Factors affecting plasma progesterone concentration in cows divergent in genetic merit for fertility

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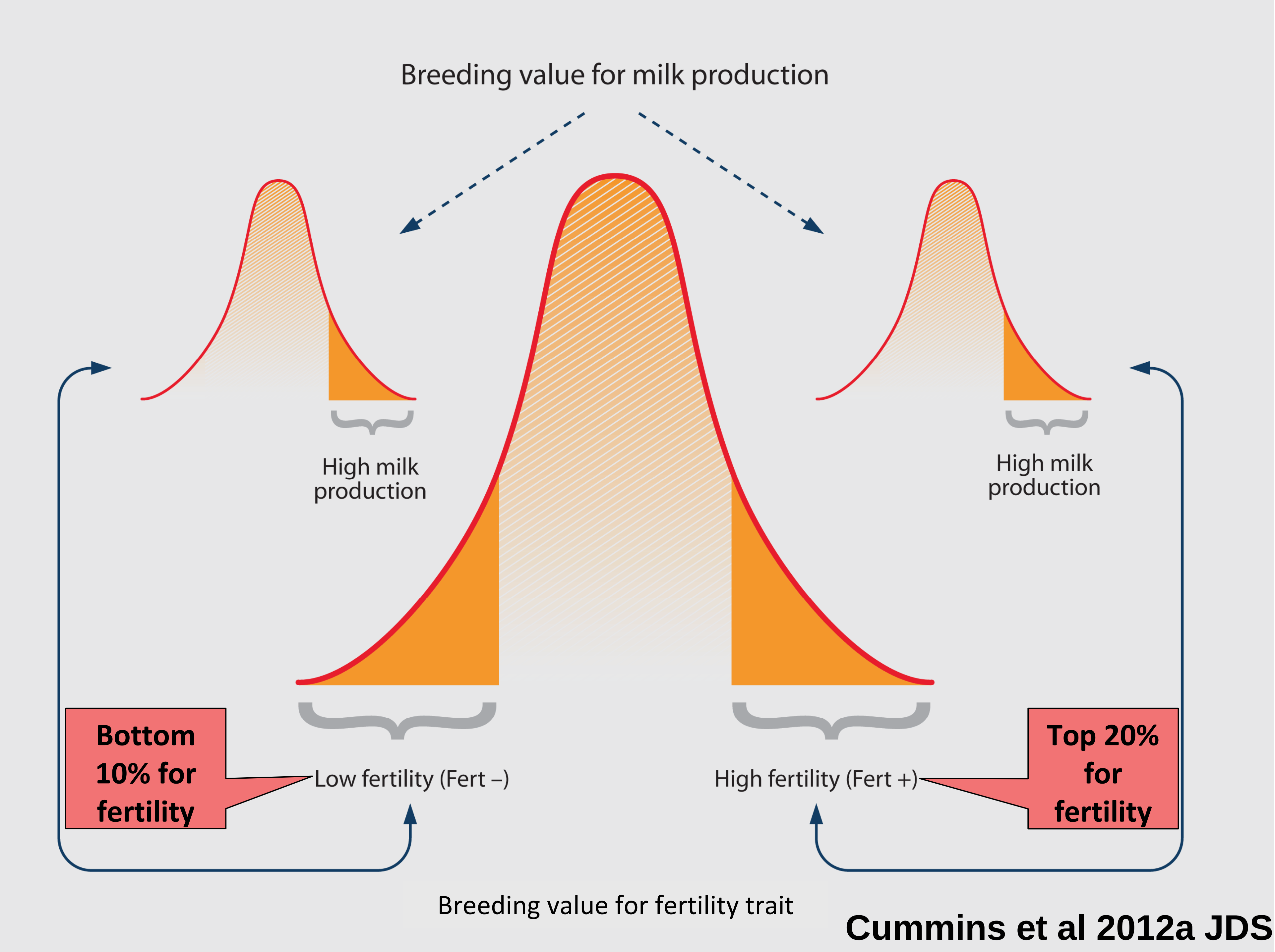
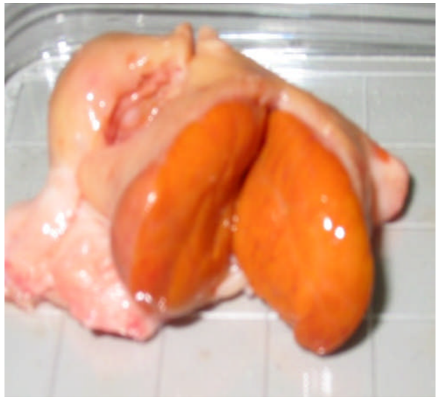
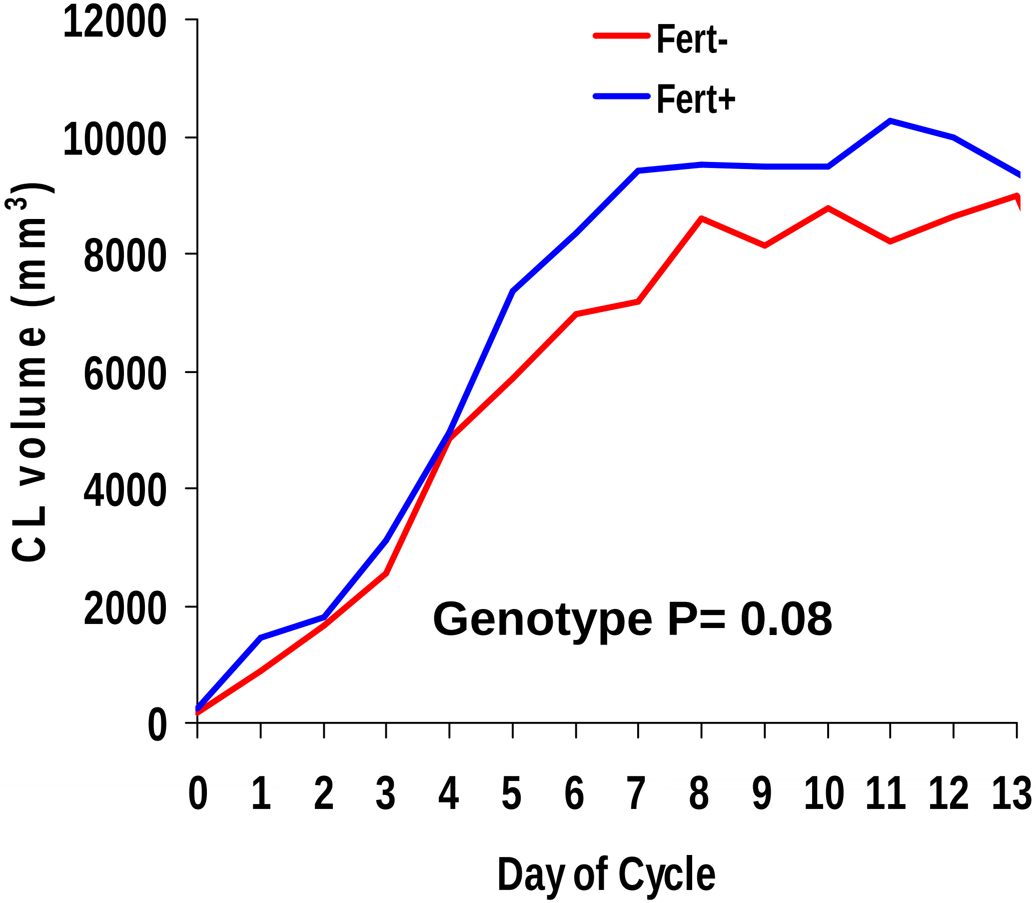
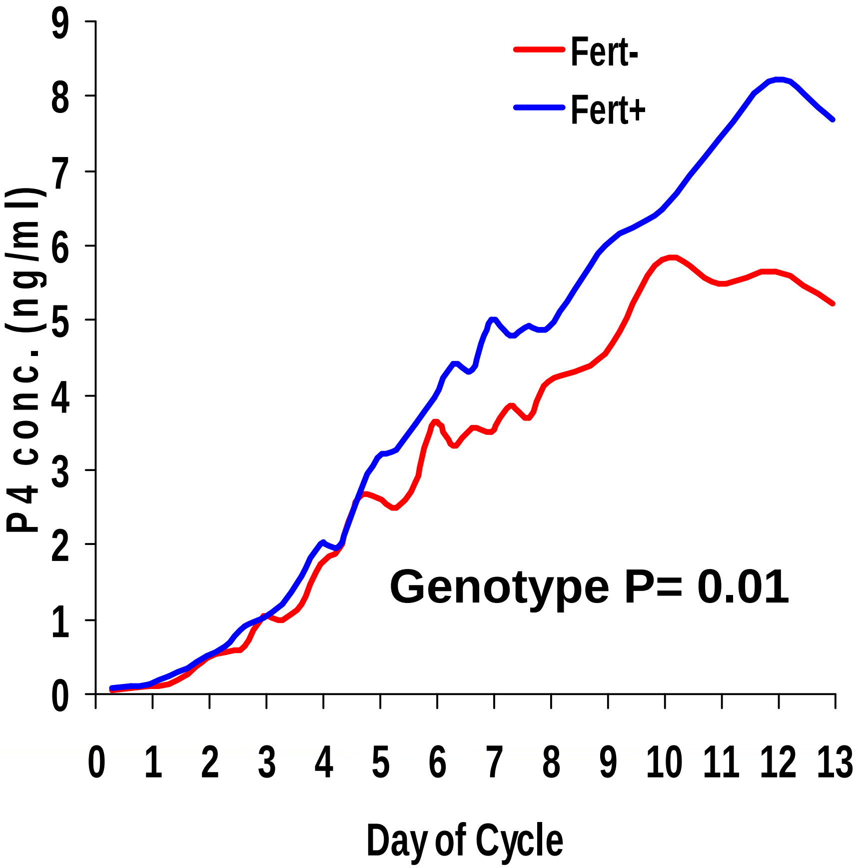


