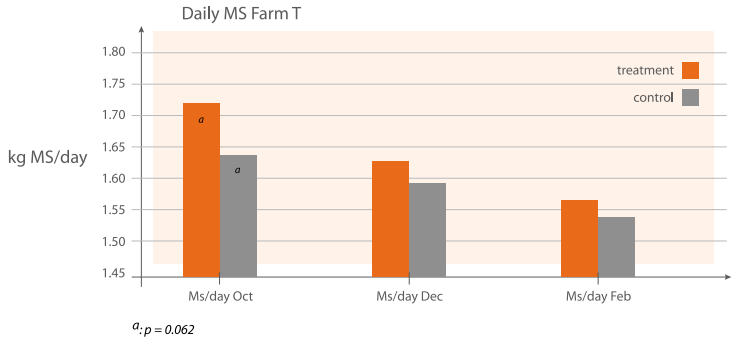


Table 2: Farm T. Daily MS all cows.

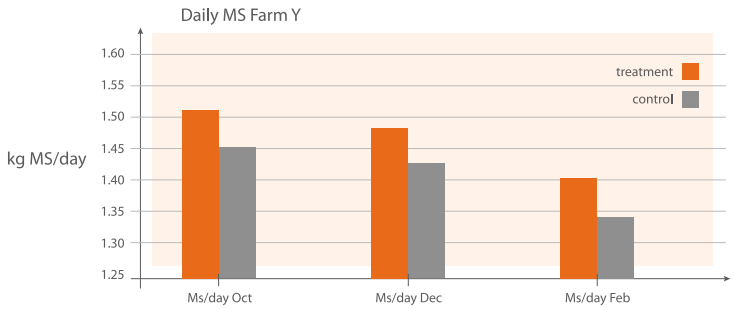
	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Ms/day Oct	treatment	126	1.7269 [a]	.33365	.02972
	control	117	1.6474 [b]	.35127	.03248
MS/day Dec	treatment	136	1.6388	.29169	.02501
	control	128	1.5925	.31412	.02776
MS/day Feb	treatment	144	1.5618	.27277	.02273
	control	141	1.5438	.28345	.02387



Results

Table 3: Farm Y. Daily MS all cows.

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Ms/day Oct	treatment	171	1.5179	.40704	.03113
	control	192	1.4529	.37180	.02683
MS/day Dec	treatment	179	1.4874	.32700	.02444
	control	211	1.4345	.33380	.02298
MS/day Feb	treatment	179	1.4011	.32565	.02434
	control	212	1.3469	.34594	.02376

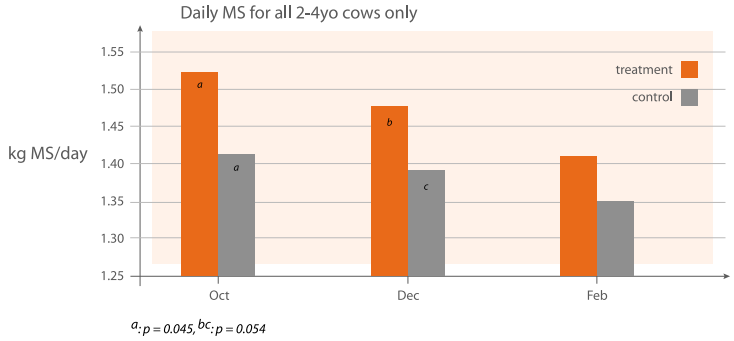


In both farms and as a whole, there is an overall increase in production for all three herd tests for the treated cows compared with the controls. Figures and Table 4 (Appendix 1) break these down on an age basis for all cows; and Figures 6-7 and Tables 5 & 6 show this on an age basis for each herd. (All Appendix 1). The effect of treatment is modified by age. There appears to be a more pronounced and regular effect in animals under 5yo.

When this group of animals was analysed in isolation, the results can be seen in Tables 7-9, and in Figures 7 to 9 below.

