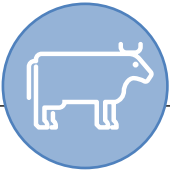


# Genetic aspects of age at first calving in Italian Holstein dairy cows



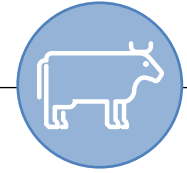
V. Ferrari<sup>1,2</sup>, F. Galluzzo<sup>1</sup>, R. Finocchiaro<sup>1</sup>, J.B.C.H.M. van Kaam<sup>1</sup>, M. Marusi<sup>1</sup>, M. Penasa<sup>2</sup>, M. Cassandro<sup>1,2</sup>

<sup>1</sup>Associazione Nazionale Allevatori della Razza Frisona, Bruna e Jersey Italiana (ANAFIBJ), Via Bergamo 292, 26100 Cremona, Italy

<sup>2</sup>Department of Agronomy, Food, Natural resources, Animals and Environment (DAFNAE), University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy



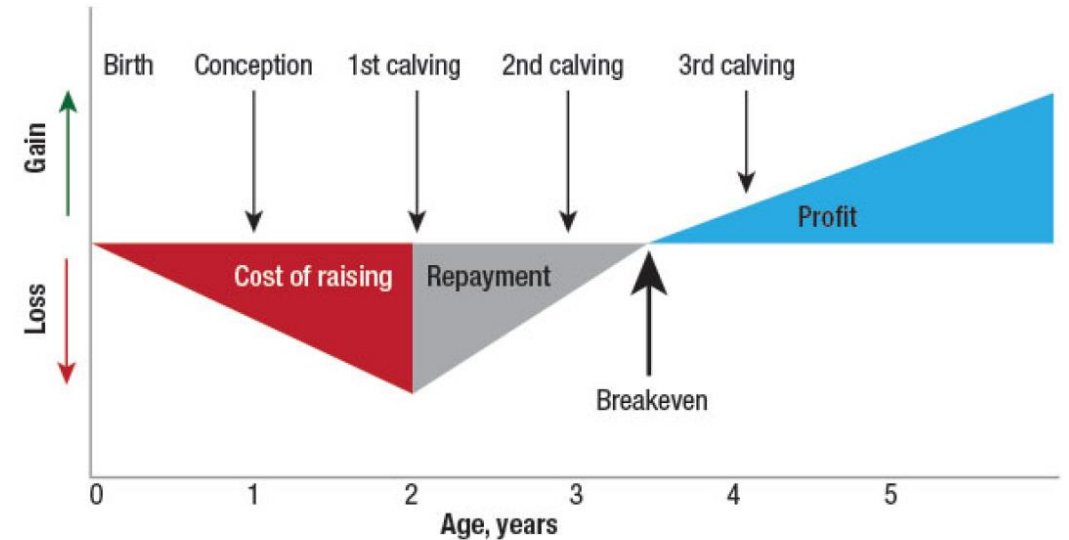
# Introduction



Age at first calving:

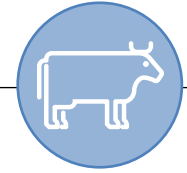
- time from birth to first calving
- start of productive life

Reduce AFC to generate income earlier



Source: WEB

# Introduction



Replacement animals → 2° / 3° cost item on total production costs per milk-litre

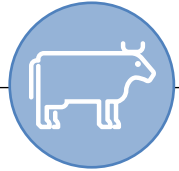


«What age at first calving should farmers target to achieve the greatest profitability?»

