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ANCCE

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Drawbacks and consequences of using different criteria in the design of semen banks

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➢ Conservation program's genetic objective

- ✓ **Keep the highest levels of genetic diversity**
- ✓ **Reduce the increase of inbreeding**

➢ Methodology

- ✓ **Management methods on living population**
- ✓ **Cryobanks**

Advantages of cryobanks

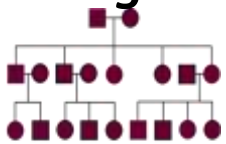
- use of post-reproductive individuals
- increase census size
- enlarge generation interval
- ‘stop’ genetic drift
- ease the loss of diversity due to selection

Design of cryobanks

- **minimum coancestry criterion**
  - ✓ **select donors**
  - ✓ **number of doses from each potential donor**

Pedigree

f_g



Coancestry matrix

Markers

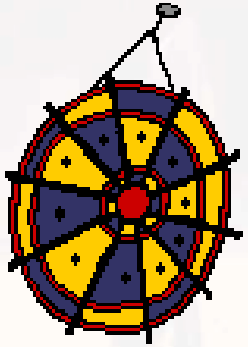
f_m

Breeding program

- **Is it worthy keeping everything?**
  - ✓ **same criteria as in breeding program**
  - ✓ **select donors with high performance**

OBJECTIVE

- **evaluate the consequences of using different approaches for deciding the donors to a cryobank**
  - ✓ **Semen bank for Pura Raza Español (PRE) horse as a case study**



MATERIAL & METHODS

- **The Pura Raza Español (PRE) horse is the most important breed in Spain**
  - ✓ **high number of animals (65.96% of the national horse population).**
  - ✓ **leisure and sports activities, mainly classical dressage**
  - ✓ **breeding scheme includes conformation, riding and dressage ability**

- **ANCCE is the main breeder association**

➢ Studbook back to 18th century

Total: 281,052
Dead: 65,090
Females: 115,544
Males: 100,418

PEDIGREE

Max. Gen.: 16,7
Comp. Gen.: 5,5
Equiv. Gen.: 9,2

Number of founders: 1,586

ENDOG (Gutiérrez and Goyache, 2005)

➢ Coancestry matrix of available males

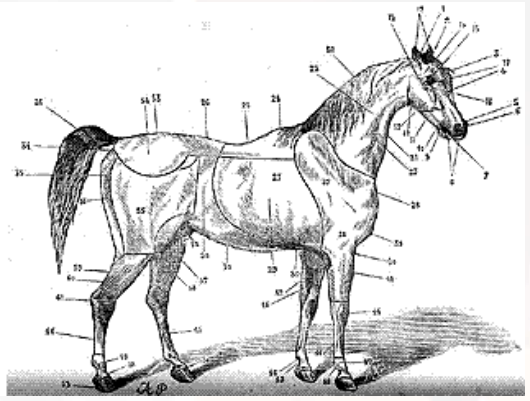
PEDIG (Boichard, 2002)

- **Genotypes**
  - ✓ **18 microsatellites**
  - ✓ **175,153 individuals**
  - ✓ **70,572 living males**

- **Coancestry matrix of available males**
  - ✓ **allelic relationship (Nejati-Javaremi et al., 1997)**
  - ✓ **tailored FORTRAN software**

- **Phenotypes**
  - ✓ **EBV for** { **Linear Morphological Qualification** / **Dressage** }