Table 7: Daily MS for all 2-4yo cows only

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Oct	treatment	191	1.522 [a]	0.3487	0.0252
	control	201	1.417 [a]	0.3398	0.0240
Dec	treatment	200	1.478 [b]	0.2931	0.0207
	control	219	1.389 [c]	0.2795	0.0189
Feb	treatment	205	1.414	0.2782	0.0194
	control	233	1.351	0.2635	0.0173



Results

Table 8: Farm T: Daily MS for all 2-4yo cows only

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Oct	treatment	96	1.668 [a]	0.2991	0.0305
	control	89	1.549 [a]	0.3193	0.0338
Dec	treatment	103	1.580 [b]	0.2572	0.0253
	control	94	1.487 [b]	0.2577	0.0266
Feb	treatment	110	1.507 [c]	0.2540	0.0242
	control	107	1.460 [d]	0.2427	0.0235

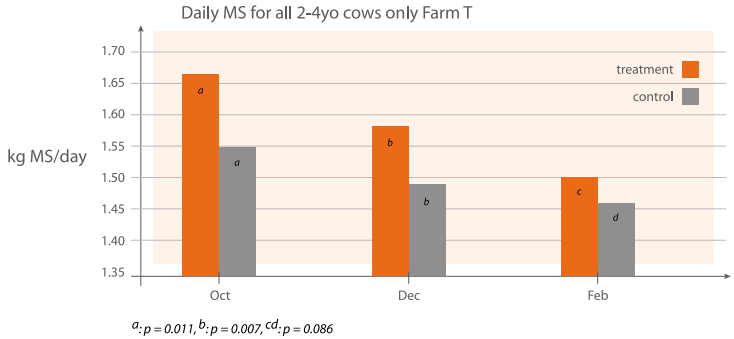
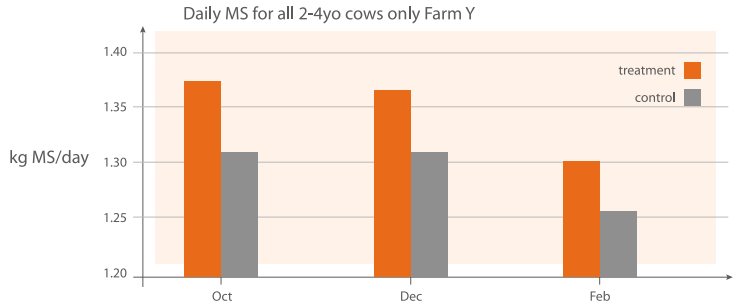


Table 9: Farm Y: Daily MS for all 2-4yo cows only

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Oct	treatment	95	1.375	0.3341	0.0343
	control	112	1.311	0.3193	0.0302
Dec	treatment	97	1.369	0.2906	0.0295
	control	125	1.315	0.2734	0.0245
Feb	treatment	95	1.306	0.2666	0.0274
	control	126	1.259	0.2454	0.0219



This data was then broken down into each age for 2- 4yo. The results can be seen in Tables 10-12 and Figures 10-12(Appendix1).

Results

- 1B: SCC

  There was no significant effect on SCC. Log SCC was used for all analyses because SCC does not have a normal distribution. The effects of treatment on SCC are shown in Table 9.

Table 9: Log SCC for all cows

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Log Oct SCC	treatment control	303 321	1.9323 1.9312	.54487 .50762	.03130 .02833
Log Dec SCC	treatment control	320 347	1.9099 1.9523	.49782 .51209	.02783 .02749
Log Feb SCC	treatment control	311 329	1.9651 1.9593	.51381 .52376	.02914 .02888

Results

- 2. Reproductive Effects

The reproductive effects of treatment were assessed using 3 techniques: in calf rates (ICRs) at 4 and 8 weeks; Kaplan Meier survival analysis on planned start of mating (PSM) to conception intervals; and incidence of treatment for anoestrus.

In calf rates (ICR)

4 and 8 week ICRs are a commonly used measure of reproductive efficiency, as espoused by the Australian In Calf Project. They measure the speed a herd gets in calf, and so have a crucial role in assessing the reproductive efficiency of a herd. Tables 13 and 14 show the ICRs for 4 and 8 week for treatment vs control cows over all farms.

Table 13: 4 week ICR

	TREATMENT	CONTROL
In calf	150	180
Not in calf	304	322
% age	0.49	0.56

P = 0.1004

Table 14: 8 week ICR

	TREATMENT	CONTROL
In calf	222	243
Not in calf	82	79
% age	0.73	0.75

P = 0.4852

There was no difference in the 8 week ICR. There was a tendency for more cows in the control group to be in calf in the first 8 weeks, but this was not significant.

