

VTR Yeast Supplementation Study Report

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Study design

VTR yeast oral supplement impact on cow milk production, body weight and reproductive performance was evaluated in a controlled study. The study was conducted in a single rotary-dairy herd with a spring-calving group of cows. Cows were electronically identified and run as a single group. Supplement was fed using the automatic ID system at the rotary dairy and an individual pellet dispenser and auger connected to the bale feeding system that was operated by the dairy computer as signalled by the automatic ID. This system allowed a single herd to be used and thereby negated need to run separate herds (with the potential for confounding based on paddock differences in pasture quality and quantity)

Spring-calving cows were selected for the study and cows were allocated to treatment (VTR yeast supplement at milking) and control (no supplement) using an odd- and even-number system. A random draw was used to assign cows with odd- or even-numbers to the treatment group (with the other numbered cows being allocated to the control group). The trial ran from October 2018 to June 2019.

Walk-over-weighing recorded cow weights twice daily (on exit from the dairy). Milk volumes were recorded each milking using the Westfalia milking system. Seven herd tests were conducted between September 2018 and June 2019 and these recorded cow volumes, fat and protein percentages. Herd tests were conducted on 2018-10-08 (1), 2018-12-10 (2), 2019-01-07 (3), 2019-02-11 (4), 2019-04-01 (5), 2019-05-13 (6) and 2019-06-18 (7). Observed milk production volume from daily milk monitoring and milk composition (kilograms and percentage) from herd tests—fat, protein, and total solids along with daily cow body weight and cow reproductive performance (time to pregnancy after mating start date) were plotted and analysed.

Generalised additive mixed models (GAMMs) were used to assess production and body weight change across the study period of a whole lactation and to account for clustering of observations (within cow) and control for known (non-linear) predictors of production (e.g. stage of lactation) and their interactions. This approach allows the effect of treatment to be examined in isolation. Reproductive performance was examined using Cox proportional hazard regression to compare time to pregnancy distributions of control and treated cows.

Results

Allocation to treatments

The distribution of cow ages and calving date between treatment and control groups is presented below. There were no significant differences between groups at classification.

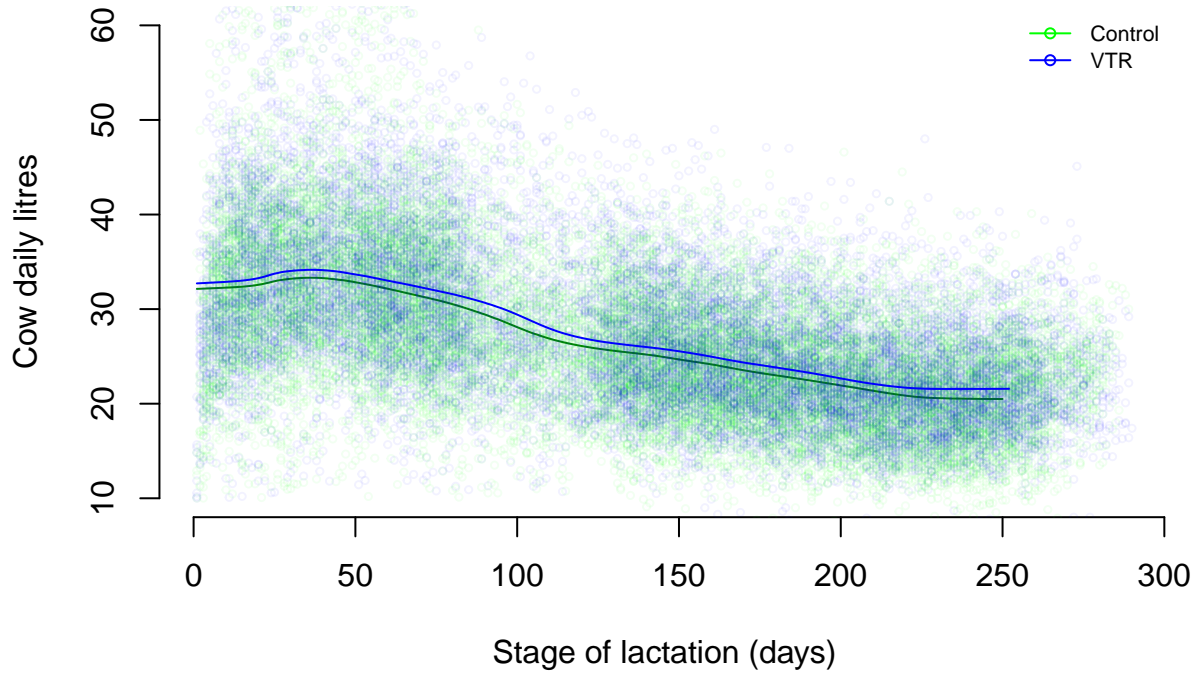
| | Treatment | AvgAgeYrs | StDevAgeYrs | AvgCalvingDate | StDevCalvingDate |
|---|-----------|-----------|-------------|----------------|------------------|
| 1 | Control | 4.3 | 2.0 | 2018-10-01 | 12.2 |
| 2 | Treatment | 4.3 | 1.8 | 2018-10-01 | 11.3 |