Breeding value for milk production
High milk production
High milk production
Bottom 10% for fertility
Low fertility (Fert –)
High fertility (Fert +)
Top 20% for fertility
Breeding value for fertility trait
Cummins et al 2012a JDS



Corpus Luteum and Progesterone





Cummins et al 2012b JDS

Research Objectives

Determine effect of genetic merit for fertility traits on factors affecting circulating progesterone (P4)

Corpus Luteum vs Liver

- Using unique lactating cow genetic model
  - Corpus luteum (CL) function
  - P4 clearance

Materials and Methods

Synchronisation

- 13 Fert- enrolled (2 failed to sync.; 2 uterine infection)
- 15 Fert+ enrolled (1 failed to sync.; 1 uterine infection)

Managed as one group indoors

Routine measurements

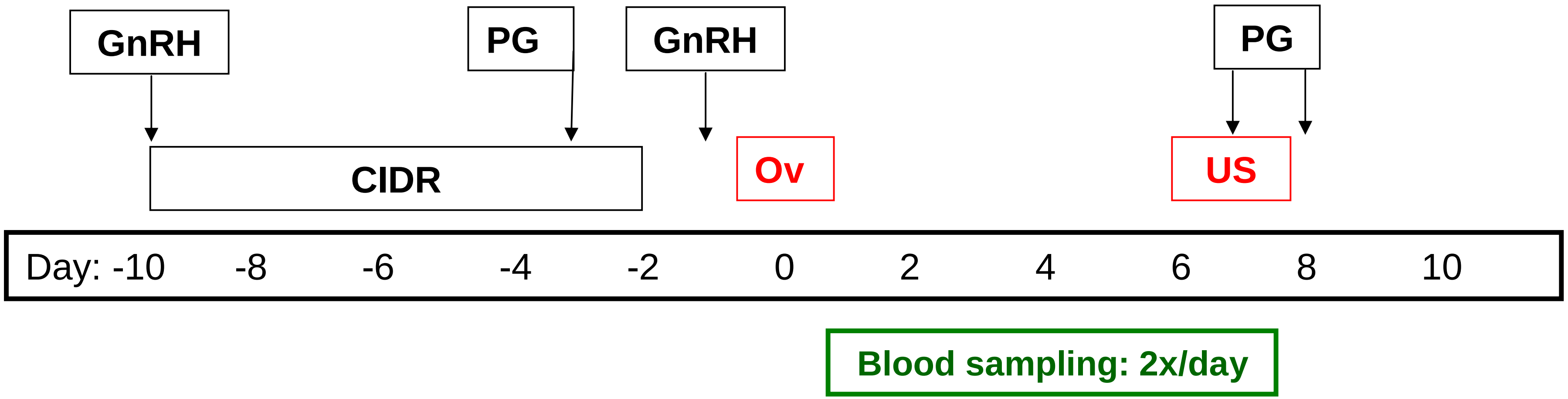
- Milk yield
- Dry matter intake

Diet

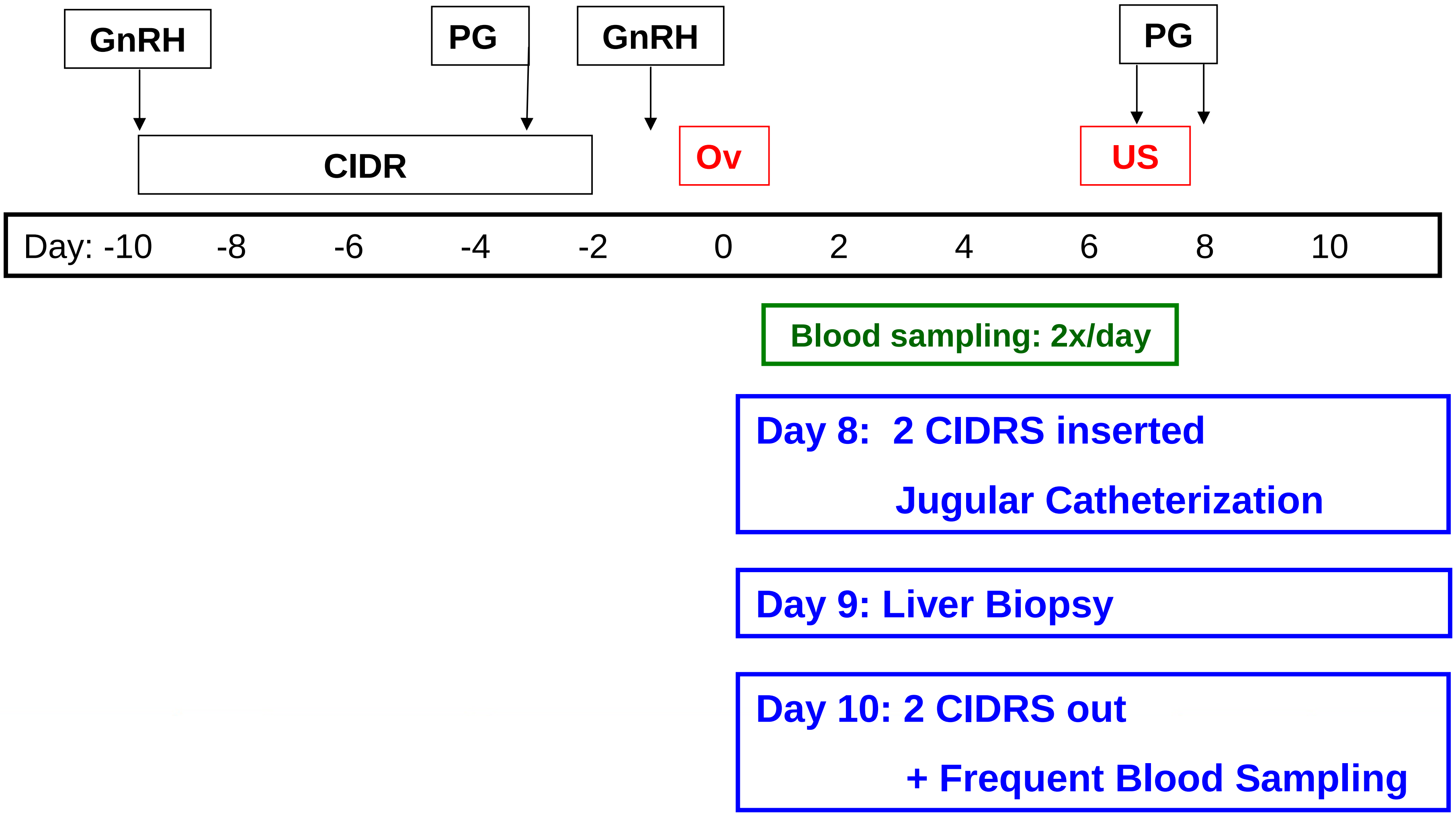
- 35% Maize silage
- 29% Dairy ration
- 24% Grass silage
- 12% Soya

	Breeding Values	
	Fert-	Fert+
Milk kg	**370 (228)**	**451 (330)**
Protein kg	**12.7 (12.5)**	**15.7 (12.4)**
CI (days)	**7.4 (3.4)**	**-5.37 (2.5)**
Survival (%)	**-1.2 (10.8)**	**3.5 (0.7)**