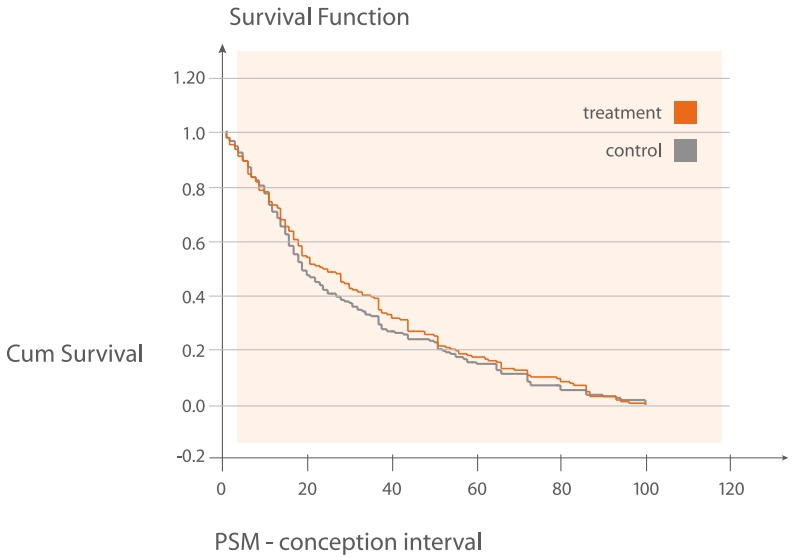
Results

Survival Analysis

Kaplan Meier survival analysis was performed on postulated risk factors, prior to performing a Cox Regression. Risk factors with log rank statistics lower than p = 0.2 were carried into a Cox Regression analysis. Postulated risk factors were treatment group; farm, anoestrus treatment; calving to PSM period <42days.

There was no significant difference between separate farms (Log Rank statistic 0.14; p = 0.7071). Treatment group was also not significant (Log Rank statistic 0.81; p = 0.3668). Anoestrus treatment was significant (Log Rank statistic 20.86; p = 0.000); and so was calving to PSM <42 days (Log Rank statistic 14.27; p = 0.0002).

Figure 13: Survival Function of treatment vs control Groups



When the last 3 risk factors were entered into a Cox Regression model, treatment group had a mildly positive effect on days to conception. However, it was not significant at p = 0.159. Anoestrus treatment and calving – PSM interval were highly significant. Cox regression on treatment effect is not valid.

There was no significant difference between the treatment and control groups when stratified for age.

Incidence of anoestrus treatment

There was no significant difference between groups in the incidence of anoestrus.

Table 15: Incidence of anoestrus

	ANOESTRUS	CYCLING
Treatment	295	32
Control	331	28

P = 0.357

Results

- 3. Biochemistry

A subsection of cows from each group was blood tested prior to the period of administration of Biostart®, and at the end of the treatment period. Serum samples were analysed for serum Selenium levels and serum B12 levels.

The results are displayed below (Table 16 and Figs 14 & 15).

Table 16: Pre and post treatment serum Se and B12 levels by treatment group

	GROUP	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
Log Oct SCC	treatment control	303 321	1.9323 1.9312	.54487 .50762	.03130 .02833
Log Dec SCC	treatment control	320 347	1.9099 1.9523	.49782 .51209	.02783 .02749

Figure 14: Pre and post treatment serum Se levels by treatment group

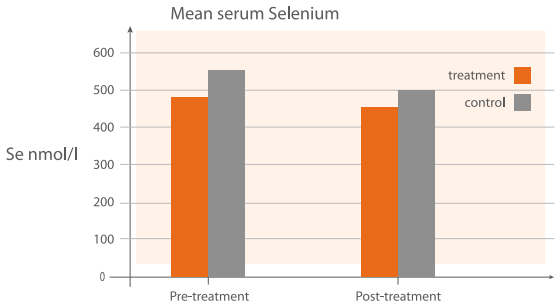
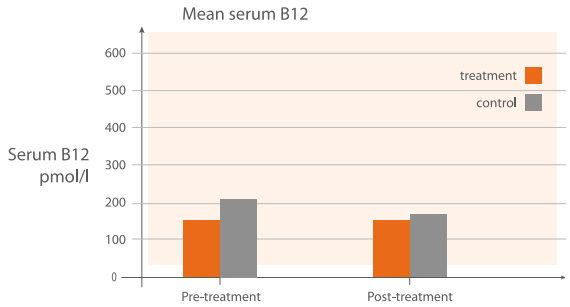


