Physiology of cows with divergent genetic merit for fertility traits during the transition period

S.G. Moore[1,2] P. Lonergan[2] T. Fair[2] S.T. Butler[1]

[1]Teagasc, Moorepark AGRIC, Ireland
[2]School of Agriculture & Food Science, UCD, Ireland

The Irish Agriculture and Food Development Authority

Animal Model

Established 2007-2008

- Similar genetic merit for milk production
- Divergent genetic merit for fertility
- Holstein genetics

Fertility Phenotype = Genetics + Environment

Same Management
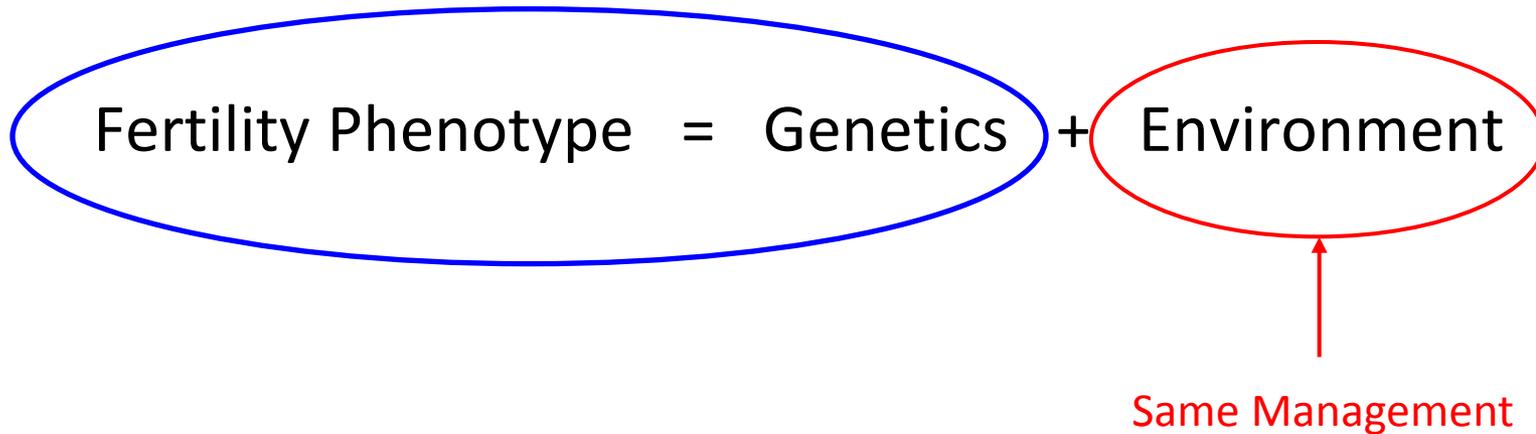
Breeding value for milk production

High milk production

High milk production

Bottom 10% for fertility

Top 20% for fertility

Low fertility (Fert −)