- ✓ **data on 9,000 males for LMQ**
- ✓ **data on 2,597 males for dressage**



Optimisation

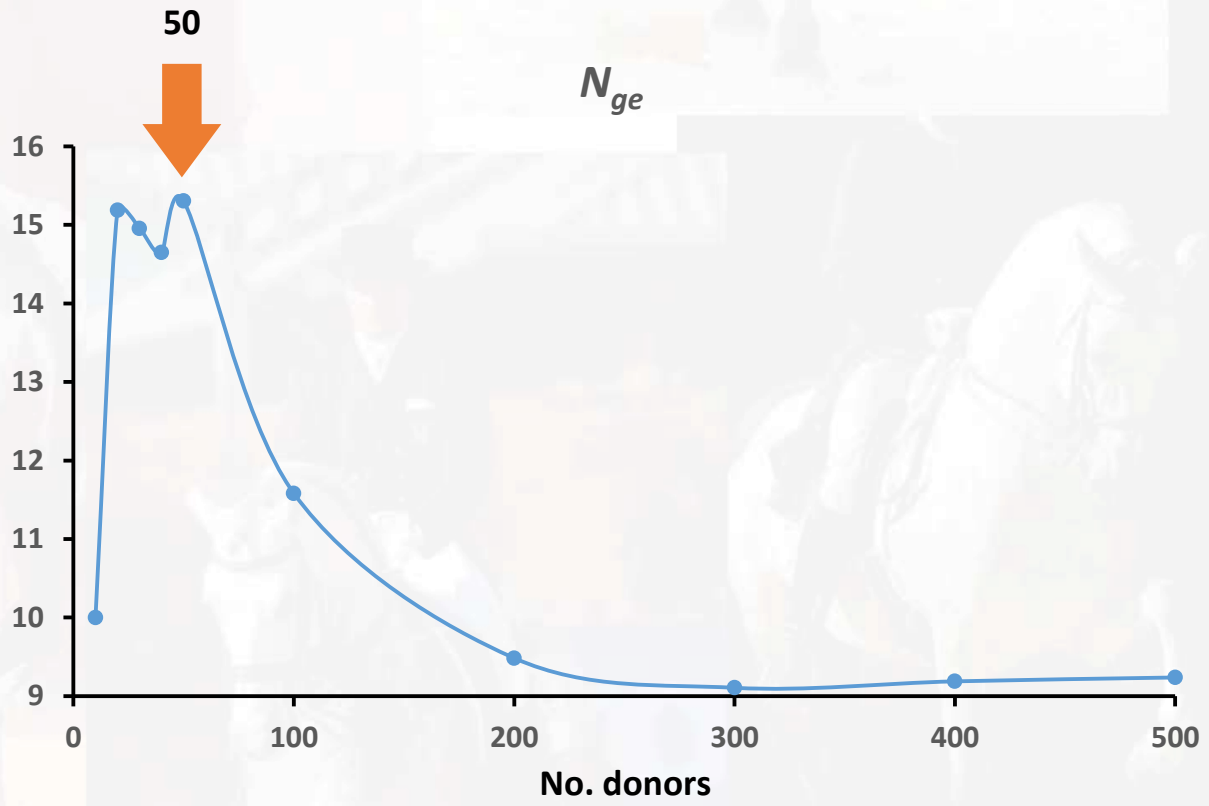
- ✓ **group of *n* candidates with the lowest average coancestry**
- ✓ **Coancestry calculated on pedigree or molecular data**

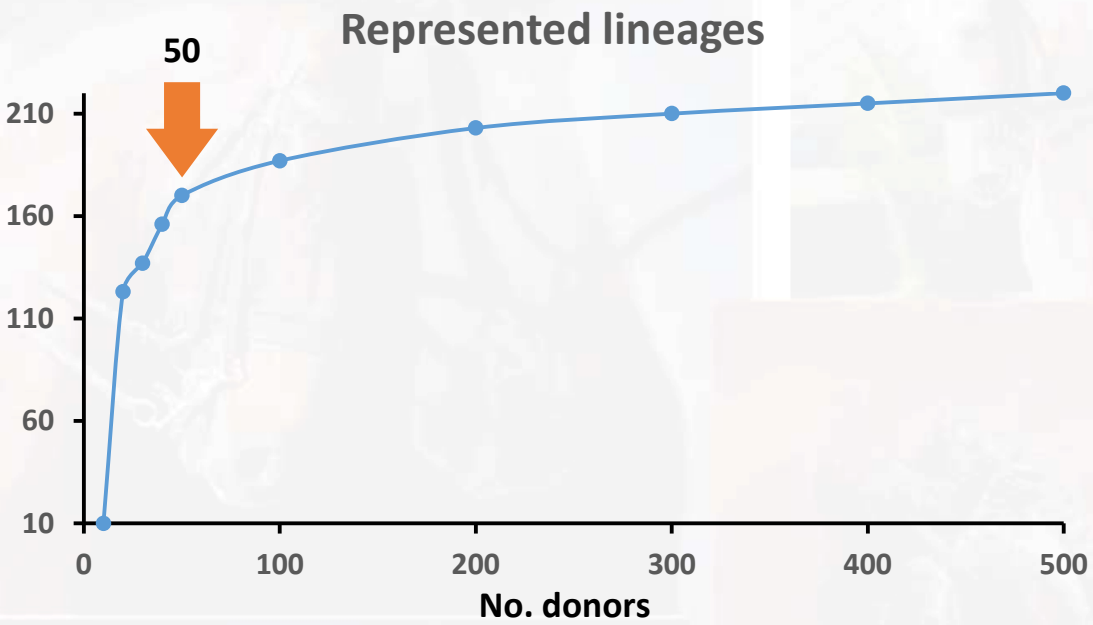
- ✓ **group of *n* candidates with the highest average EBV**
- ✓ **restrictions on the level of (pedigree) coancestry reached**