Figure 15: Pre and post treatment serum B12 levels by treatment group

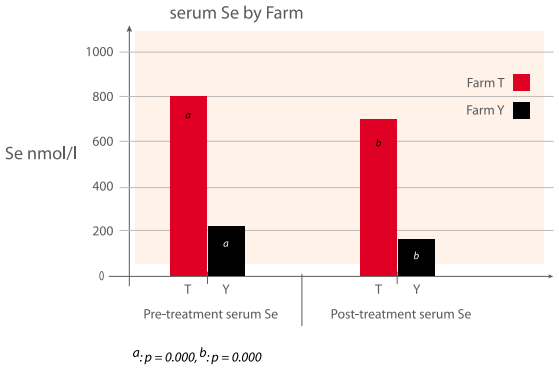


There was no difference between the groups at the commencement of the treatment period. Following treatment, there was no difference in serum Selenium or serum B12 levels between the groups.

Results

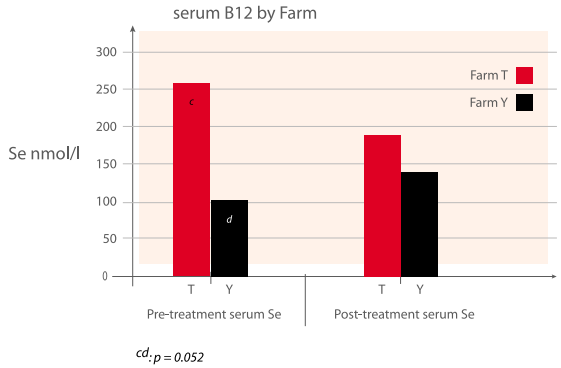
There was a farm variation in biochemistry levels. Farm T had significantly higher serum Selenium levels (Figure 16) both pre- and post-treatment. Farm T also had higher serum B12 levels pre-treatment but not post-treatment (Figure 17).

Figure 16: Pre and post treatment serum Se levels by Farm



a: p = 0.000, b: p = 0.000

Figure 17: Pre and post treatment serum B12 levels by Farm



cd: p = 0.052

The serum B12 levels of both farms was not significantly different following treatment.

Conclusions

- ### 1. Milk Production

  Oral administration of 15mls of Biostart weekly from calving increased milk production at the first herd test (October),after adjusting for age and days in milk (DIM). (1.606 vs 1.526; p = 0.045). There was a numerical but not a statistical effect at the December herd test (1.552 vs 1.494; p = 0.299). In the herd test immediately following cessation of treatment (February), there was no real effect (1.472 vs 1.425; p = 0.684).

  The effect of Biostart varied with age and with farm. Farm is a proxy for a range of factors such as breed, geography, management, genetics etc. The effect of Biostart was more noticeable in the cross bred herd than in the Jersey herd. (October herd test XB herd 1.73 vs 1.647; p = 0-.062: Jersey herd 1.52 vs 1.43; p = 0.27).

  Age distribution was different between the two farms.

  The effect of Biostart was mixed in cows age 5 and over. The effect in cows under 5 was almost wholly positive, with 2yo and 4yo cows responding more favourably. When only 2-4 yo cows were analysed, treated cows produced significantly more milk than control cows in October (1.688 vs 1.549; p = 0.028); and tended to produce more milk in December (1.580 vs 1.487; p = 0.054). There was no effect in February production.

  This effect was more marked in the XB herd when analysed alone.

  There was no effect on SCC.

- ### 2. Reproductive Effects

  There were no significant differences between treatment and control groups in regard to reproductive efficiency. The normal risk factors applied: calving-PSM interval and anoestrus treatment.

- ### 3. Biochemistry Results

  There were no significant differences between groups in terms of serum biochemistry for B12 and Selenium levels as far as was measured.
  There is probably a benefit in performing more serum analysis during the period of treatment to ascertain any more subtle changes.

