

Optimal definition of contemporary groups for crossbred pigs in a joint purebred and crossbred genetic evaluation

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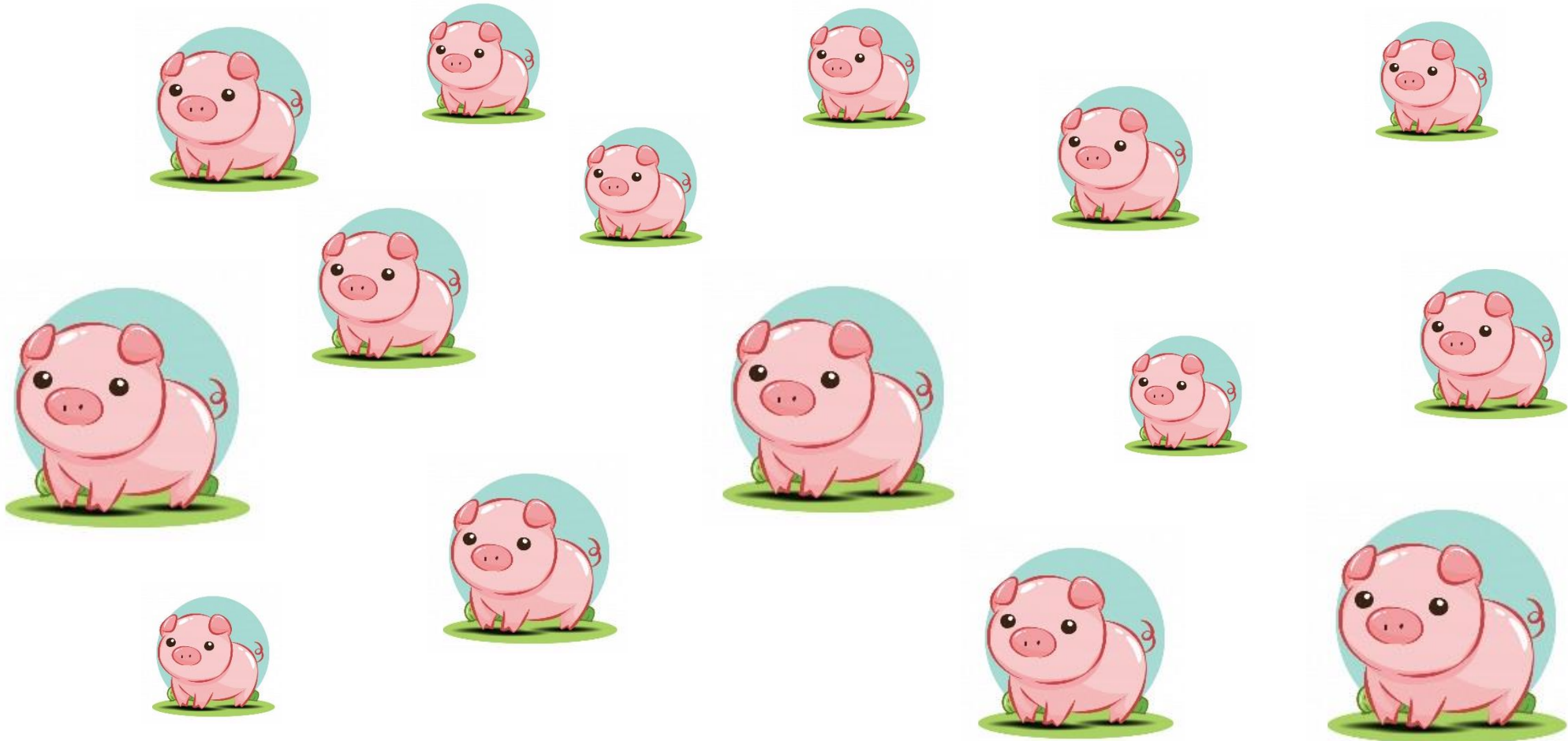