Exploratory analysis

The observed production, body weight and reproduction performance is presented below.

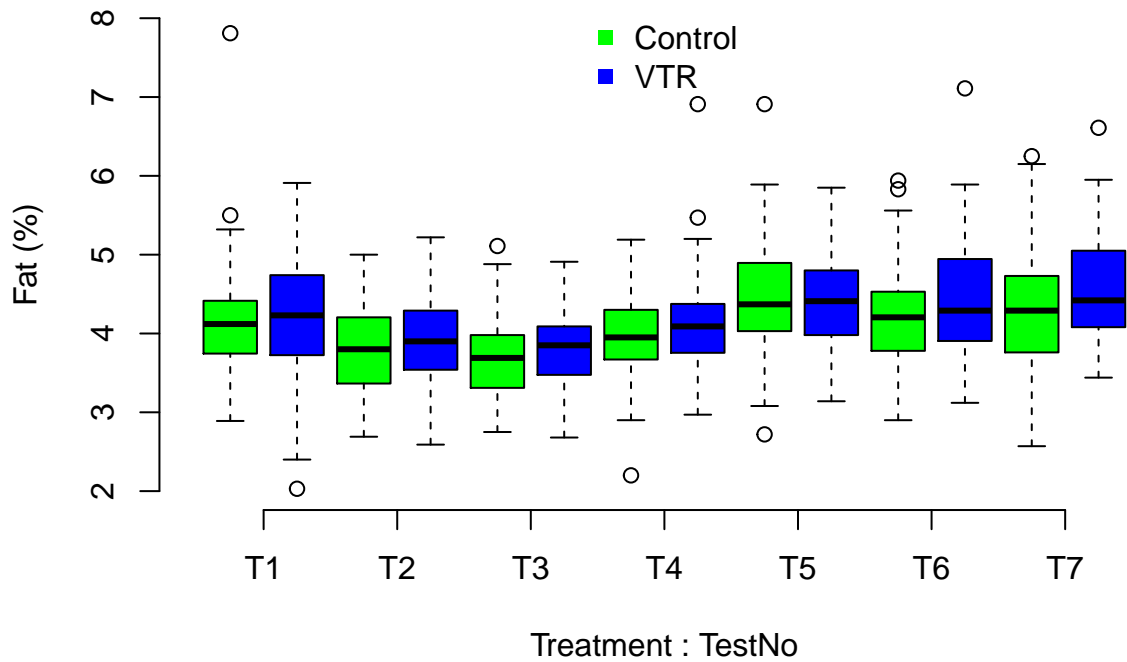
Milk volumes (from daily milk monitoring)