Appendix 1: Descriptive Statistics Tables and Figures

Table 4: Daily ms by age for all cows

		TREATMENT				CONTROL			
AGE		MEAN	SD	SEM	N	MEAN	SD	SEM	N
2	Oct ms/dy	1.290	0.2852	0.0346	71	1.203	0.2534	0.0273	93
	Dec ms/dy	1.251	0.2419	0.0298	71	1.179	0.2014	0.0216	93
	Feb ms/dy	1.200	0.2561	0.0308	71	1.163	0.1757	0.0184	93
3	Oct ms/dy	1.561	0.3143	0.0424	62	1.545	0.3111	0.0405	72
	Dec ms/dy	1.484	0.2308	0.0296	62	1.493	0.2275	0.0274	72
	Feb ms/dy	1.423	0.2168	0.0280	62	1.421	0.2266	0.0269	72
4	Oct ms/dy	1.723	0.2950	0.0358	76	1.609	0.3027	0.0404	72
	Dec ms/dy	1.677	0.2293	0.0268	76	1.564	0.2377	0.0299	72
	Feb ms/dy	1.601	0.1913	0.0219	76	1.522	0.2424	0.0288	72
5	Oct ms/dy	1.825	0.4624	0.0697	47	1.855	0.3122	0.0476	50
	Dec ms/dy	1.741	0.3671	0.0547	47	1.783	0.3029	0.0428	50
	Feb ms/dy	1.658	0.2966	0.0442	47	1.703	0.2879	0.0411	50
6	Oct ms/dy	1.788	0.2970	0.0939	14	1.796	0.3651	0.0976	15
	Dec ms/dy	1.767	0.2147	0.0595	14	1.703	0.3092	0.0826	15
	Feb ms/dy	1.696	0.1577	0.0421	14	1.622	0.2641	0.0682	15
7	Oct ms/dy	1.914	0.3358	0.0969	13	1.725	0.2824	0.0851	12
	Dec ms/dy	1.768	0.3039	0.0843	13	1.725	0.2309	0.0666	12
	Feb ms/dy	1.722	0.2183	0.0606	13	1.611	0.2270	0.0684	12
8	Oct ms/dy	1.695	0.3350	0.0967	14	1.486	0.4289	0.1430	11
	Dec ms/dy	1.601	0.2631	0.0703	14	1.548	0.4091	0.1234	11
	Feb ms/dy	1.493	0.1963	0.0525	14	1.494	0.3701	0.1170	11
9	Oct ms/dy	1.626	0.3888	0.0972	16	1.623	0.3797	0.0895	19
	Dec ms/dy	1.649	0.2219	0.0555	16	1.591	0.4435	0.1017	19
	Feb ms/dy	1.549	0.1952	0.0488	16	1.624	0.2224	0.0539	19
10	Oct ms/dy	1.815	0.1741	0.0870	6	1.595	0.3414	0.1707	5
	Dec ms/dy	1.672	0.2633	0.1075	6	1.570	0.3130	0.1400	5
	Feb ms/dy	1.565	0.3518	0.1436	6	1.492	0.3345	0.1496	5
11	Oct ms/dy	1.583	0.6816	0.3408	4	1.687	0.1656	0.0956	3
	Dec ms/dy	1.330	0.4678	0.2339	4	1.623	0.1943	0.1122	3
	Feb ms/dy	1.270	0.4058	0.2029	4	1.560	0.2307	0.1332	3
12	Oct ms/dy	1.325	0.3813	0.1906	4	1.438	0.4008	0.2004	4
	Dec ms/dy	1.288	0.3142	0.1571	4	1.363	0.3956	0.1978	4
	Feb ms/dy	1.235	0.2528	0.1264	4	1.273	0.3538	0.1769	4
13	Oct ms/dy	.	.	.		1.655	0.2475	0.1750	2
	Dec ms/dy	.	.	.		1.640	0.3818	0.2700	2
	Feb ms/dy	.	.	.		1.590	0.3960	0.2800	2

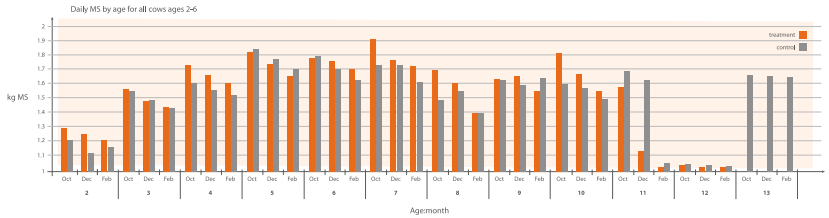
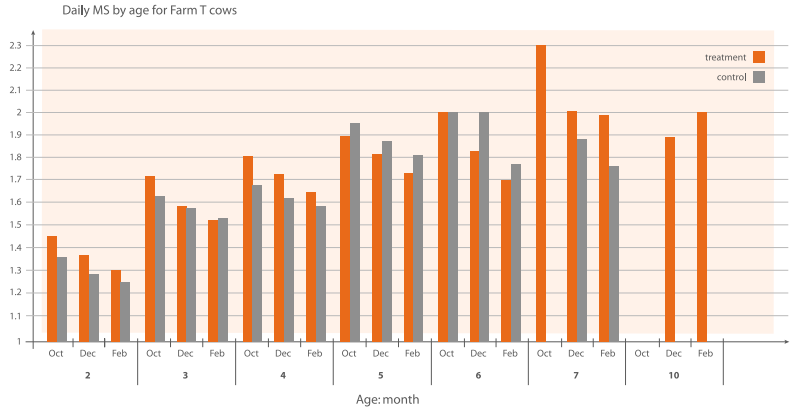