Materials and Methods



Materials and Methods



Materials and Methods

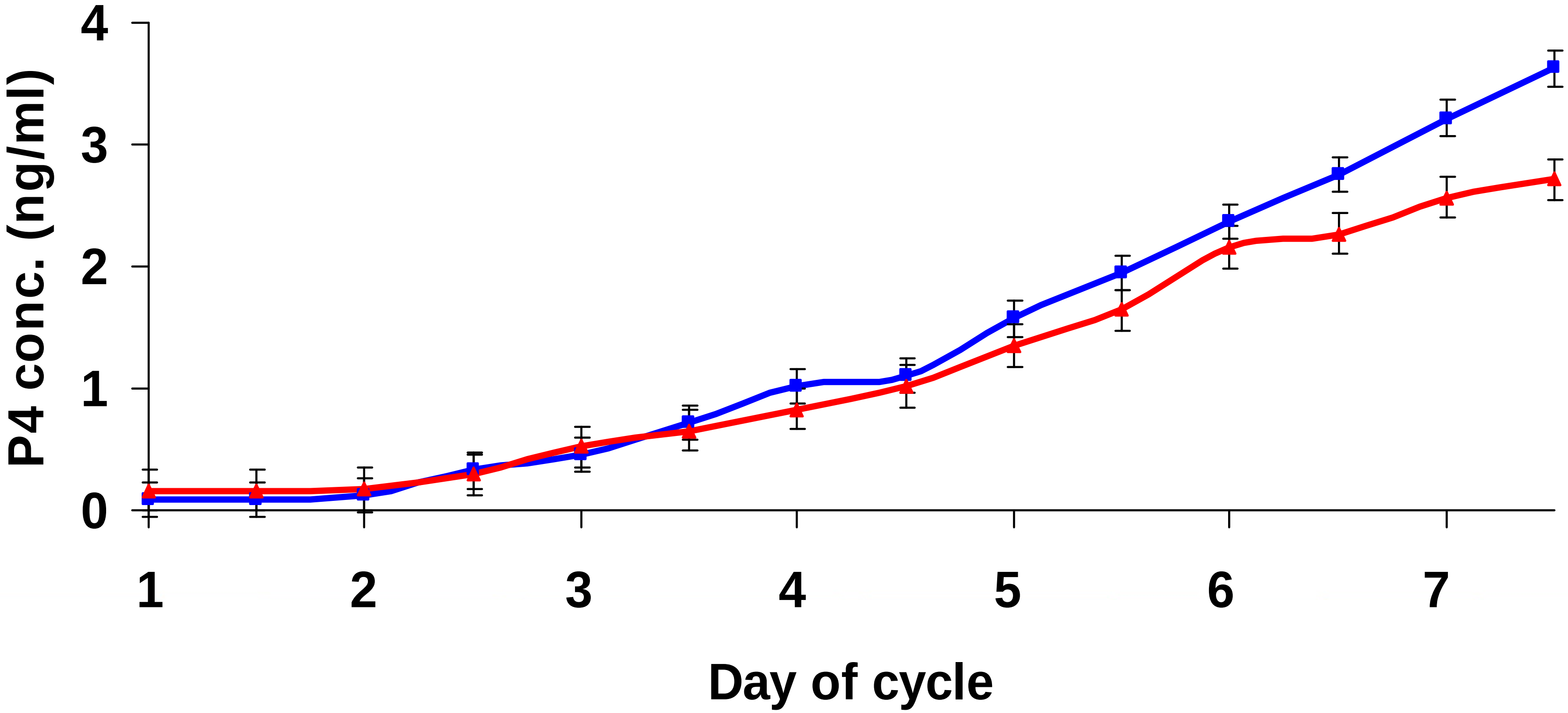
Data analysed using SAS

- Repeated measures model:
  - $Y = \mu + geno + lact + time + geno \times time + geno \times lact + block + \varepsilon$
  - Cow(geno) included as a random effect
  - AR covariance structure
- Variables without repeated measures
  - $Y = \mu + geno + lact + geno \times lact + block + \varepsilon$

- PROC NLIN used to estimate the decay rate coefficient of P4 (C)
  - $P4 = b \times e^{(c \times t)}$

Progesterone (P4) concentration (Day 1-7.5)