1. Introduction; 2. Aim; 3. Materials and methods; 4. Results; 5. Conclusion



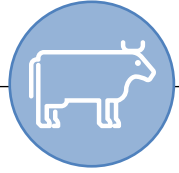
# Aim



Evaluate genetic aspects of AFC in Italian Holstein:

- ✓ Estimate **heritability**
- ✓ Approximate **genetic correlations** with other traits
- ✓ Breeding values estimation (**EBV**)
- ✓ Define the range of AFC in which the **best lifetime potential is expressed**

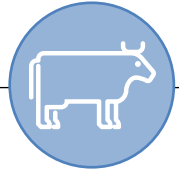
# Materials and methods



## Data

- 4,206,218 Holsteins
- 11,528 herds
- Born since 1993
- Calving between 1996 and 2020
- AFC between 18 and 35 mo
- Gestation length from 240 to 305 d
- 4 generation back pedigree

# Materials and methods



## Statistical model:

$$y_{ijkl} = HYS_i + GL_j + A_k + e_{ijkl}$$

$HYS_i$  = fixed effect of herd-year-season of birth

$GL_j$  = fixed effect of gestation length in 4 classes: 240 to 260, 261 to 280, 281 to 290, and 291 to 305 d

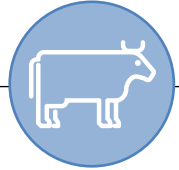
$A_k$  = random additive genetic effect of the animal

$e_{ijkl}$  = random error

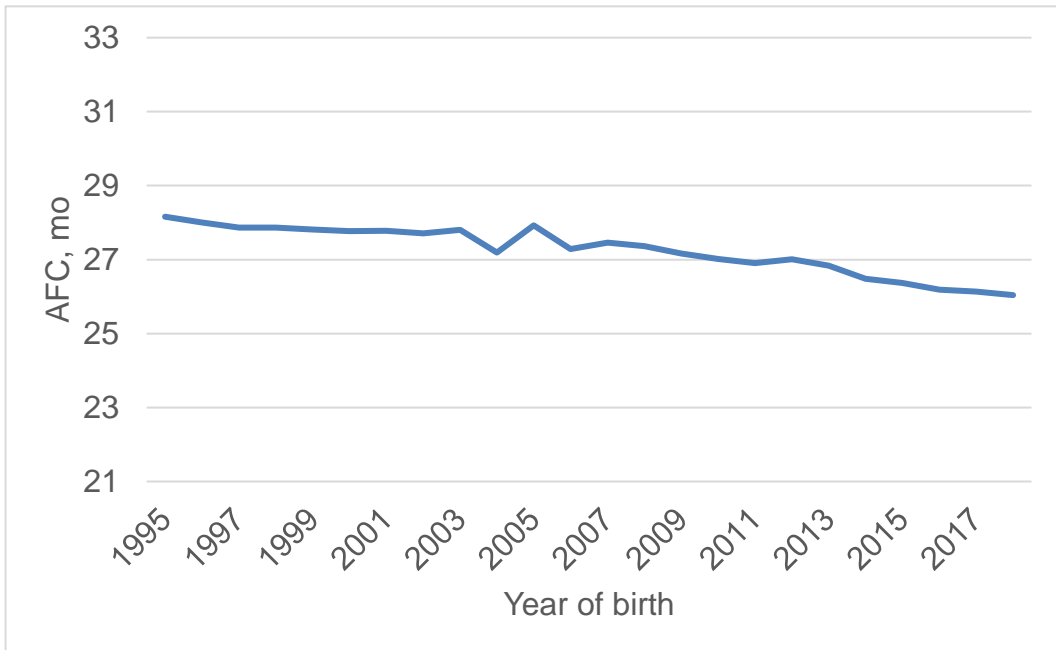
## Software:

1. THRGIBBS1F90
2. POSTGIBBSF90
3. MiX99 → EBV

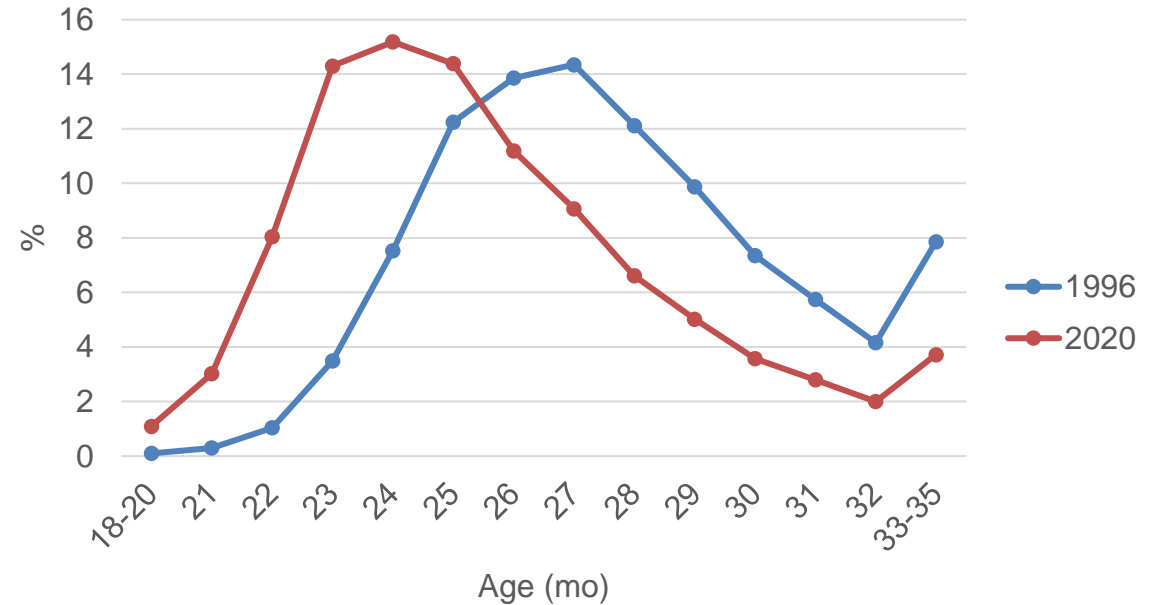
# Results



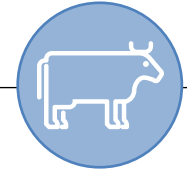
Phenotypic trend of AFC by year of birth