Table 5: Daily ms by age for Farm T cows

		TREATMENT				CONTROL			
AGE		MEAN	SD	SEM	N	MEAN	SD	SEM	N
2	Oct ms/dy	1.458	0.2480	0.0438	35	1.365	0.2061	0.0359	36
	Dec ms/dy	1.373	0.2002	0.0354	35	1.287	0.1730	0.0301	36
	Feb ms/dy	1.304	0.2464	0.0416	35	1.249	0.1474	0.0246	36
3	Oct ms/dy	1.719	0.2229	0.0465	28	1.628	0.3616	0.0738	29
	Dec ms/dy	1.587	0.1938	0.0373	28	1.573	0.2605	0.0511	29
	Feb ms/dy	1.528	0.1745	0.0330	28	1.539	0.2074	0.0392	29
4	Oct ms/dy	1.804	0.2855	0.0446	47	1.680	0.2995	0.0529	44
	Dec ms/dy	1.727	0.2262	0.0341	47	1.611	0.2081	0.0352	44
	Feb ms/dy	1.646	0.1967	0.0287	47	1.584	0.2111	0.0322	44
5	Oct ms/dy	1.894	0.3753	0.0709	31	1.953	0.2252	0.0442	31
	Dec ms/dy	1.810	0.3355	0.0623	31	1.877	0.2615	0.0470	31
	Feb ms/dy	1.727	0.2704	0.0502	31	1.815	0.2253	0.0411	31
6	Oct ms/dy	2.070	.	.	3	2.050	0.6788	0.4800	3
	Dec ms/dy	1.830	0.2121	0.1500	3	2.000	0.5657	0.4000	3
	Feb ms/dy	1.697	0.1850	0.1068	3	1.763	0.4366	0.2521	3
7	Oct ms/dy	2.350	.	.	1	.	.	.	1
	Dec ms/dy	2.090	.	.	1	1.880	.	.	1
	Feb ms/dy	1.920	.	.	1	1.760	.	.	1
10	Oct ms/dy	.	.	.	1	.	.	.	
	Dec ms/dy	1.890	.	.	1	.	.	.	
	Feb ms/dy	2.000	.	.	1	.	.	.	



Appendix 1: Descriptive Statistics Tables and Figures

Table 6: Daily ms by age for Farm Y cows

		TREATMENT				CONTROL			
AGE		MEAN	SD	SEM	N	MEAN	SD	SEM	N
2	Oct ms/dy	1.142	0.2301	0.0383	36	1.102	0.2278	0.0313	57
	Dec ms/dy	1.136	0.2231	0.0383	36	1.113	0.1898	0.0258	57
	Feb ms/dy	1.094	0.2223	0.0381	36	1.107	0.1712	0.0231	57
3	Oct ms/dy	1.448	0.3240	0.0573	34	1.488	0.2617	0.0442	43
	Dec ms/dy	1.402	0.2272	0.0390	34	1.445	0.1924	0.0293	43
	Feb ms/dy	1.330	0.2100	0.0371	34	1.343	0.2060	0.0314	43
4	Oct ms/dy	1.600	0.2697	0.0519	29	1.515	0.2861	0.0584	28
	Dec ms/dy	1.602	0.2165	0.0402	29	1.505	0.2623	0.0496	28
	Feb ms/dy	1.527	0.1594	0.0296	29	1.426	0.2592	0.0490	28
5	Oct ms/dy	1.704	0.5787	0.1447	16	1.706	0.3707	0.0899	19
	Dec ms/dy	1.617	0.3994	0.0999	16	1.629	0.3089	0.0709	19
	Feb ms/dy	1.534	0.3097	0.0774	16	1.526	0.2926	0.0671	19
6	Oct ms/dy	1.757	0.2970	0.0990	11	1.753	0.3192	0.0921	12
	Dec ms/dy	1.755	0.2233	0.0673	11	1.653	0.2553	0.0737	12
	Feb ms/dy	1.696	0.1596	0.0481	11	1.587	0.2176	0.0628	12
7	Oct ms/dy	1.875	0.3214	0.0969	12	1.725	0.2824	0.0851	11
	Dec ms/dy	1.741	0.3009	0.0869	12	1.711	0.2367	0.0714	11
	Feb ms/dy	1.706	0.2194	0.0633	12	1.596	0.2335	0.0738	11
8	Oct ms/dy	1.695	0.3350	0.0967	14	1.486	0.4289	0.1430	11
	Dec ms/dy	1.601	0.2631	0.0703	14	1.548	0.4091	0.1234	11
	Feb ms/dy	1.493	0.1963	0.0525	14	1.494	0.3701	0.1170	11
9	Oct ms/dy	1.626	0.3888	0.0972	16	1.623	0.3797	0.0895	19
	Dec ms/dy	1.649	0.2219	0.0555	16	1.591	0.4435	0.1017	19
	Feb ms/dy	1.549	0.1952	0.0488	16	1.624	0.2224	0.0539	19