High fertility (Fert +)
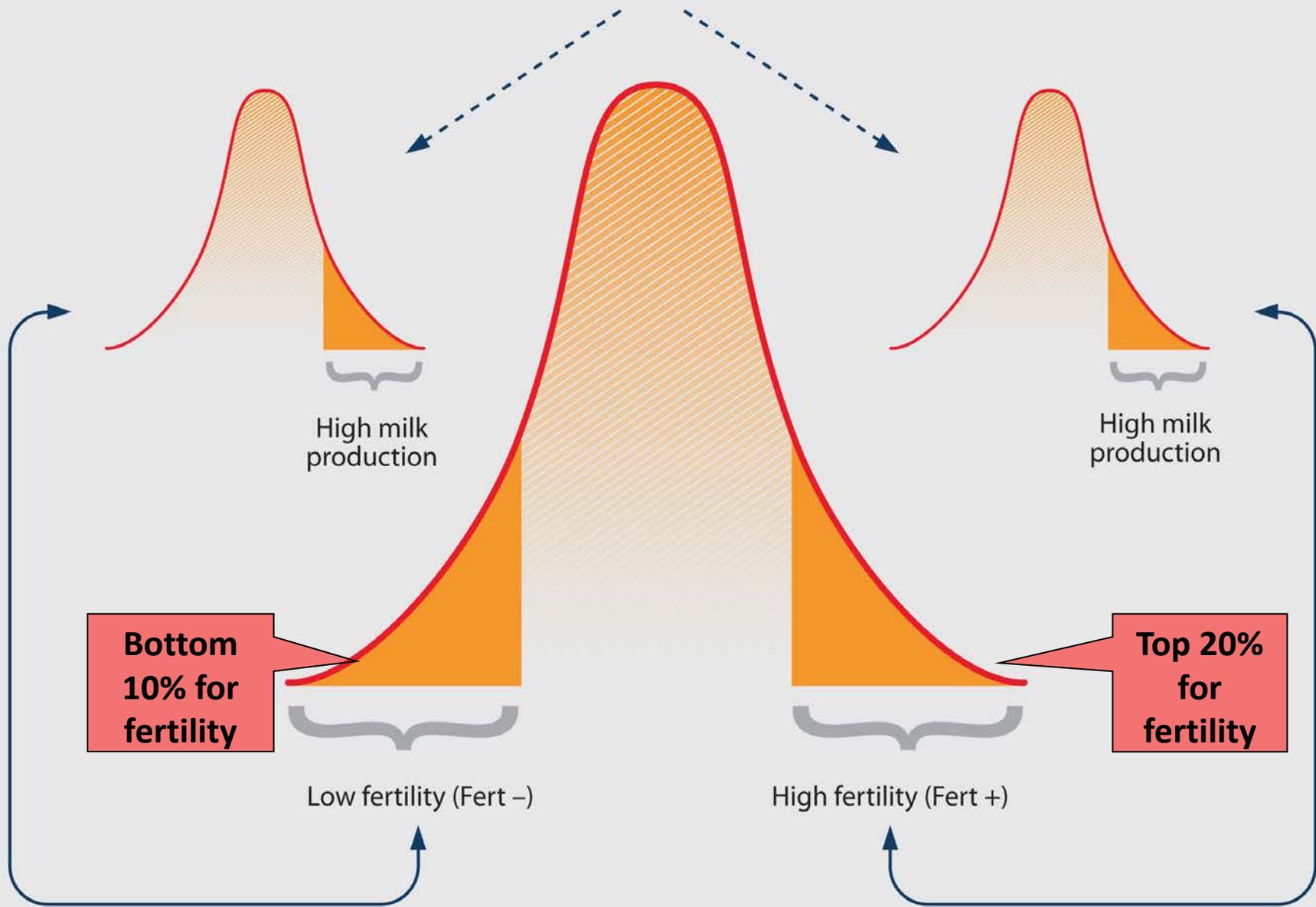
Breeding value for fertility trait

Cummins et al 2012a JDS

Transition Period

- Peripartum period

- Failure to adapt to increased nutrient demands
  - Poorer production
  - Metabolic diseases
  - Compromised fertility

- Does genetic merit for fertility affect the transition period?