Frequency (%) of heifers across age at first calving (AFC) in 1996 and 2020

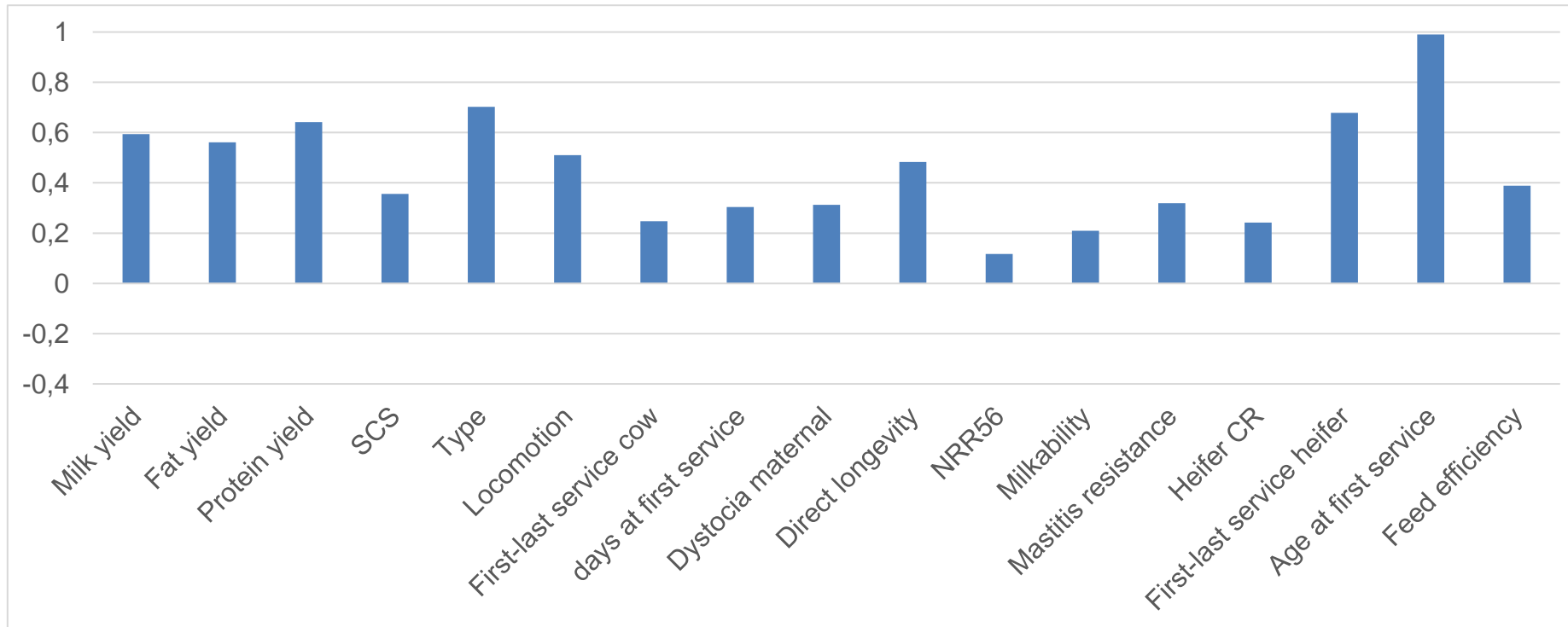


# Results



## Approximate genetic correlations between AFC and other traits

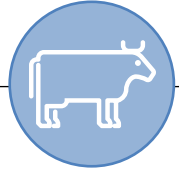
(Calo et al., 1973; Wall et al., 2003)



1. Introduction; 2. Aim; 3. Materials and methods; 4. Results; 5. Conclusion