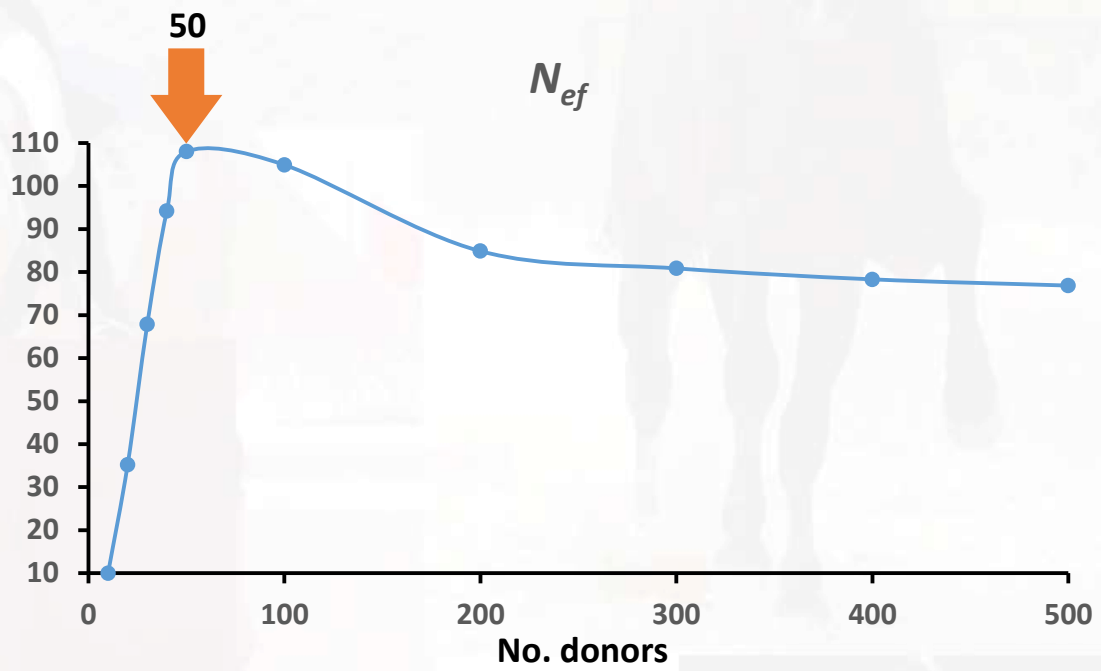
- ✓ **tailored FORTRAN software**

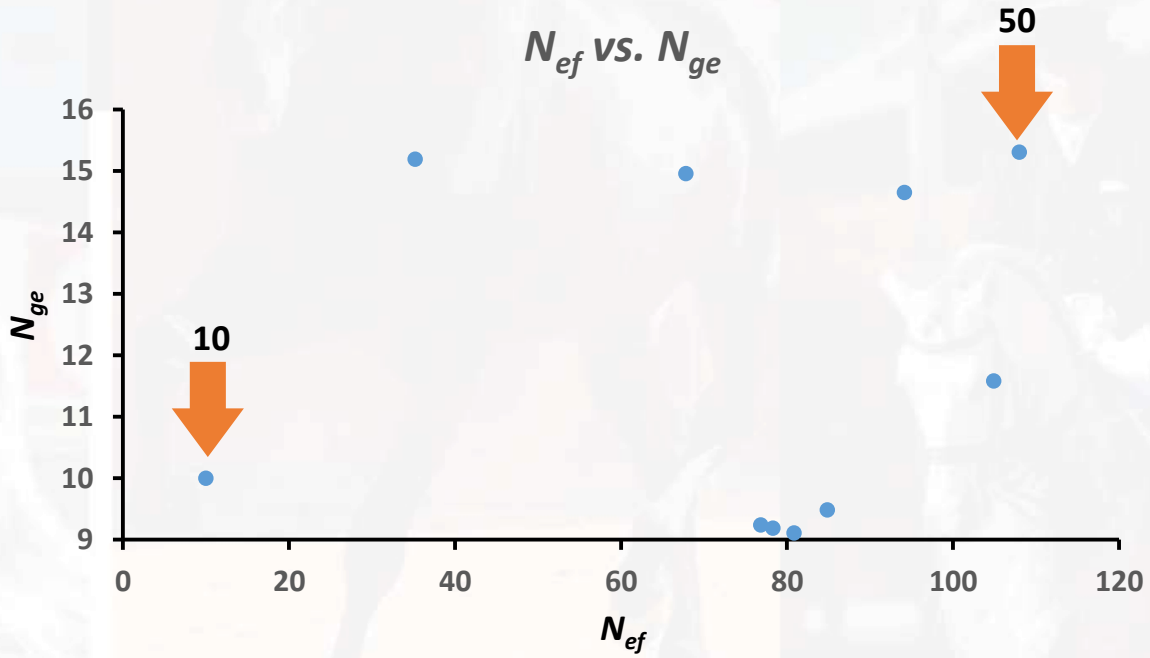
RESULTS

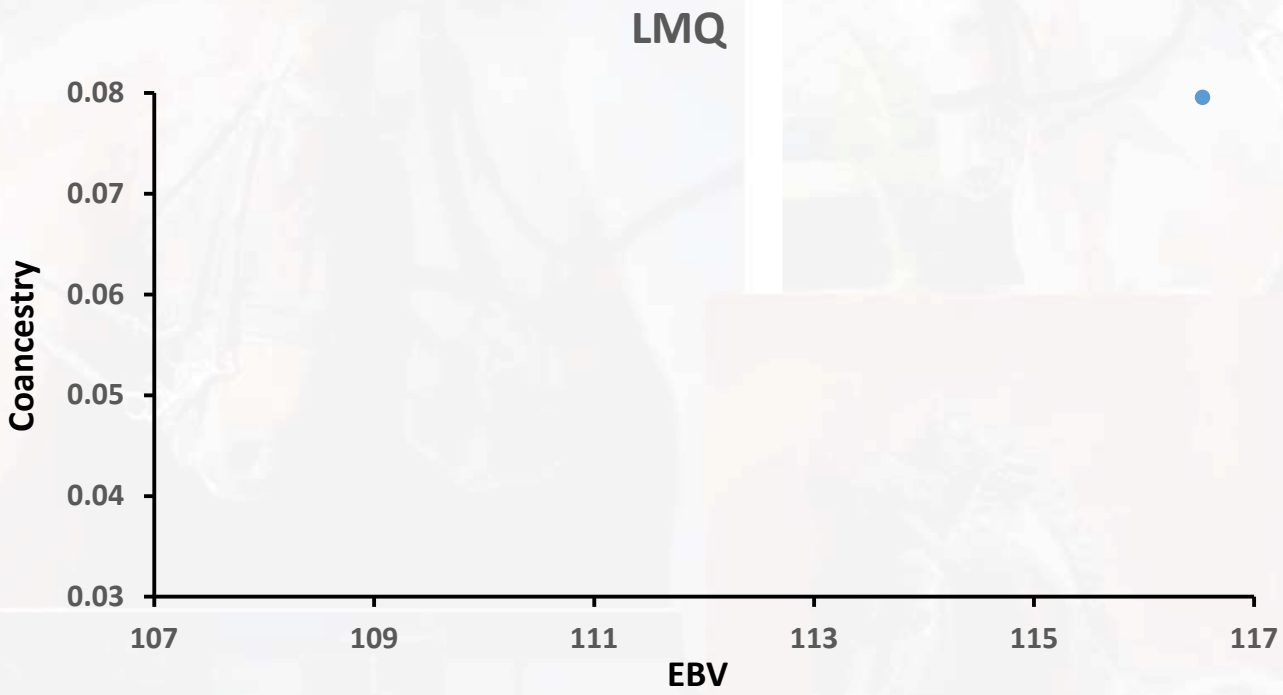
	f_global	F	f_off_diag	N_{ef}	Rep. lineages	N_{ge}
All	0.0581	0.0755	0.0581			
10	0.0500	0.0000	0.0000	10.00	10	10.00
20	0.0329	0.0241	0.0077	35.20	123	15.19
30	0.0334	0.0542	0.0164	67.83	137	14.95
40	0.0341	0.0568	0.0215	94.15	156	14.65
50	0.0327	0.0498	0.0226	108.01	170	15.30
100	0.0432	0.0586	0.0383	104.91	187	11.58
200	0.0527	0.0580	0.0503	84.86	203	9.48
300	0.0549	0.0630	0.0533	80.85	210	9.11
400	0.0544	0.0622	0.0532	78.30	215	9.19
500	0.0541	0.0633	0.0532	76.86	220	9.24
100 worst	0.2127	0.1989	0.2088	13.10	82	2.35
100 random	0.0629	0.0770	0.0581	37.16	212.6	7.95