Materials and Methods

26 cows

    - 11 Fert- enrolled

   - 15 Fert+ enrolled

Managed as one group indoors

Diet

    - Precalving: Grass silage, Concentrate, Straw, Minerals

    - Early lactation: Grass silage, Maize silage, Concentrate, Soya

   - After 5 weeks: Grazed Perennial ryegrass + Concentrate

Animal Measurements

Uterine Cytology

Vaginal Mucus Score

Blood

Week: -4, -3, -2, -1, Calving, 1, 2, 3, 4, 5, 6, 7, 8

3x weekly Milk Progesterone

Daily Dry Matter Intake

Daily Milk Production
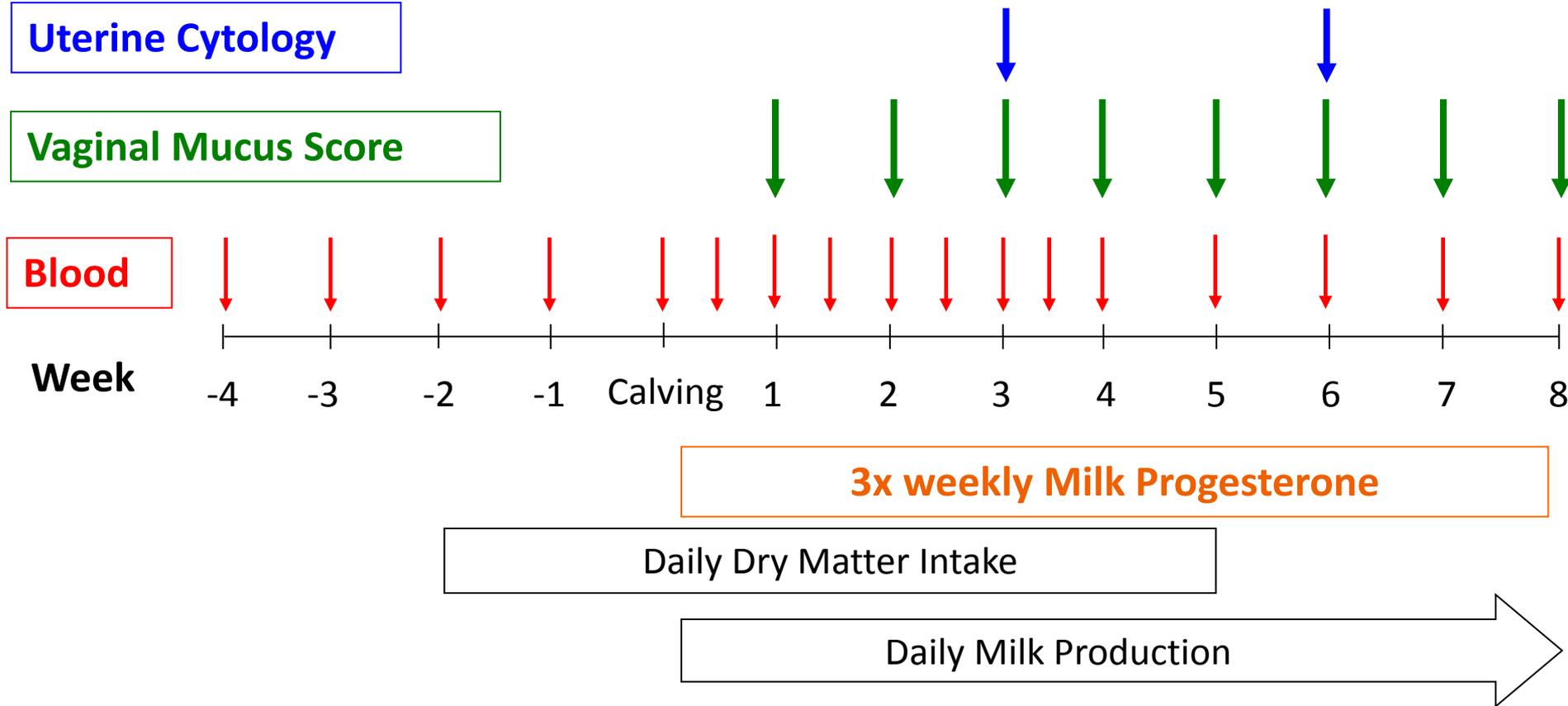
Statistical Analysis

- Repeated measures model:
  - Y = μ + geno + parity + time + geno **×** time + geno **×** parity + calving date + ε
    - Cow(geno) included as a random effect
    - AR covariance structure