# Results

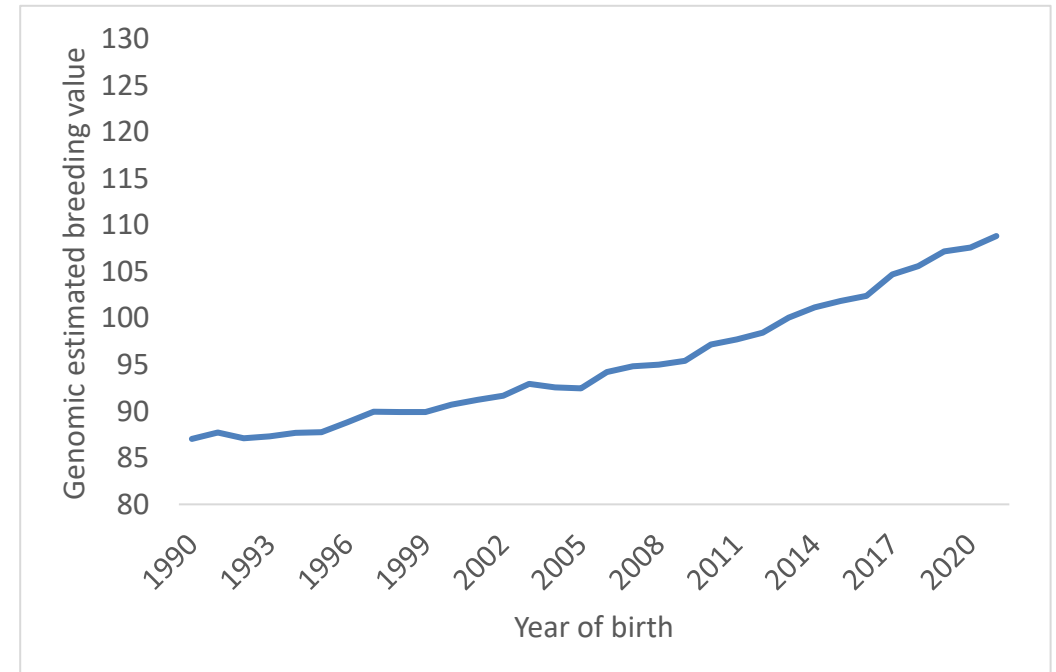


- $h^2 = 0.038$  (PSD 0.005)
- Index expressed with mean 100 and SD 5

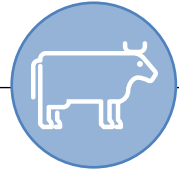


**Higher** index = **lower** AFC

## Bulls' AFC GEBV trend by year of birth



# Results



## What does it mean?

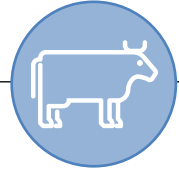
Index	AFC (mo)
85	27.72
90	27.31
95	26.86
100	26.35
105	25.81
110	25.05
115	24.44