Introduction

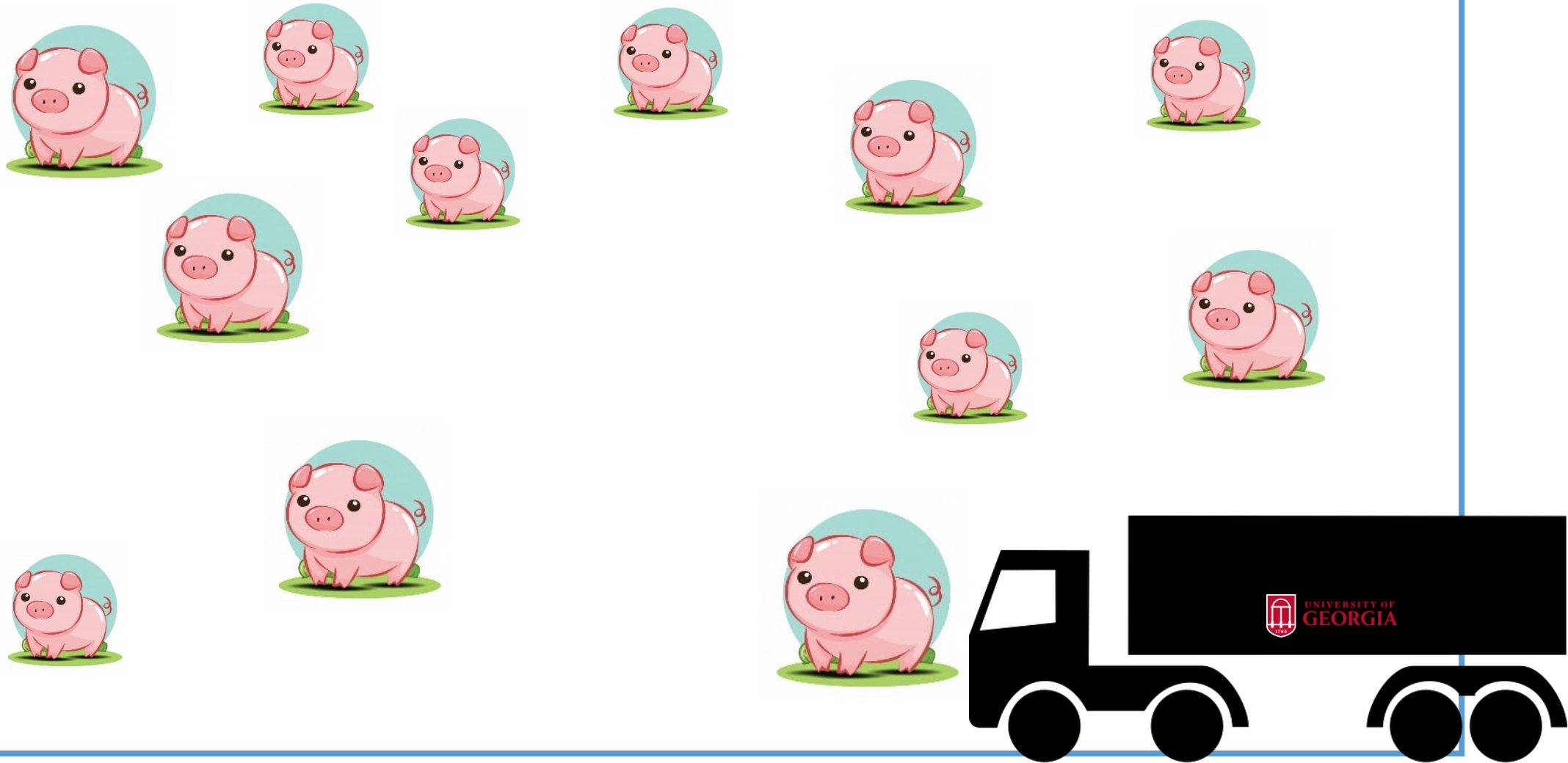
- Purebred selection for crossbred performance
- Different but correlated traits:
 - Nucleus vs Commercial
 - Non-additive genetic factors
 - Age at recording
 - Calculation
 - **Sequential selection**