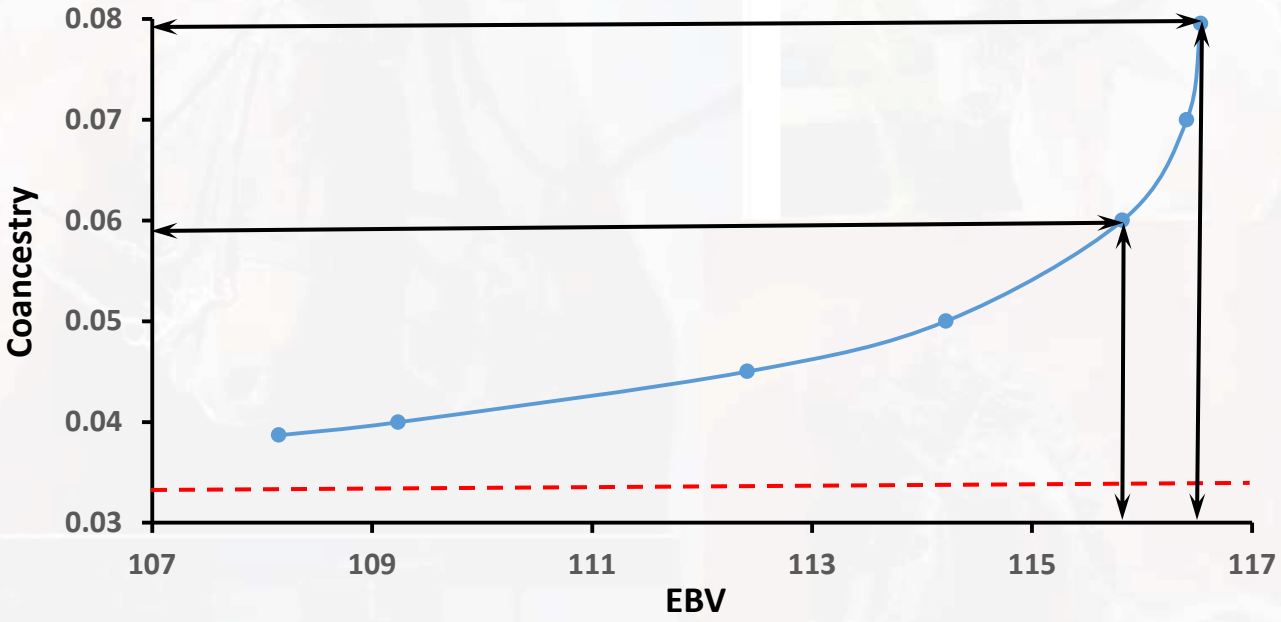

Represented lineages
50
210
160
110
60
10
0
100
200
300
400
500
No. donors


50
N_{ef}
110
100
90
80
70
60
50
40
30
20
10
0
100
200
300
400
500
No. donors

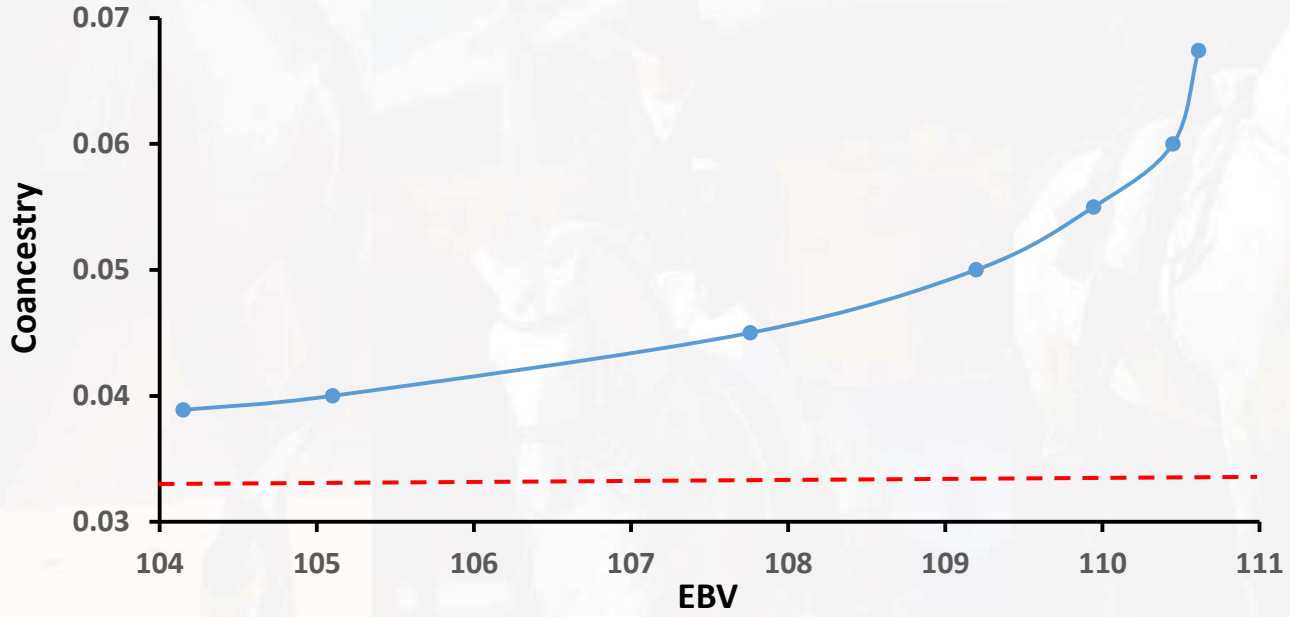

N_{ef} vs. N_{ge}
50
10
16
15
14
13
12
11
10
9
N_{ge}
0
20
40
60
80
100
120
N_{ef}