+ 1 sd → -0.64 mo  
- 1 sd → +0.46 mo

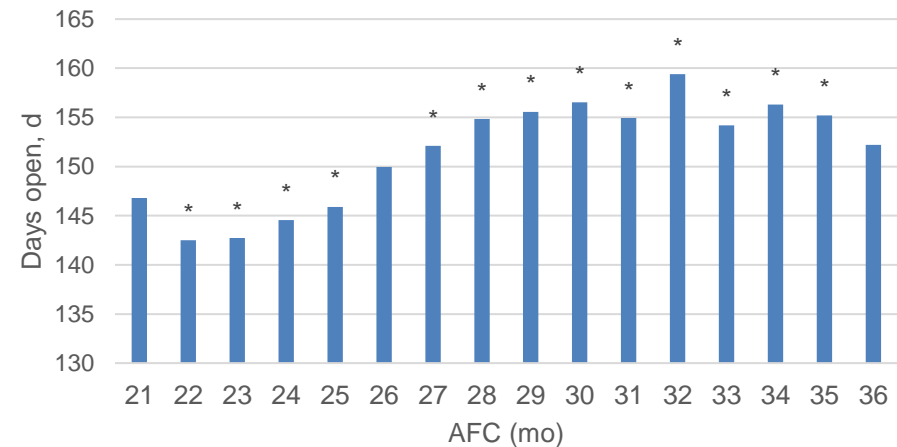
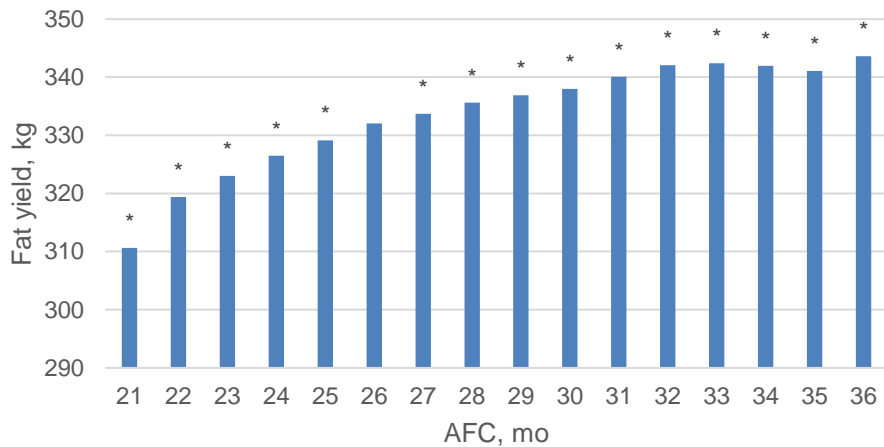
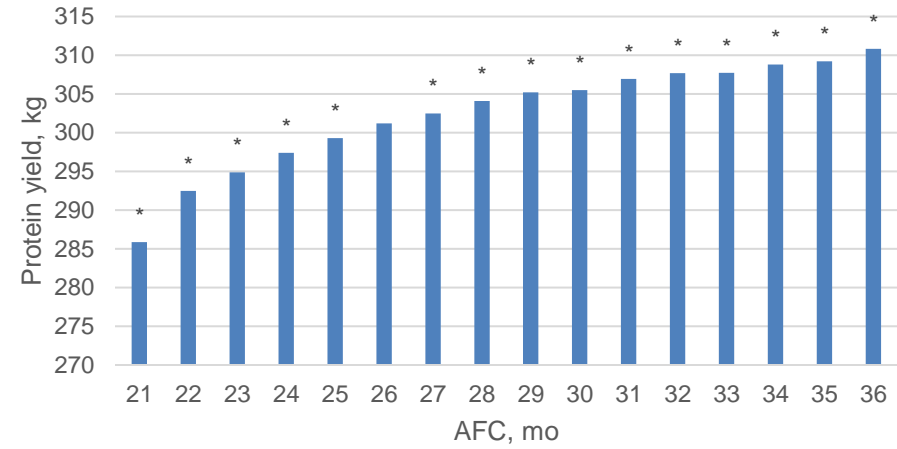
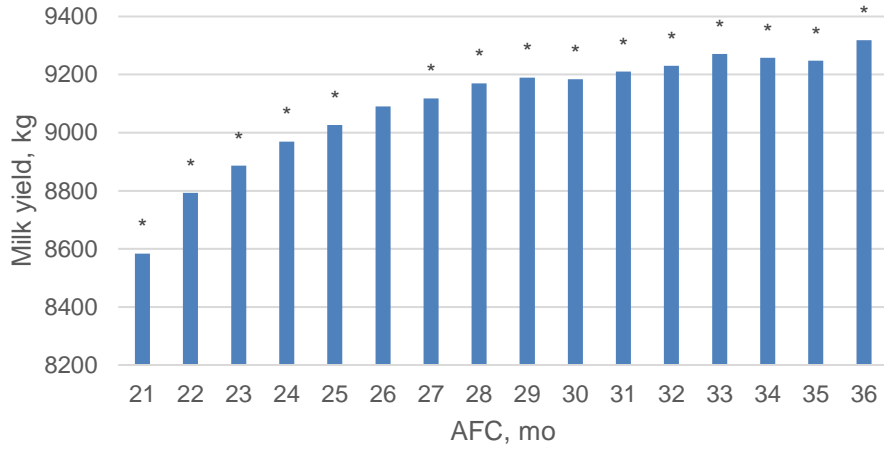
## Differences between top bulls and low bulls for AFC