	Day 4.5-7.5 P4	P
Fert+	2.39	0.04
Fert-	1.97	



Milk Yield and Dry Matter Intake

Fert+ Mean 30.1 kg/day

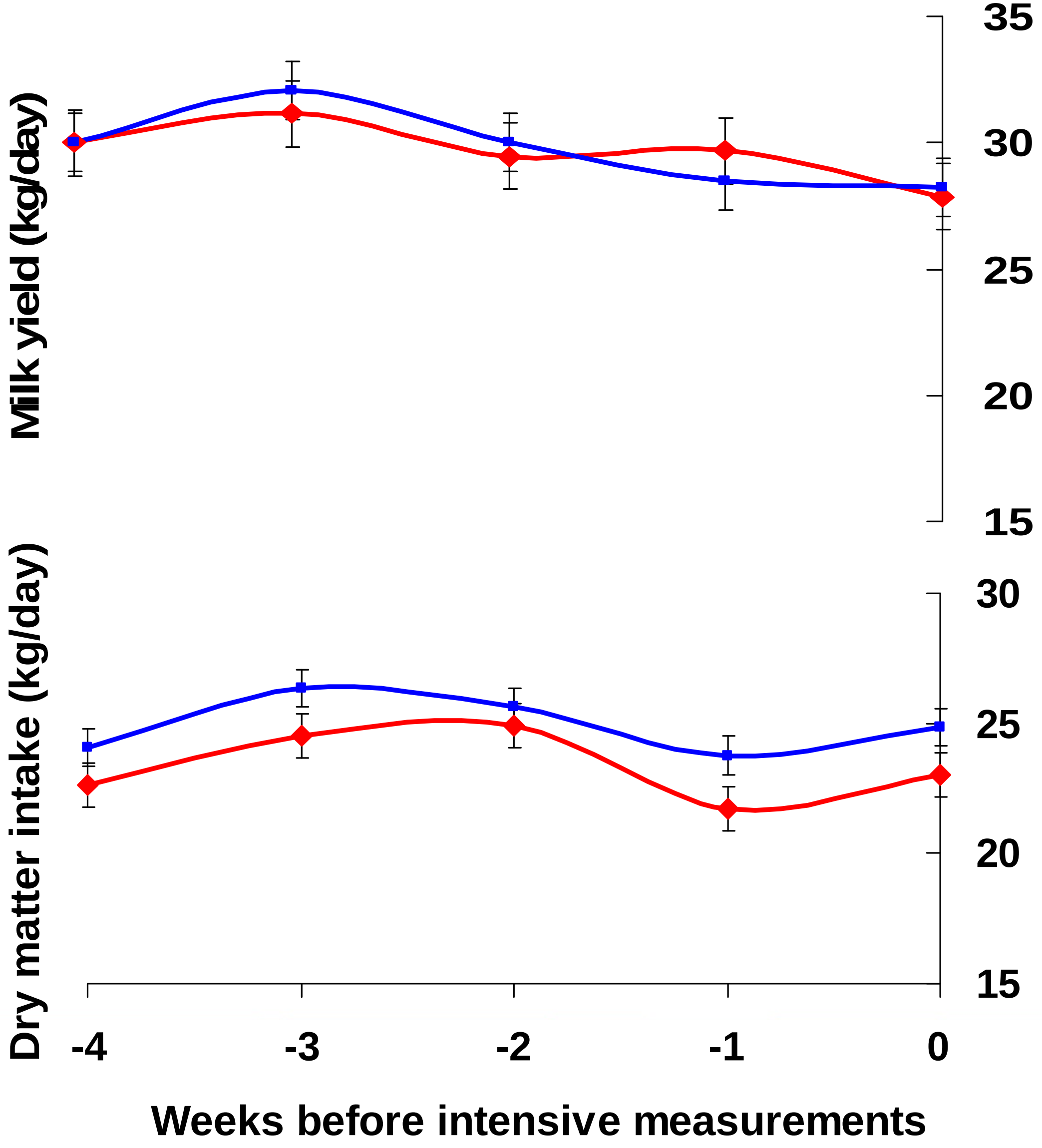
Fert- Mean 29.9 kg/day

Geno P= 0.9

Fert+ Mean 24.9 kg/day