- Nonparametric data:
  - Body condition score variables
  - Vaginal mucus score

- Logistic regression:
 - Binary variables

Energy Output
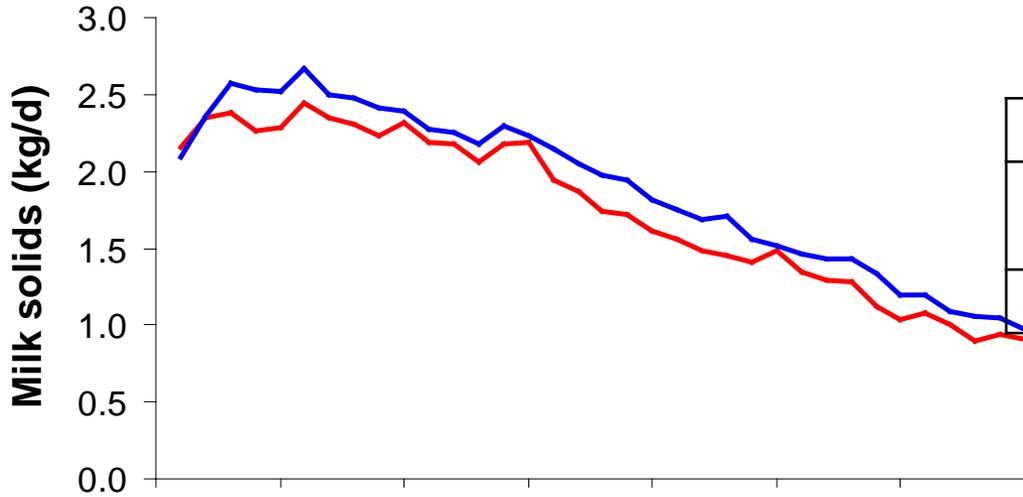
	Fert+	Fert-	SEM	P-value
Milk Solids (kg/day)	1.89	1.74	0.05	0.05
Milk Yield (kg/day)	24.2	22.3	0.88	0.08
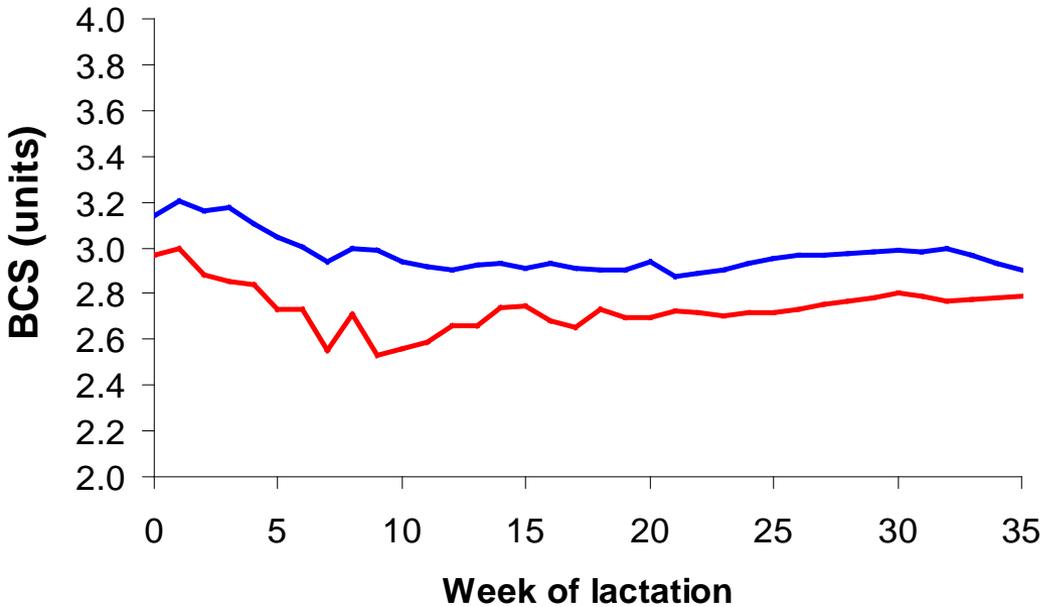
	Fert+	Fert-	SEM	P-value
Mean BW (kg)	578	546	11.1	0.05
Mean BCS (units)	2.98	2.75	0.02	< 0.001
Calving BCS	3.12	2.98	-	0.14
Nadir BCS	2.75	2.45	-	0.009
BCS loss	-0.35	-0.48	0.06	0.01