Daily volumes by treatment

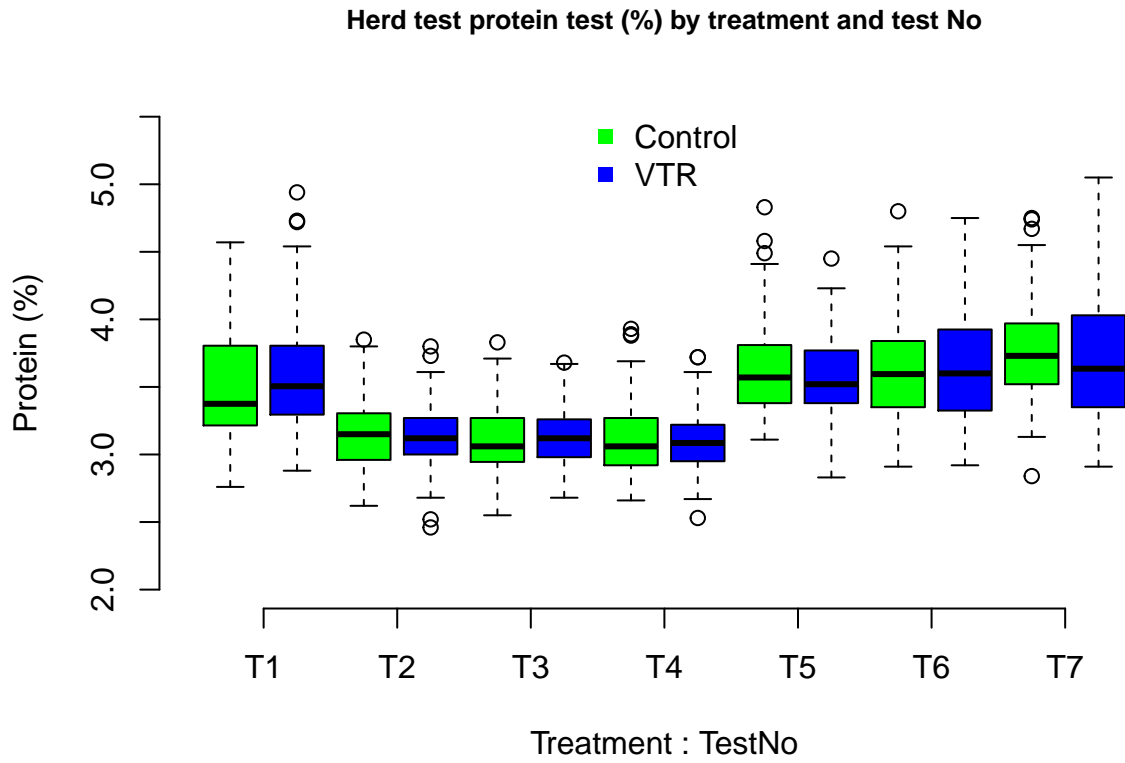


Milk fat composition (from herd tests)

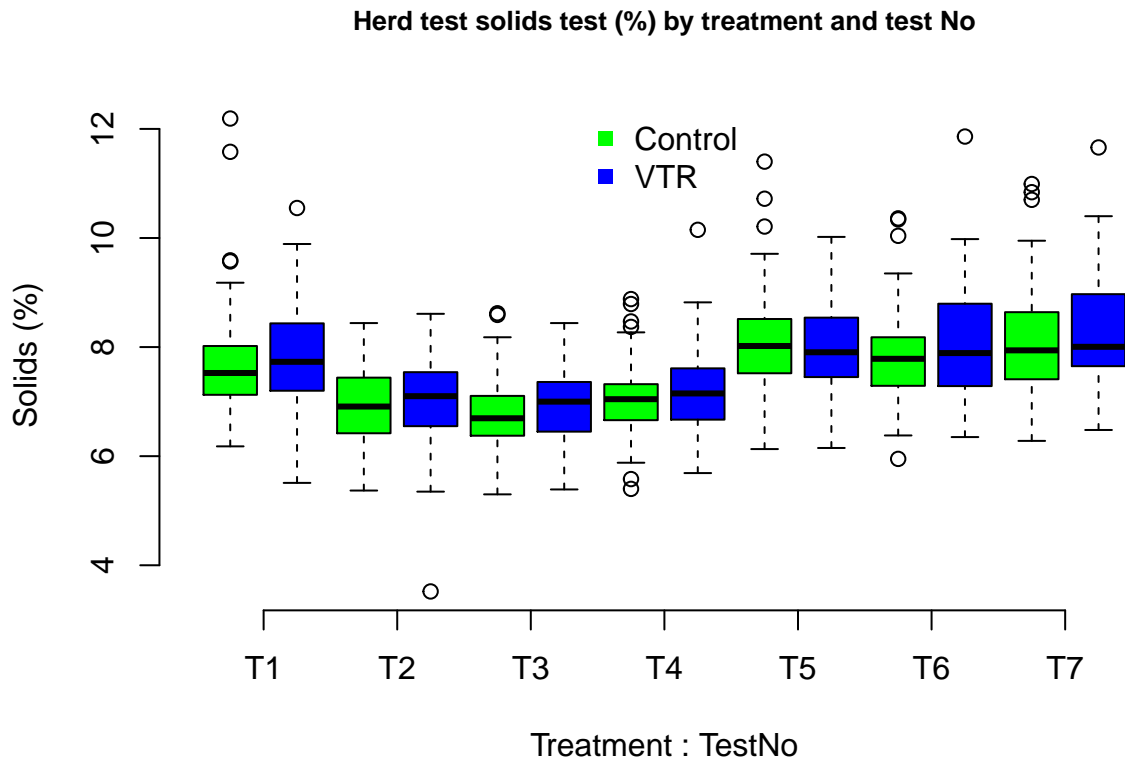
Herd test fat test (%) by treatment and test No