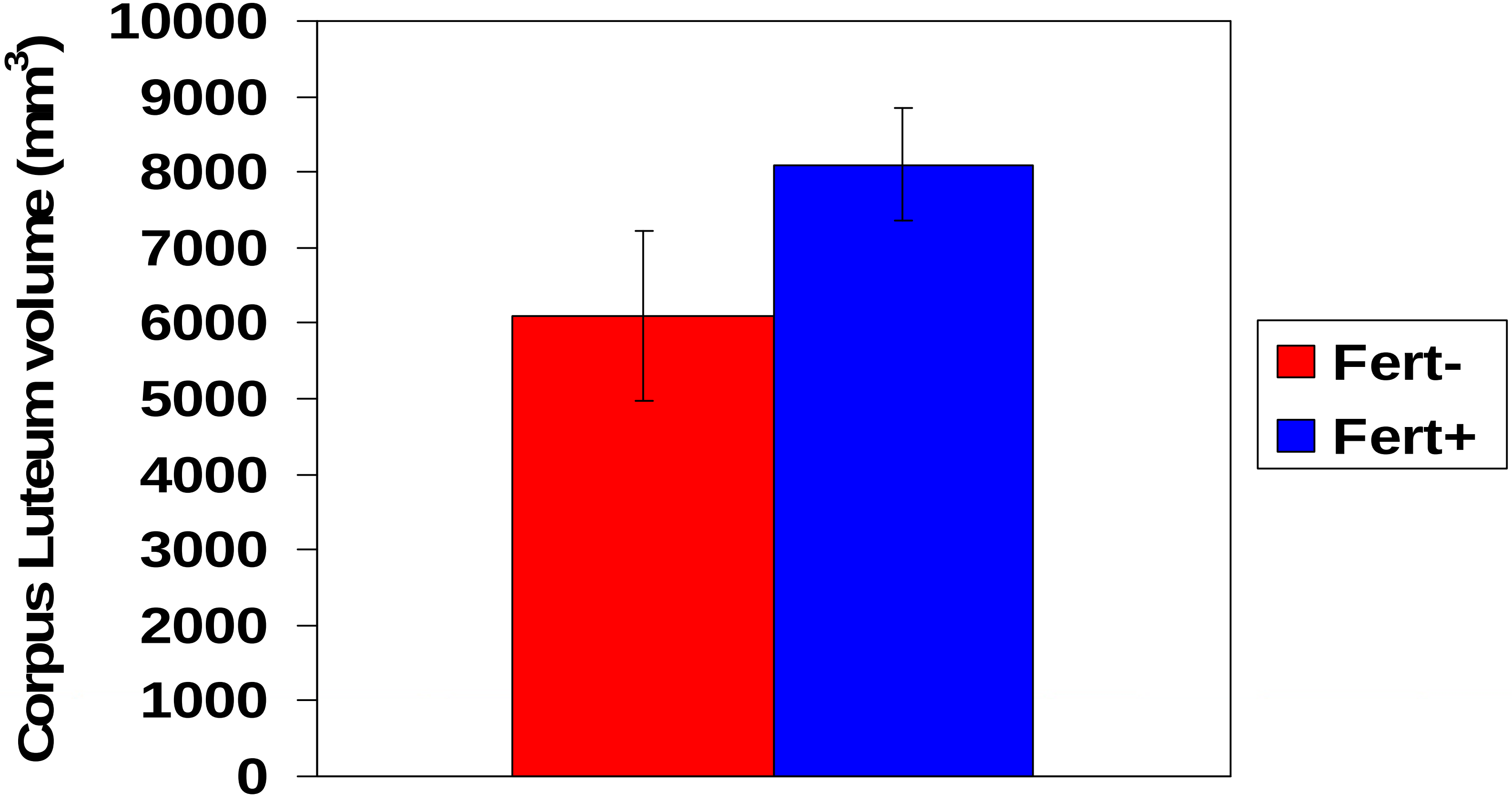
Fert- Mean 23.4 kg/day

Geno P= 0.03

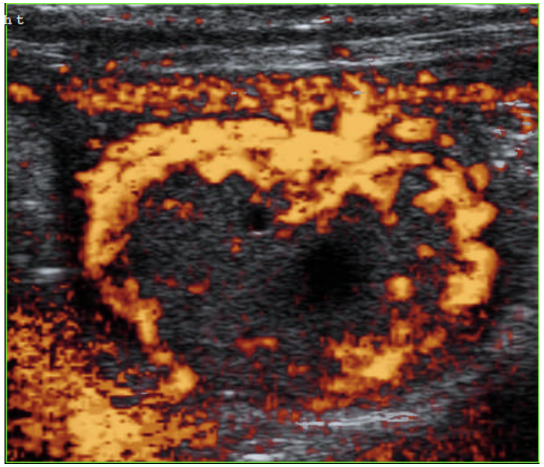


Corpus Luteum Volume

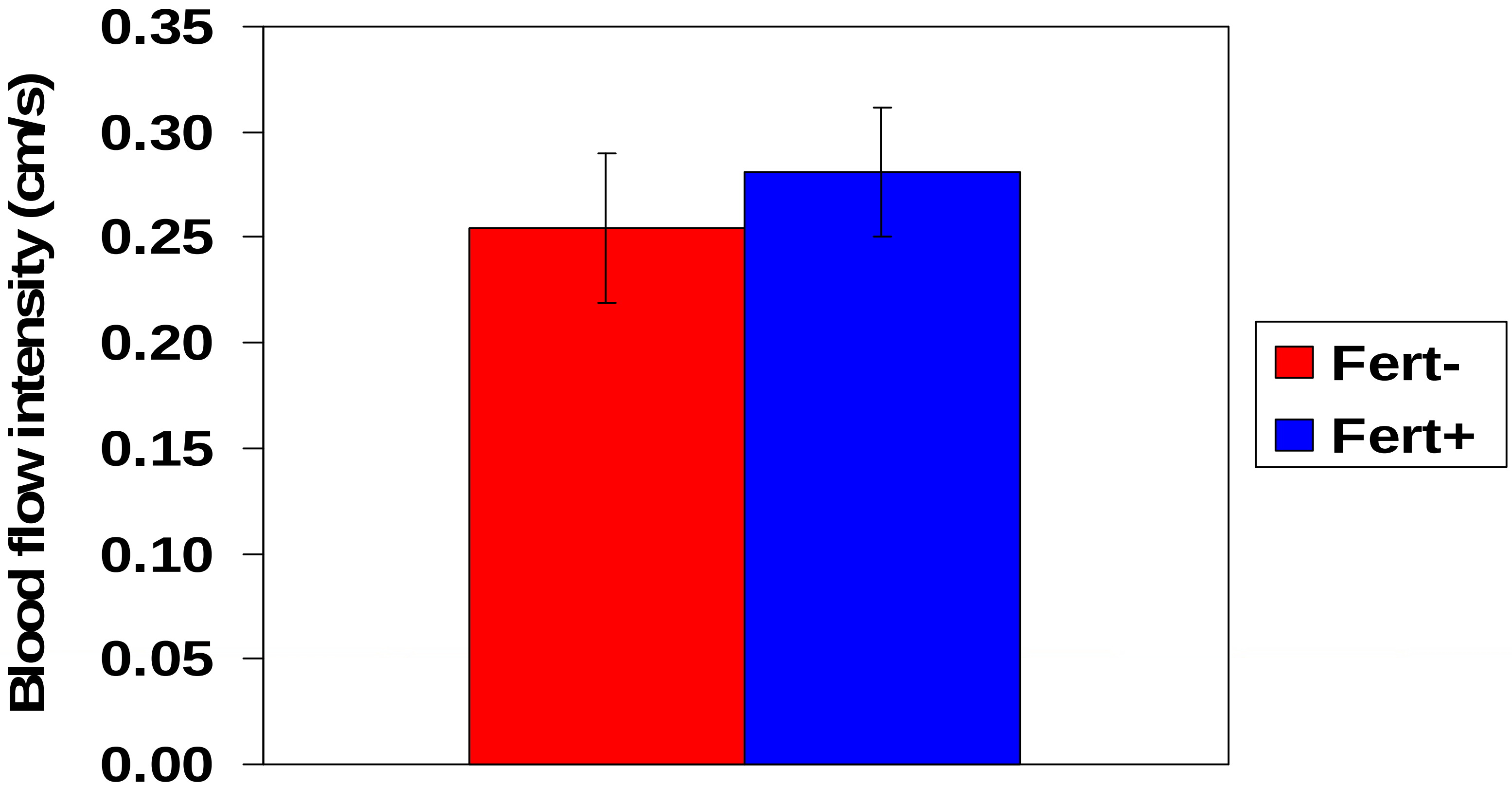
	Mean Volume	P
Fert+	8098.0	0.16
Fert-	6090.3	