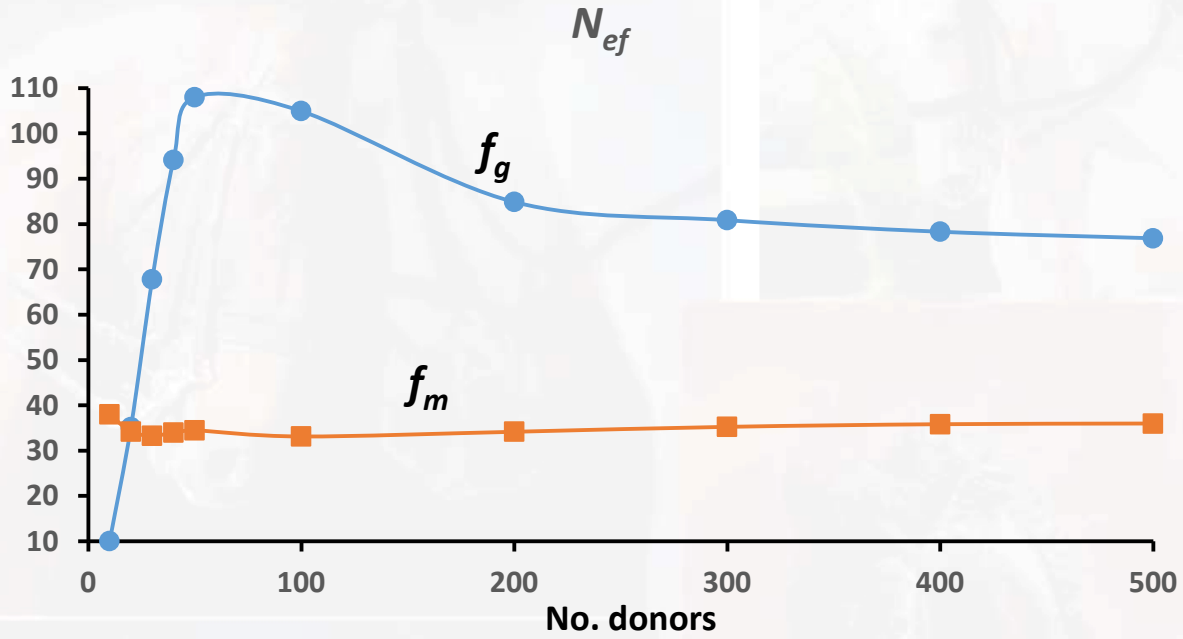

LMQ
0.08
0.07
0.06
0.05
0.04
0.03
Coancestry
107
109
111
113
115
117
EBV

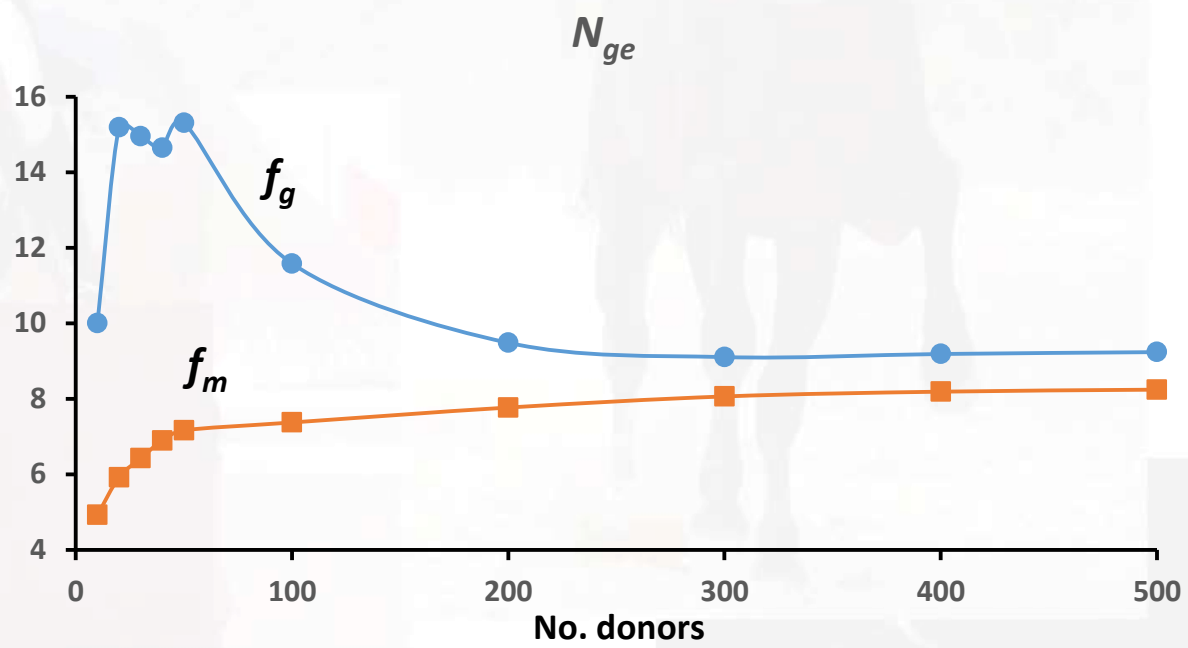