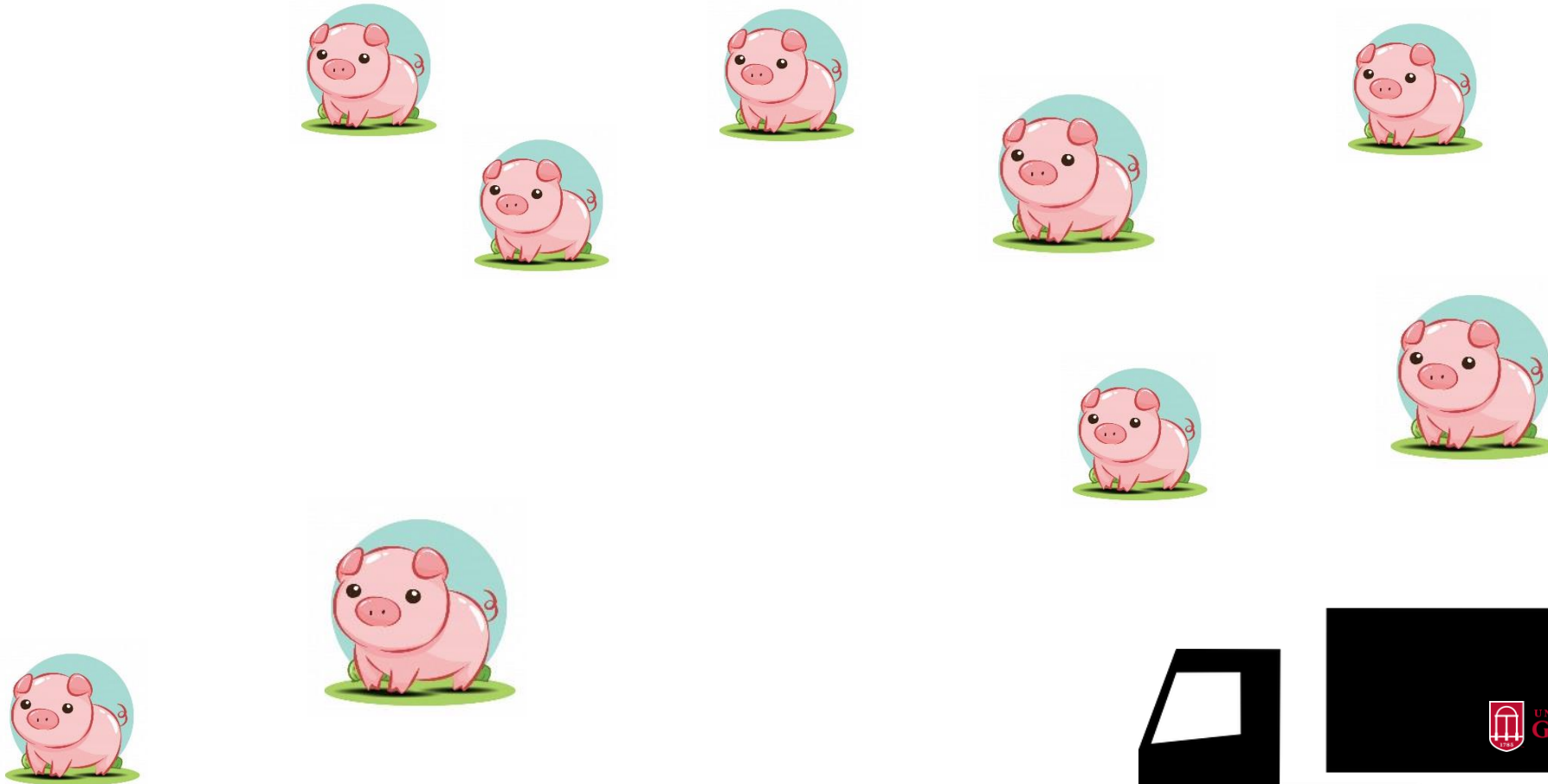
Sequential selection



Sequential selection



Sequential selection



Sequential selection



Challenges

- Many small groups
- Best compared to the best
- Different indirect genetic effects
- Age adjustment?
- Pen information not routinely recorded



Objective

Investigate the effect of contemporary group definition for crossbred traits on:

Variance components

Breeding value accuracy



Traits

- Purebred growth (G_p)
- Purebred backfat (BF_p)
- Crossbred growth (G_x)
- Crossbred backfat (BF_x)