Milk protein composition (from herd tests)

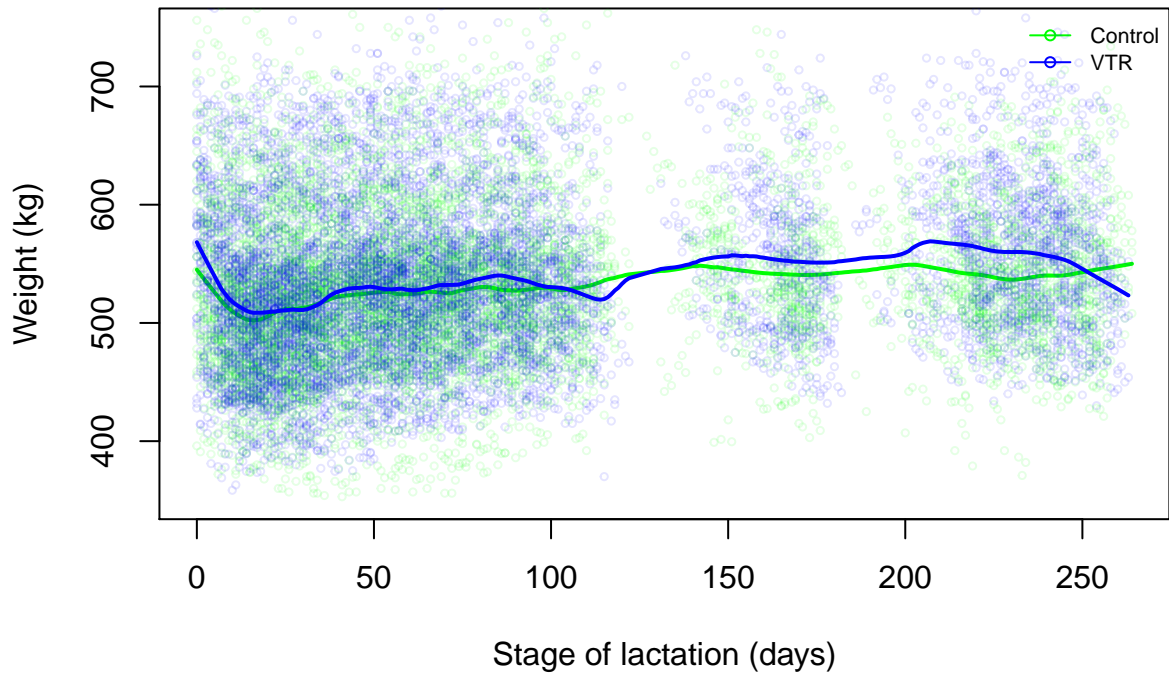


Milk solids composition (from herd tests)



Cow body weight (from daily walk-over-weighing)