		TREATMENT				CONTROL			
AGE		MEAN	SD	SEM	N	MEAN	SD	SEM	N
10	Oct ms/dy	1.815	0.1741	0.0870	5	1.595	0.3414	0.1707	5
	Dec ms/dy	1.628	0.2690	0.1203	5	1.570	0.3130	0.1400	5
	Feb ms/dy	1.478	0.3129	0.1399	5	1.492	0.3345	0.1496	5
11	Oct ms/dy	1.583	0.6816	0.3408	4	1.687	0.1656	0.0956	
	Dec ms/dy	1.330	0.4678	0.2339	4	1.623	0.1943	0.1122	3
	Feb ms/dy	1.270	0.4058	0.2029	4	1.560	0.2307	0.1332	3
12	Oct ms/dy	1.325	0.3813	0.1906	4	1.438	0.4008	0.2004	4
	Dec ms/dy	1.288	0.3142	0.1571	4	1.363	0.3956	0.1978	4
	Feb ms/dy	1.235	0.2528	0.1264	4	1.273	0.3538	0.1769	4
13	Oct ms/dy	.	.	.		1.655	0.2475	0.1750	2
	Dec ms/dy	.	.	.		1.640	0.3818	0.2700	2
	Feb ms/dy	.	.	.		1.590	0.3960	0.2800	2

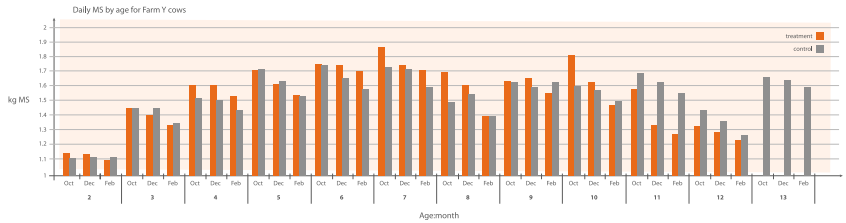


Table 10: Daily ms for ages 2-4 for all cows

		TREATMENT			CONTROL		
AGE		MEAN	SD	SEM	MEAN	SD	SEM
2	Oct ms/dy	1.290	0.2852	0.0346	1.203	0.2534	0.0273
	Dec ms/dy	1.251	0.2419	0.0298	1.179	0.2014	0.0216
	Feb ms/dy	1.200	0.2561	0.0308	1.163	0.1757	0.0184
3	Oct ms/dy	1.561	0.3143	0.0424	1.545	0.3111	0.0405
	Dec ms/dy	1.484	0.2308	0.0296	1.493	0.2275	0.0274
	Feb ms/dy	1.423	0.2168	0.0280	1.421	0.2266	0.0269
4	Oct ms/dy	1.723	0.2950	0.0358	1.609	0.3027	0.0404
	Dec ms/dy	1.677	0.2293	0.0268	1.564	0.2377	0.0299
	Feb ms/dy	1.601	0.1913	0.0219	1.522	0.2424	0.0288