		AFC	Milk, kg	Protein, kg	Fertility	
TOP	≥105	mean	108.26	1,076.17	51.06	105.25
		SD	2.65	510.86	17.28	4.61
LOW	≤95	mean	91.65	-229.86	-7.02	102.08
		SD	3.80	693.80	23.30	5.10

# Results

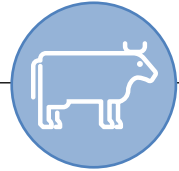


## LSM of age at first calving (AFC) on actual milk, protein, and fat yield and days open

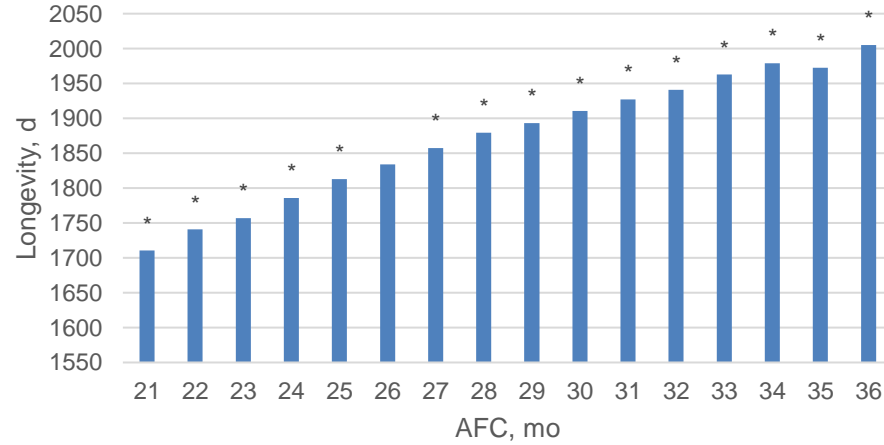
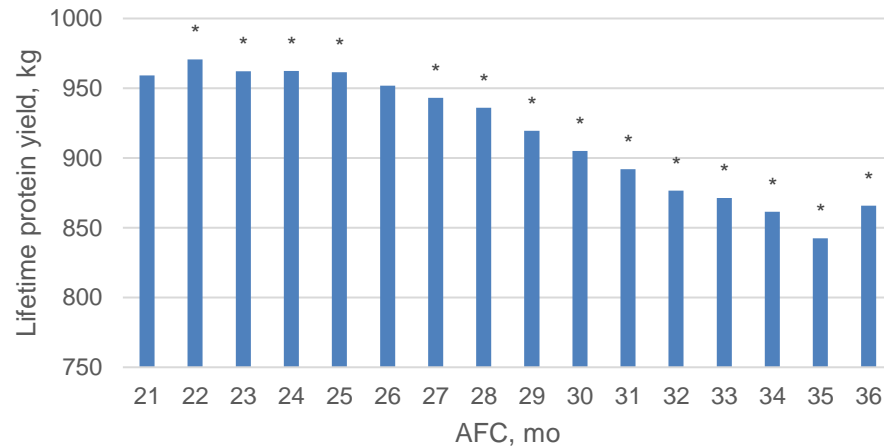
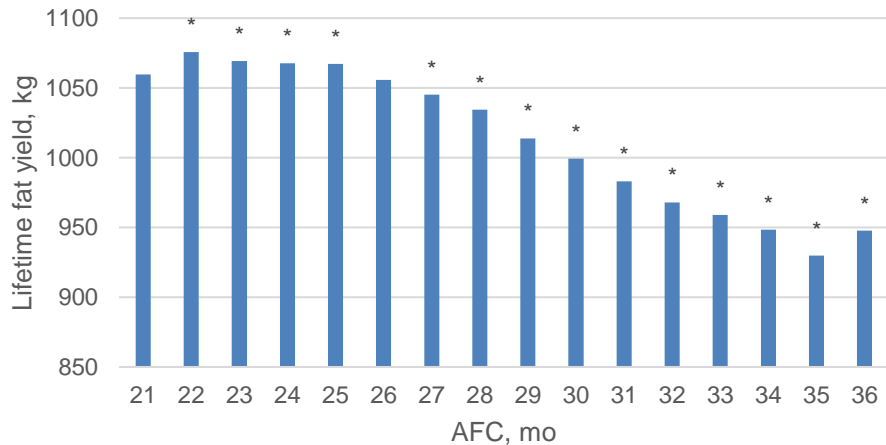
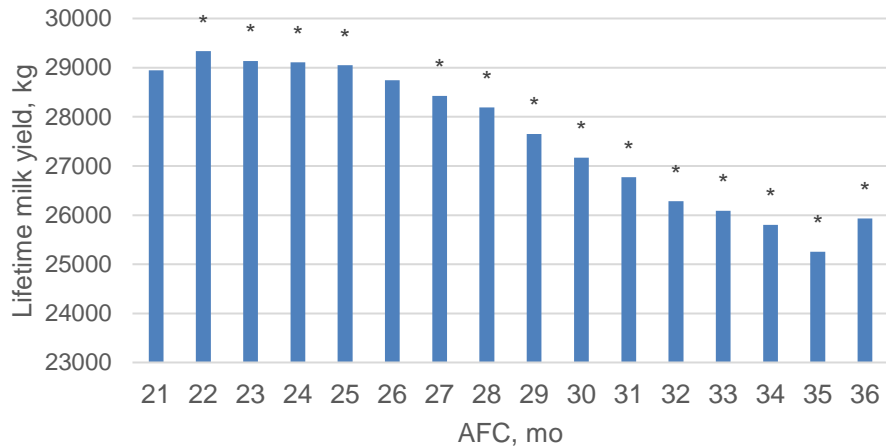


1. Introduction; 2. Aim; 3. Materials and methods; 4. Results; 5. Conclusion

# Results

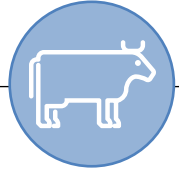


## LSM of age at first calving (AFC) on lifetime milk, protein, and fat yield and longevity



1. Introduction; 2. Aim; 3. Materials and methods; 4. Results; 5. Conclusion

# Conclusions



- ✓ Reducing AFC allows farmers to reduce costs.
- ✓ Even if heritability is low, AFC can be genetically improved.
- ✓ Good management is fundamental.
- ✓ AFC values between 22 and 23 mo display higher lifetime production performances and lower days open.