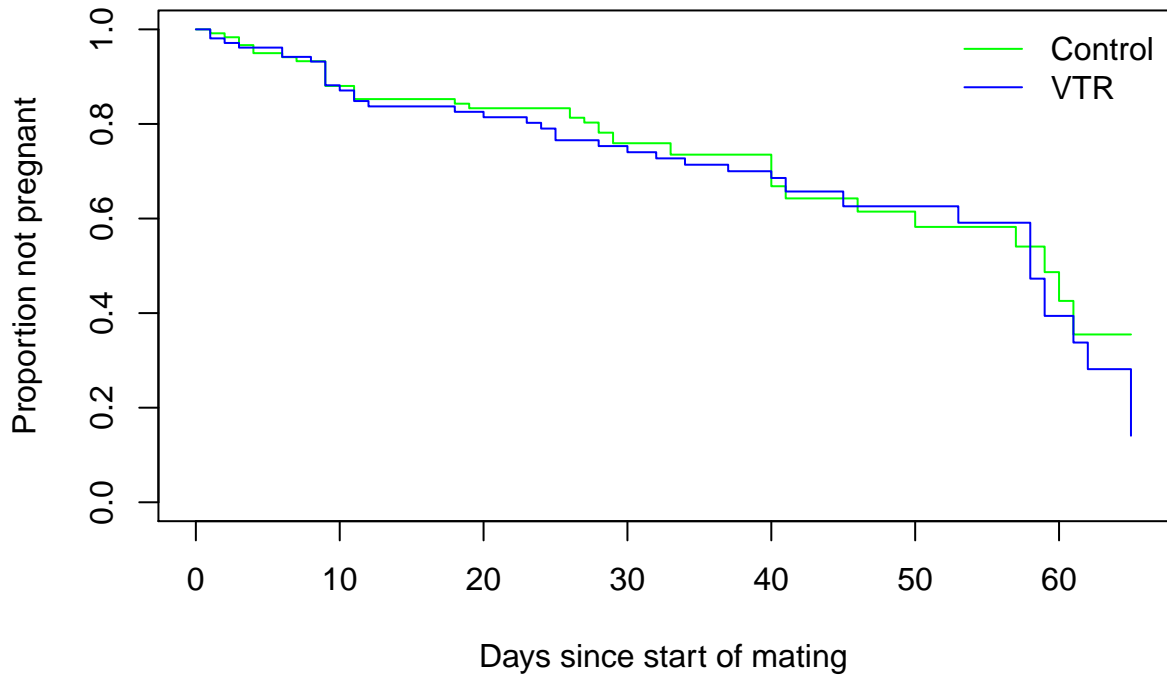
Cow daily weights



Note that the automated weigh scale electronic tag ready partly malfunctioned across two periods (approximately 120–150 days and 180–200 days of lactation for most cows).

Reproductive performance (from mating and pregnancy test records)

Survivor function for cows remaining empty



Statistical analysis

Multivariate statistics examined the effect of treatment on production, body weight and reproduction across the study period. Known predictors of performance such as stage of lactation (SOL), cow age (years) and number of days calved were included along with important interaction terms within respective models to better isolate the effect of treatment. Generalised Additive Mixed Models (GAMMs) were used to evaluate the effect of treatment on production. This analysis controls for clustering of observations within cow (repeated measures) and adjusts for non-linearity of responses (e.g. natural lactation curves) to isolate effect of treatment.

Litres

GAMM

Family: gaussian
Link function: identity

Formula:

Volume ~ Treatment + SOLDaysCntr + Treatment:SOLDaysCntr + s(SOLDaysCntr)

Parametric coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|--------------------------------|----------|------------|---------|-------------|
| (Intercept) | 26.54318 | 0.09209 | 288.24 | < 2e-16 *** |
| TreatmentTreatment | 1.17264 | 0.10265 | 11.42 | < 2e-16 *** |
| SOLDaysCntr | 0.28383 | 0.01993 | 14.24 | < 2e-16 *** |
| TreatmentTreatment:SOLDaysCntr | -0.00503 | 0.00130 | -3.87 | 0.00011 *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

| | edf | Ref.df | F | p-value |
|----------------|------|--------|--------|---------|
| s(SOLDaysCntr) | 7.92 | 8 225 | <2e-16 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 12/13