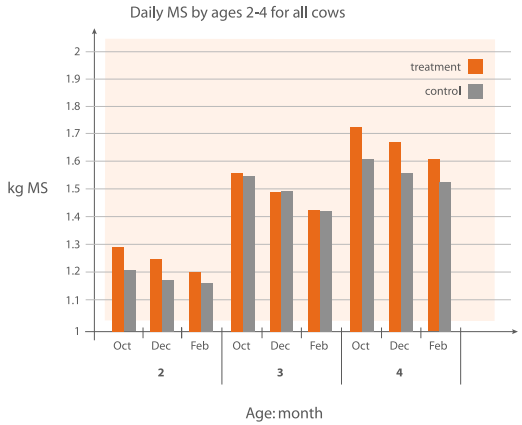
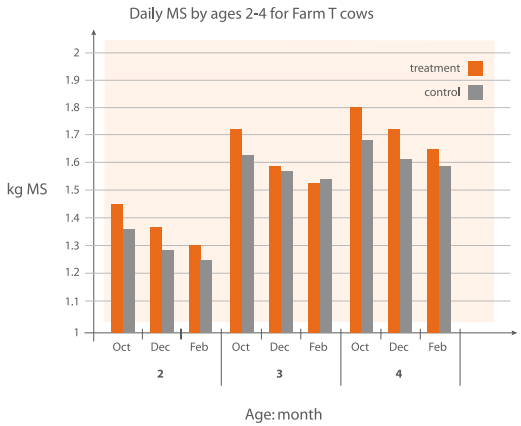


Table 11: Daily ms for ages 2-4 for Farm T cows

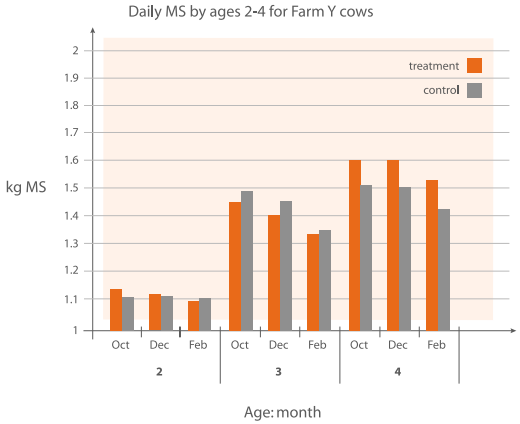
		TREATMENT			CONTROL		
AGE		MEAN	SD	SEM	MEAN	SD	SEM
2	Oct ms/dy	1.458	0.2480	0.0438	1.365	0.2061	0.0359
	Dec ms/dy	1.373	0.2002	0.0354	1.287	0.1730	0.0301
	Feb ms/dy	1.304	0.2464	0.0416	1.249	0.1474	0.0246
3	Oct ms/dy	1.719	0.2229	0.0465	1.628	0.3616	0.0738
	Dec ms/dy	1.587	0.1938	0.0373	1.573	0.2605	0.0511
	Feb ms/dy	1.528	0.1745	0.0330	1.539	0.2074	0.0392
4	Oct ms/dy	1.804	0.2855	0.0446	1.680	0.2995	0.0529
	Dec ms/dy	1.727	0.2262	0.0341	1.611	0.2081	0.0352
	Feb ms/dy	1.646	0.1967	0.0287	1.584	0.2111	0.0322



Appendix 1: Descriptive Statistics Tables and Figures

Table 12: Daily ms for ages 2-4 for Farm Y cows

		TREATMENT			CONTROL		
AGE		MEAN	SD	SEM	MEAN	SD	SEM
2	Oct ms/dy	1.142	0.2301	0.0383	1.102	0.2278	0.0313
	Dec ms/dy	1.136	0.2231	0.0383	1.113	0.1898	0.0258
	Feb ms/dy	1.094	0.2223	0.0381	1.107	0.1712	0.0231
3	Oct ms/dy	1.448	0.3240	0.0573	1.488	0.2617	0.0442
	Dec ms/dy	1.402	0.2272	0.0390	1.445	0.1924	0.0293
	Feb ms/dy	1.330	0.2100	0.0371	1.343	0.2060	0.0314
4	Oct ms/dy	1.600	0.2697	0.0519	1.515	0.2861	0.0584
	Dec ms/dy	1.602	0.2165	0.0402	1.505	0.2623	0.0496
	Feb ms/dy	1.527	0.1594	0.0296	1.426	0.2592	0.0490



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