## Future perspective:

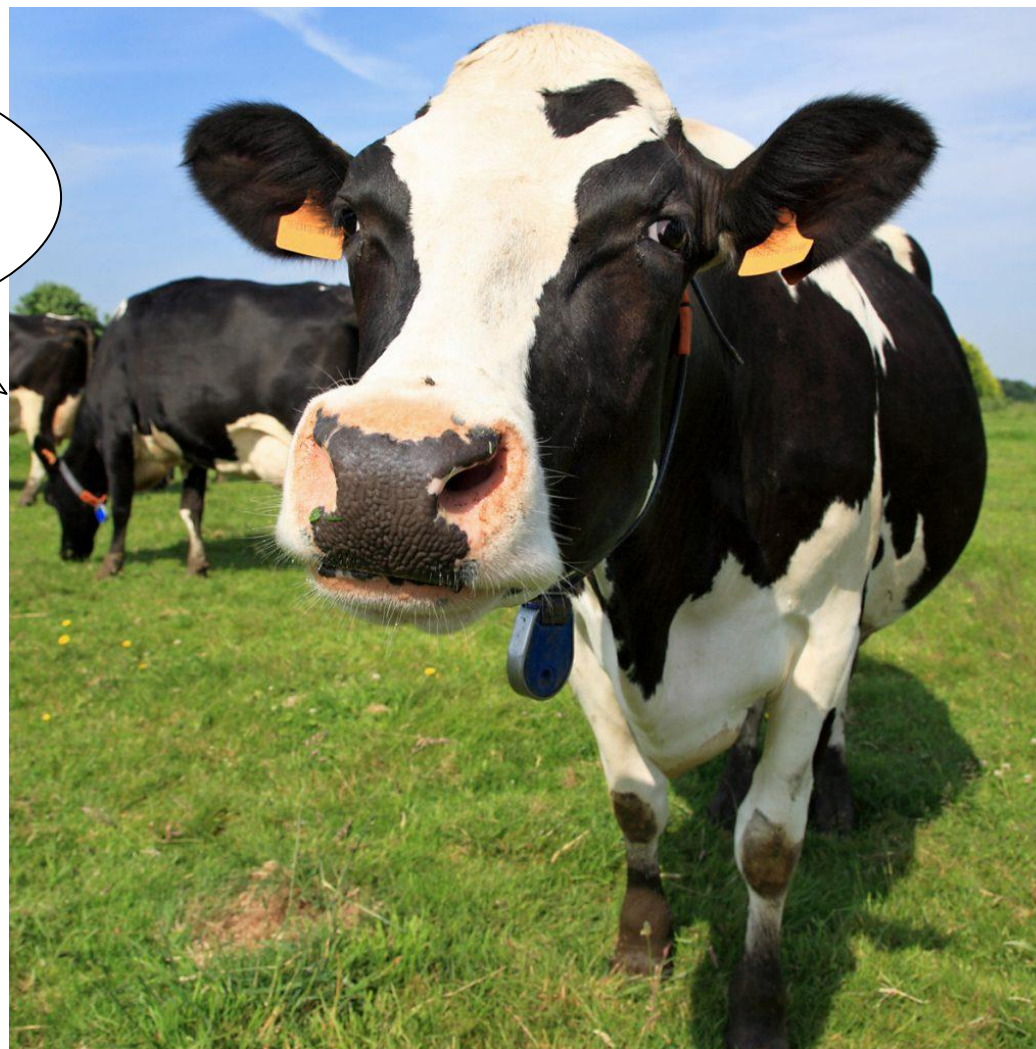
→ Including AFC into Italian economic selection index



# Thank you for your attention!!!

1222-2022  
800  
ANNIUNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

*Any  
questions?*



valentinaferrari@anafi.it  
valentina.ferrari.5@phd.unipd.it