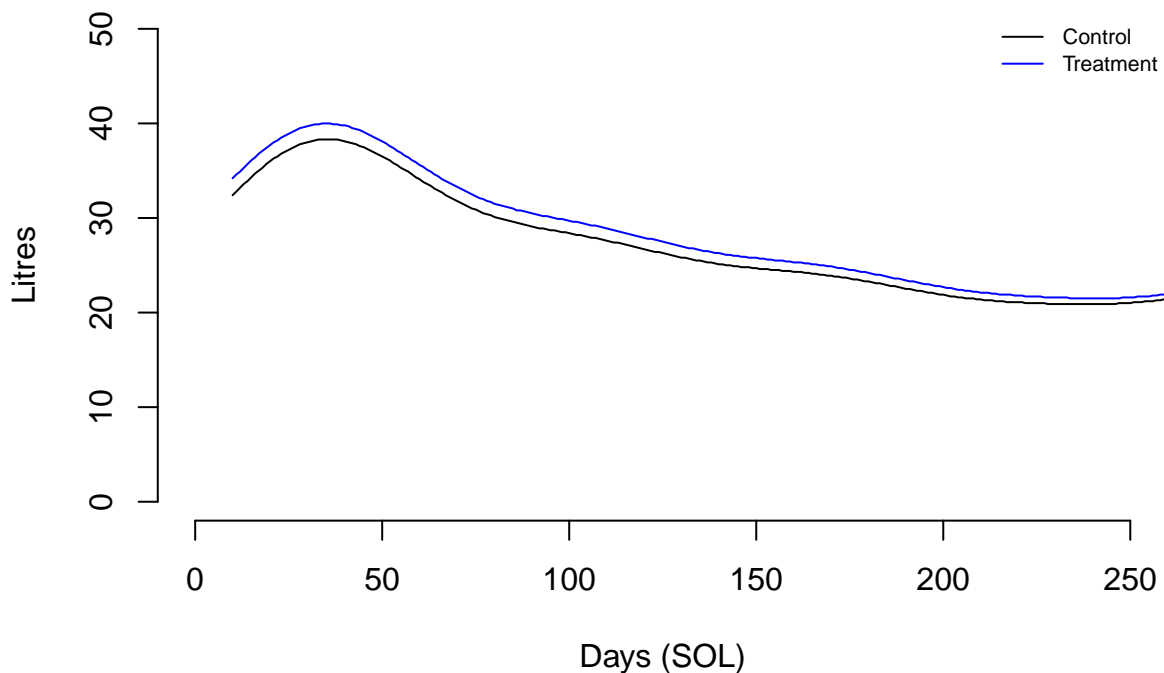
R-sq.(adj) = 0.302 Deviance explained = 30.2%

GCV = 84.989 Scale est. = 84.959 n = 33115

VTR treated cows produced an extra 1.2 litres per day across the 300-day lactation compared to control cows. This response was statistically significant ($p < 0.05$). There was no significant effect of treatment on fat percentage, protein percentage or solid percentage across lactation. The GAMM for litres was used to build a predictive model of average cow response to treatment and is presented below.

GAMM Predicted

Predicted daily volumes by treatment (from GAM)



Treatment was a significant predictor of daily volumes. Treated cows produced more milk volume than control cows. There was an interaction between treatment and stage of lactation such that the treated cow volume response was greatest at around 50 days of lactation. The volume response progressively decreased to approximately zero by around 250 days of lactation.

Milk components

Treatment was not a significant predictor of fat, protein or total solids test (models not presented)

Body weight

There was no difference between treatment groups in body weight across the course of the trial. There was a trend towards treated cows being slightly heavier (1.8 kilograms) than control cows across the study ($p = 0.012$).

Family: gaussian

Link function: identity

Formula:

WeightKgs ~ Treatment + as.numeric(AgeYrs) + s(SOLDays)

Parametric coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|--------------------|----------|------------|---------|----------|-----|
| (Intercept) | 330.089 | 3.305 | 99.88 | <2e-16 | *** |
| TreatmentTreatment | 6.044 | 2.406 | 2.51 | 0.012 | * |
| as.numeric(AgeYrs) | 26.534 | 0.677 | 39.20 | <2e-16 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

| | edf | Ref.df | F | p-value | |
|------------|------|--------|------|---------|-----|
| s(SOLDays) | 8.43 | 8.9 | 29.9 | <2e-16 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) = 0.0556 Deviance explained = 5.59%

GCV = 45715 Scale est. = 45698 n = 31668

Reproductive (survival) analysis

There was no significant difference between treatment groups in pregnancy rate or timing of pregnancy.

Discussion

There was a statistically significant milk volume response to treatment of an average of 1.2 litre per day across the lactation. There was no significant change in milk composition as a result of treatment and therefore treated cows can be expected to produce more milk, fat, protein and milk solids than untreated cows across the lactation.

There was no significant change in cow body weight or reproductive performance due to treatment.