Energy Intake/Balance
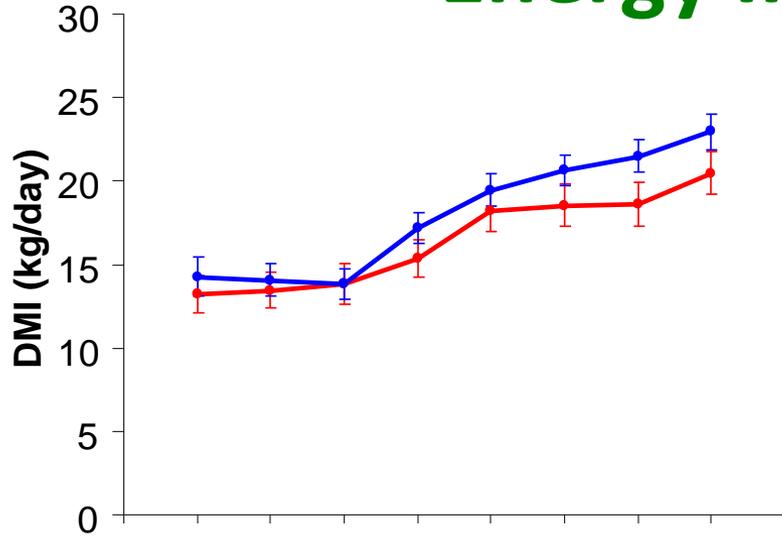
DMI (kg/day)	Fert+	Fert-	SEM	P-value
Prepartum	14.8	14.3	0.74	0.63
Postpartum	19.7	16.8	0.79	0.02
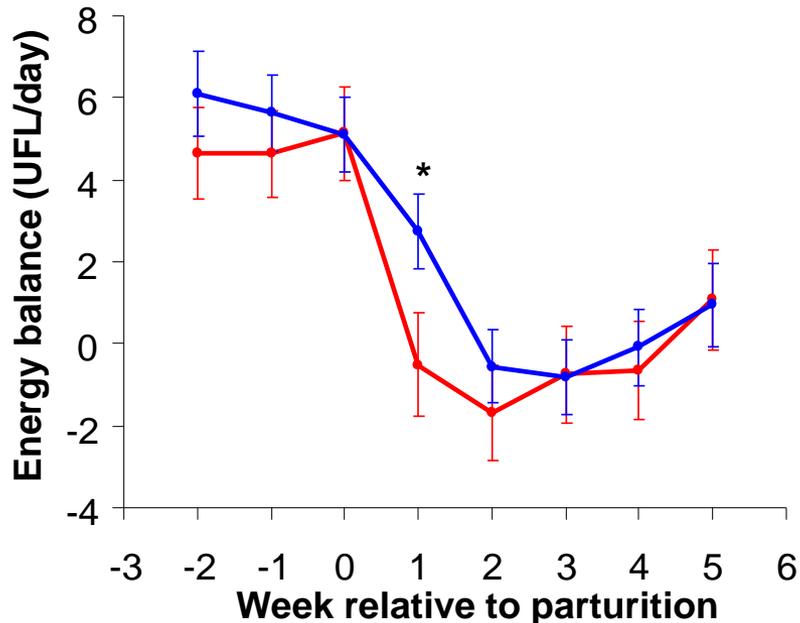
EB (UFL/day)	Fert+	Fert-	SEM	P-value
Prepartum	6.1	5.5	0.54	0.45
Postpartum	-0.3	-1.2	0.71	0.37