LMQ

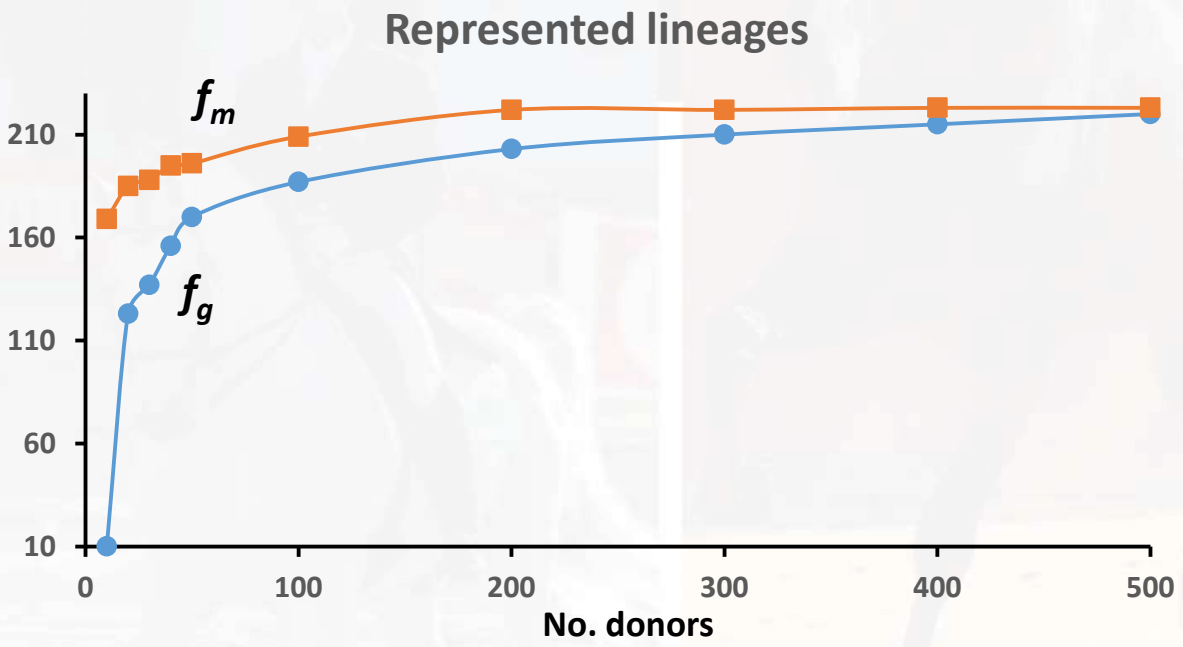


Dressage




N_{ef}
110
100
90
80
70
60
50
40
30
20
10
0
100
200
300
400
500
f_g
f_m
No. donors