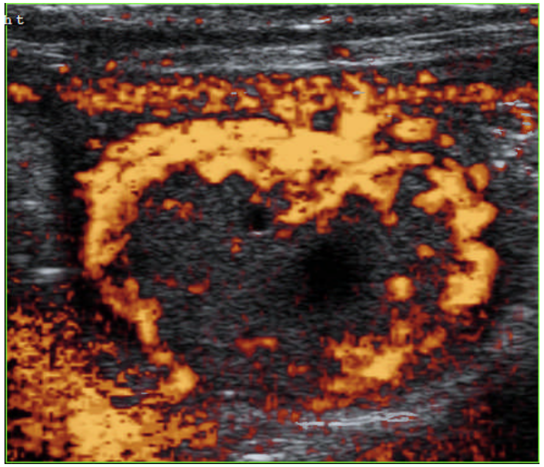
CL Blood Flow Intensity



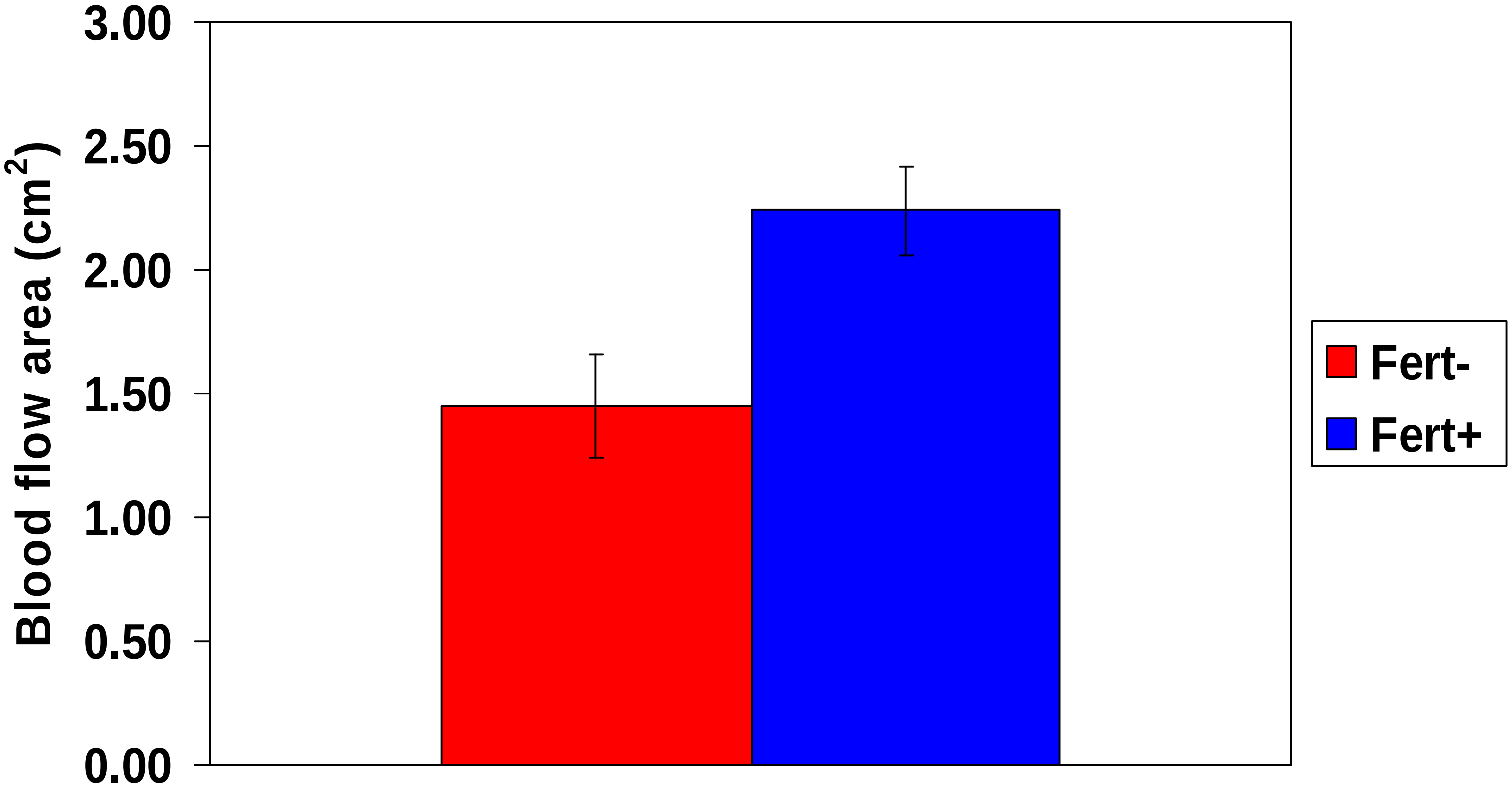
	Mean BFI	P
Fert+	0.25	0.6
Fert-	0.28	



CL Blood Flow Area

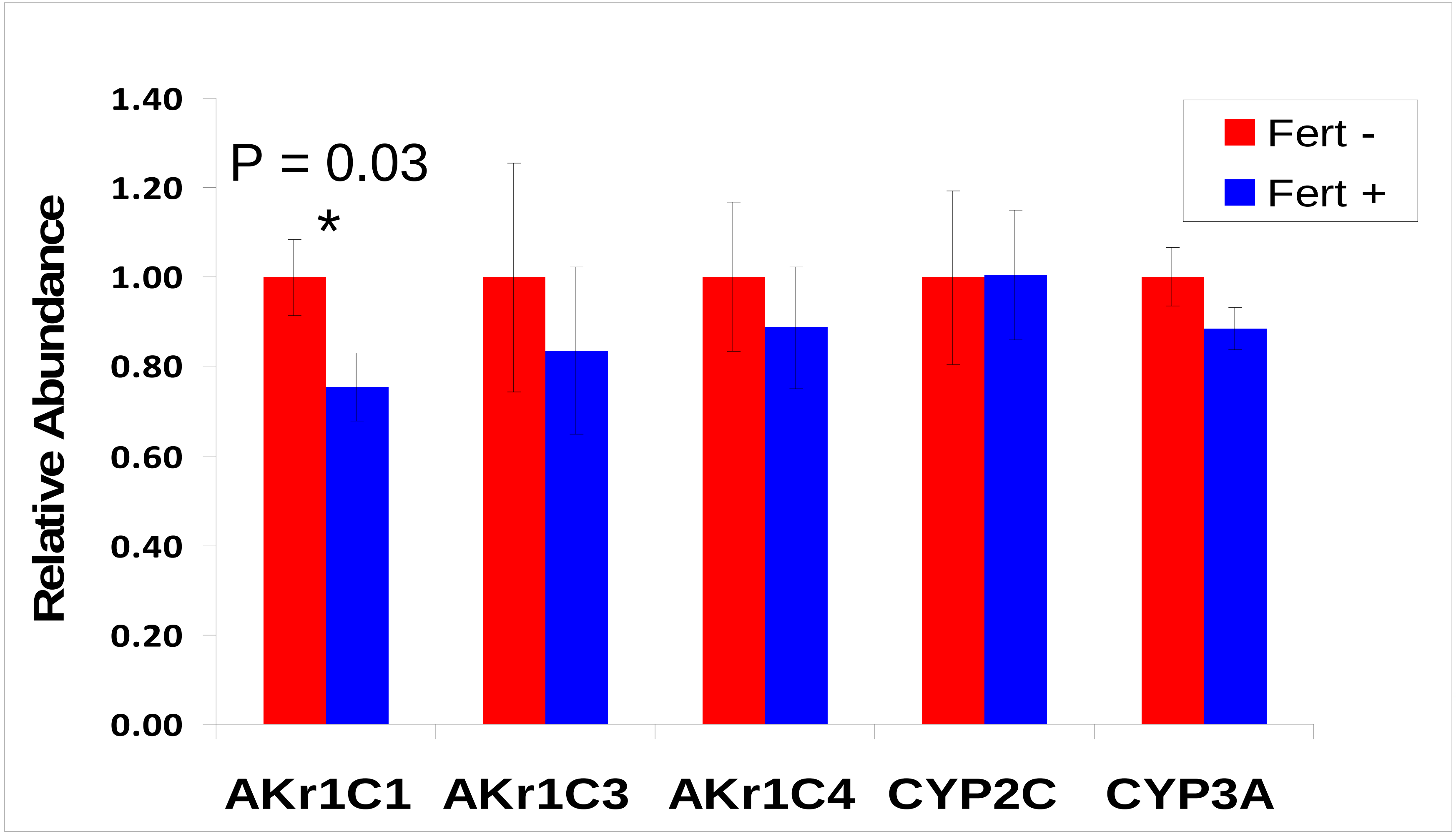


	Mean BFA	P
Fert+	2.24	0.03
Fert-	1.45	



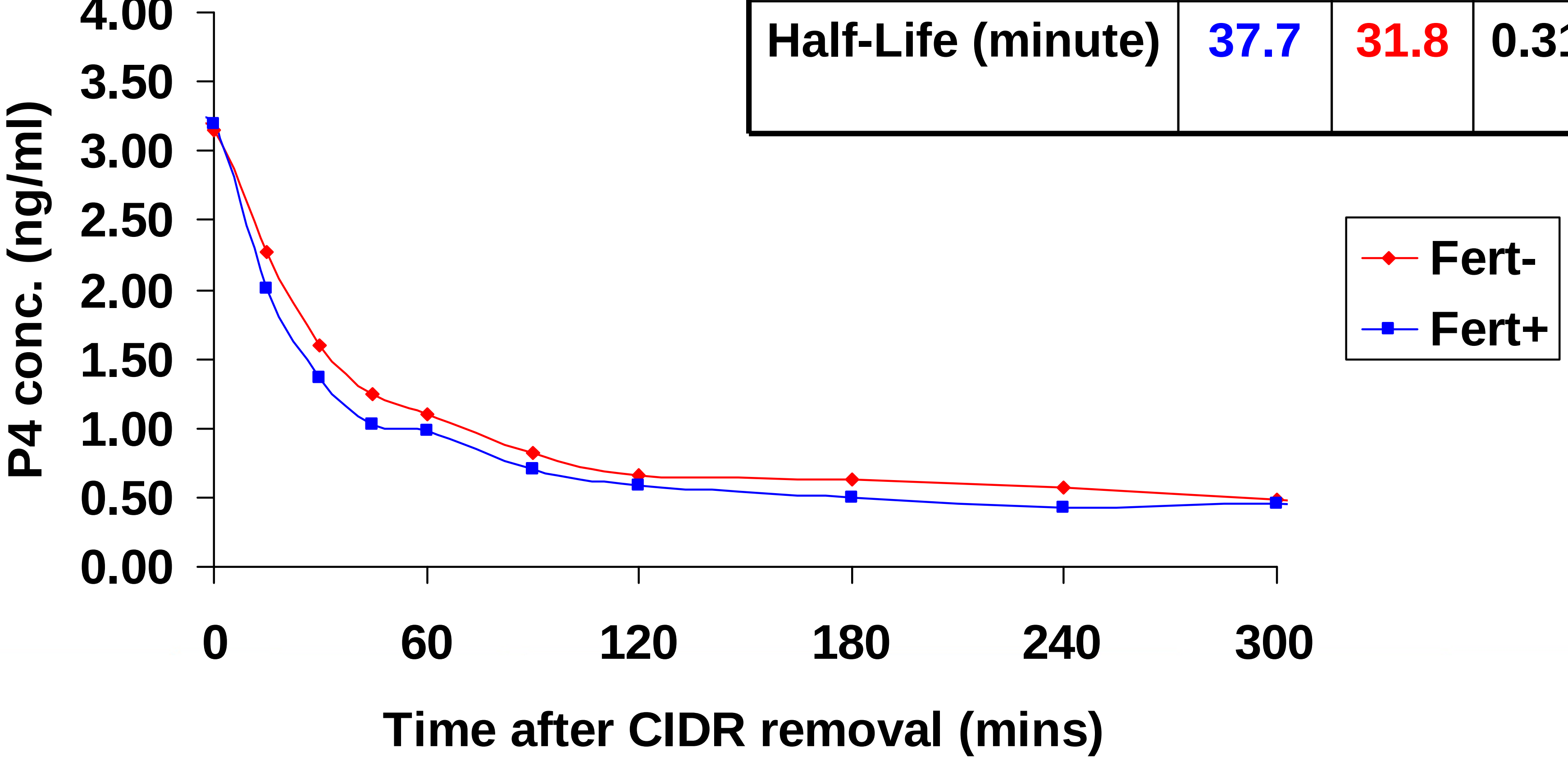
Hepatic Gene Expression

- **Examined genes responsible for P4 catabolism**
  - **RT qPCR**



P4 Clearance

	Fert+	Fert-	P
MCR (%/minute)	1.8	2.3	0.16
Half-Life (minute)	37.7	31.8	0.31



Conclusions

No effect of genotype on

- **CL volume and blood flow intensity**
- **P4 half-life and metabolic clearance rate**
- **Genes responsible for P4 catabolism?**
- **Milk yield**

Fert+:

- **Greater circulating P4**
- **Greater CL blood flow area** → **P4 synthesis**
- **Greater dry matter intake** → **Liver metabolism**

- **CL synthetic capacity vs. P4 clearance**

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Thank You!

Questions???