Metabolic Status

Insulin (uIU/mL) vs Week relative to parturition

Geno	P = 0.08
Geno x week	P = 0.04

Glucose (mmol/L) vs Week relative to parturition

Geno	P = 0.04
Geno x week	P < 0.0001

Fert+
Fert-

IGF-I (ng/mL) vs Week relative to parturition

Geno	P = 0.01
Geno x week	P < 0.001

Plasma NEFA (mmol/L) vs Week relative to parturition

Geno	P = 0.64
Geno x week	P = 0.02
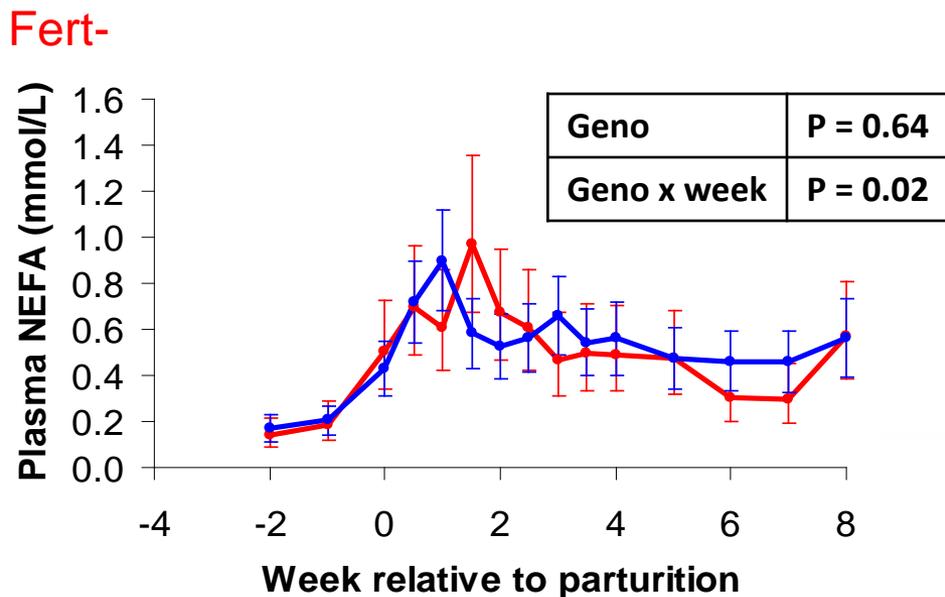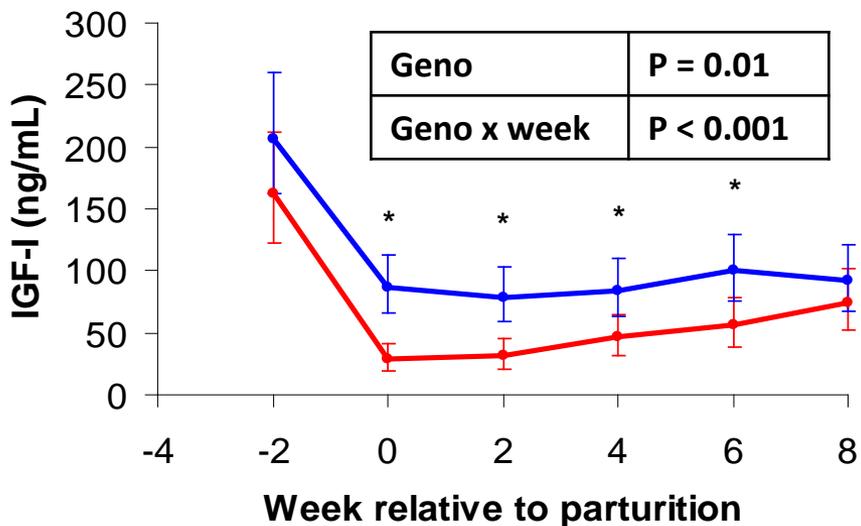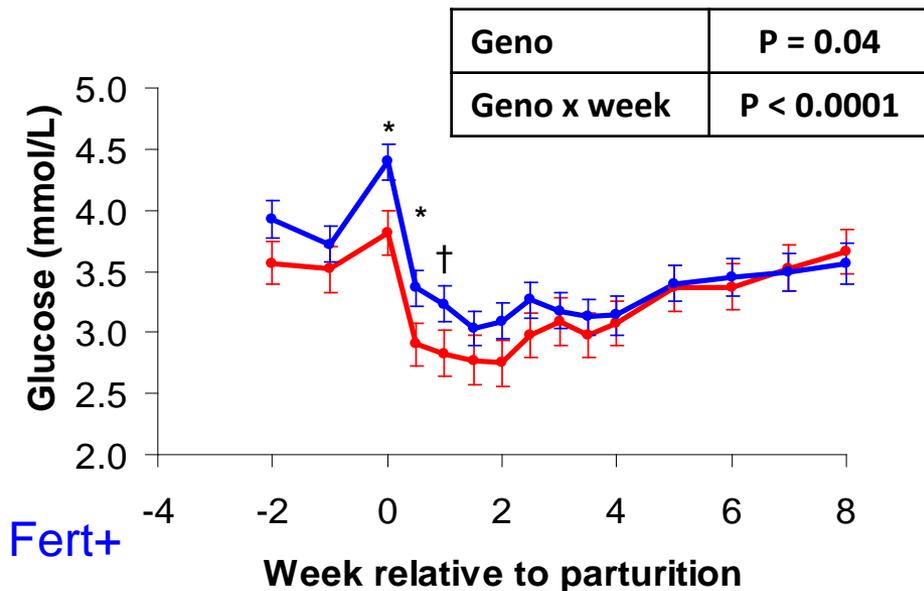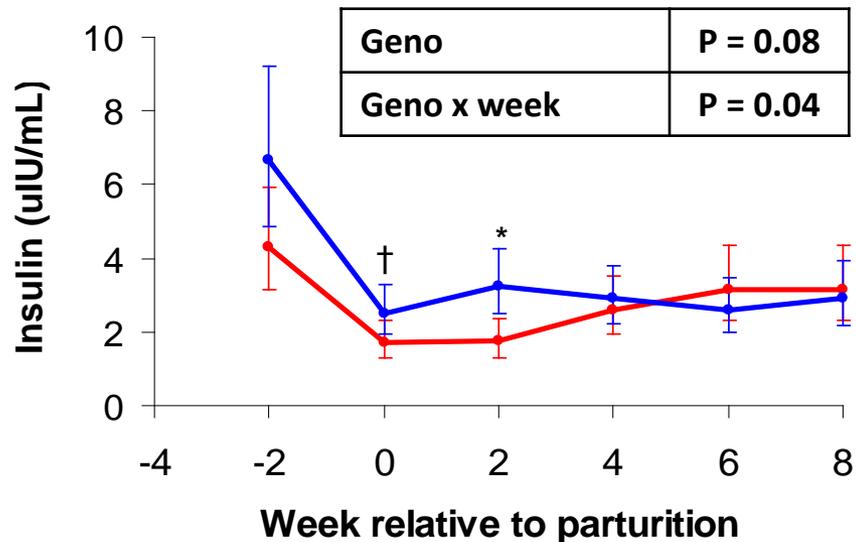
Uterine Health
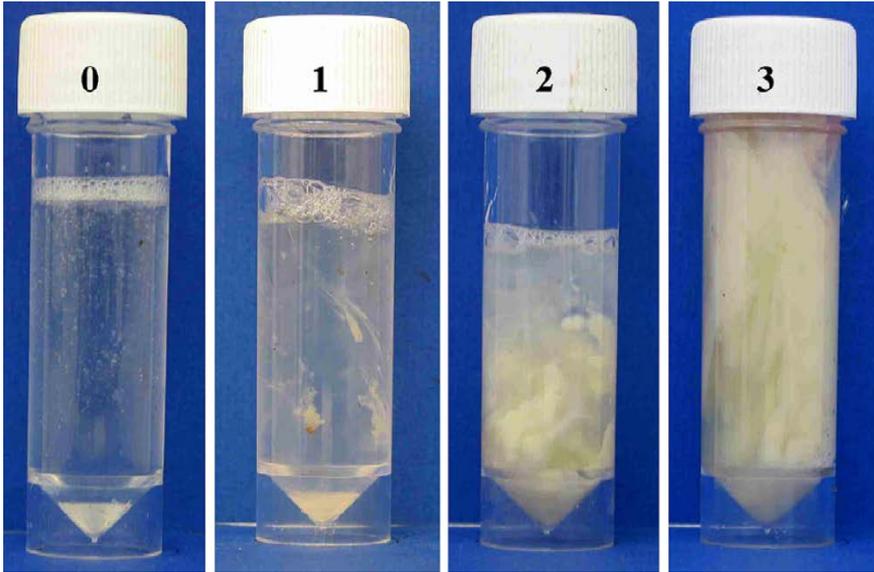
Week	Fert+	Fert-	P-value
1	1.9	2.3	0.31
2	0.9	2.5	0.003
3	1.1	2.2	0.04
4	0.4	1.1	0.09
5	0.4	1.2	0.08
6	0.0	1.2	0.06
7	0.0	0.2	0.26
8	0.0	0.0	0.74