N_{ge}
16
14
12
10
8
6
4
0
100
200
300
400
500
f_g
f_m
No. donors


Represented lineages
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160
110
60
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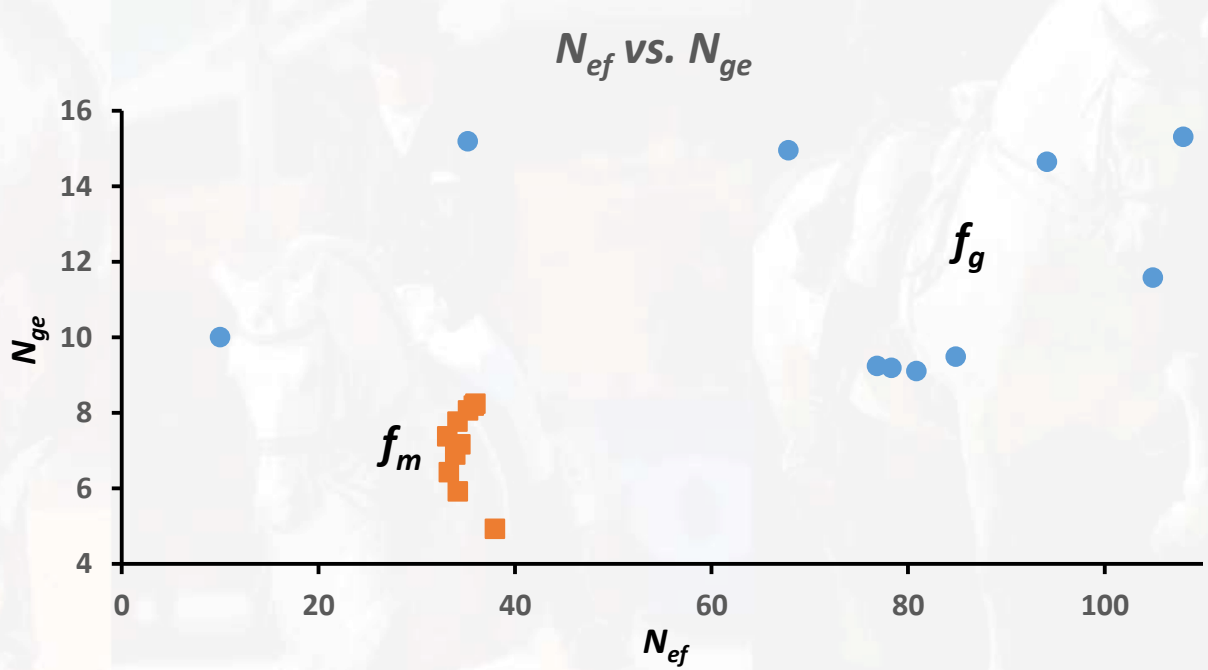
0
100
200
300
400
500
f_m
f_g
No. donors


N_{ef} vs. N_{ge}
16
14
12
10
8
6
4
0
20
40
60
80
100
N_{ge}
N_{ef}
f_g
f_m

TAKE HOME MESSAGES

- **Used criteria affect results indeed**
  - ✓ **reduction in the set of candidates**
  - ✓ **special effect of accounting for a trait**

- **A reliable pedigree is useful**
  - ✓ **low density genotyping may be misleading**
  - ✓ **SNP panels could outperform pedigrees**

- **Other practical or logistic considerations**
  - ✓ **restricting sampling to some geographical areas**

- **Need of keeping low performance individuals may be arguable**
  - ✓ **depends on the aim of the bank**
    - **'backup'**
    - **complementation of 'in situ' programs**
    - **reorientation of populations**
  - ✓ **depends on the time horizon of use**
- **restrictions in the levels of genetic diversity (inbreeding) should be included**
  - ✓ **like in living populations under OC management**

THANK YOU FOR YOUR ATTENTION!