Endometritis classification	% Neutrophils
Week 3	> 18
Week 6	> 10

Neutrophils
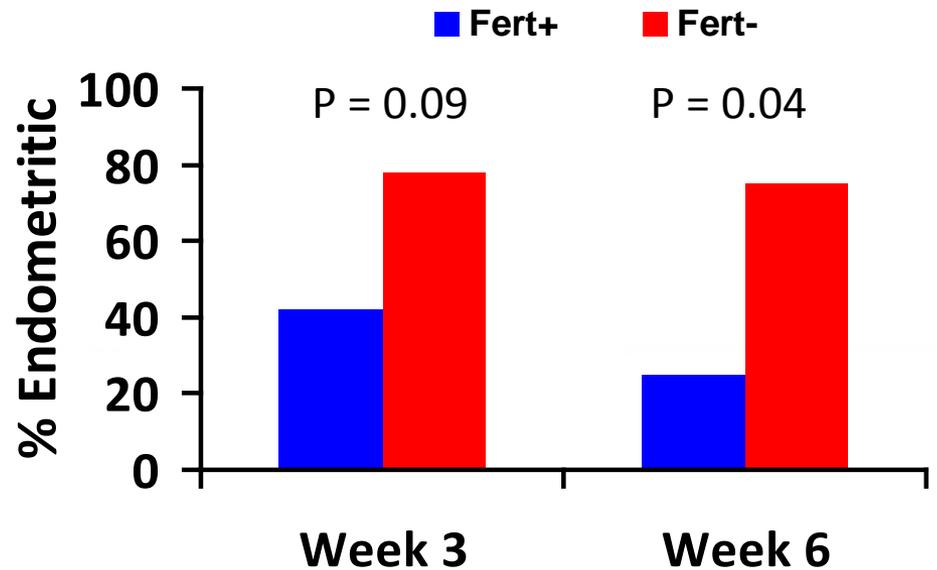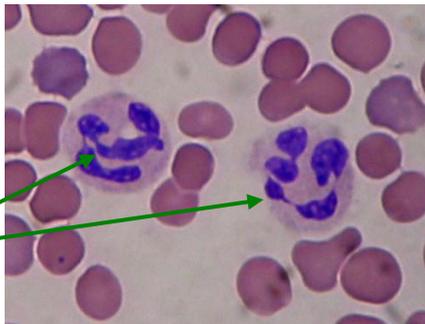
Resumption of cyclicity
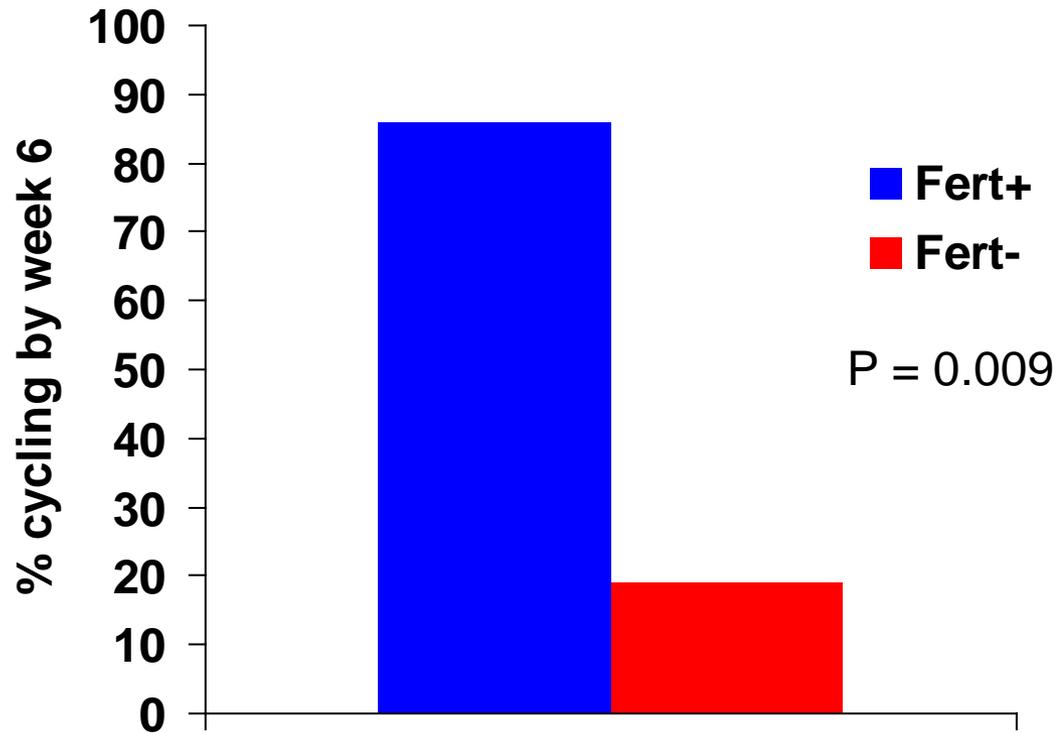
Conclusions

- **Fert+ vs. Fert-**
  - Greater dry matter intake
  - More favourable metabolic status
  - Maintain greater body condition score
  - Superior uterine health
  - Earlier resumption of cyclicity

- **Implications**
  - Good fertility & milk production achievable
  - Must use sires with good daughter fertility traits

THANKS FOR YOUR ATTENTION

QUESTIONS???