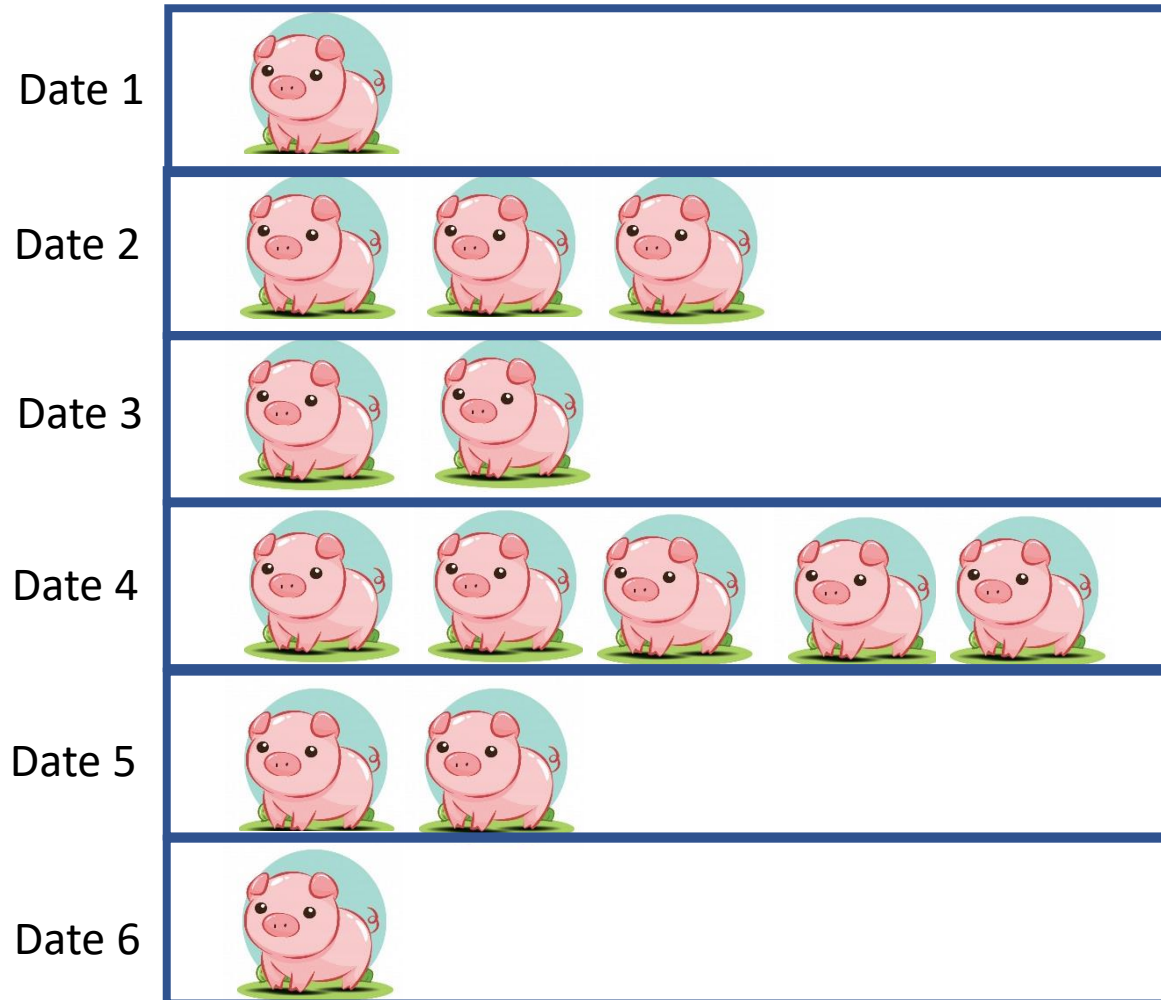
Variance components

- AIREML
- Combined purebred and crossbred data
- 4-trait models
- Random:
 - Animal
 - Litter
- 3 different CG composition



CG_day

Farm + Line + Sex + Birth year + Birth week + Slaughter date

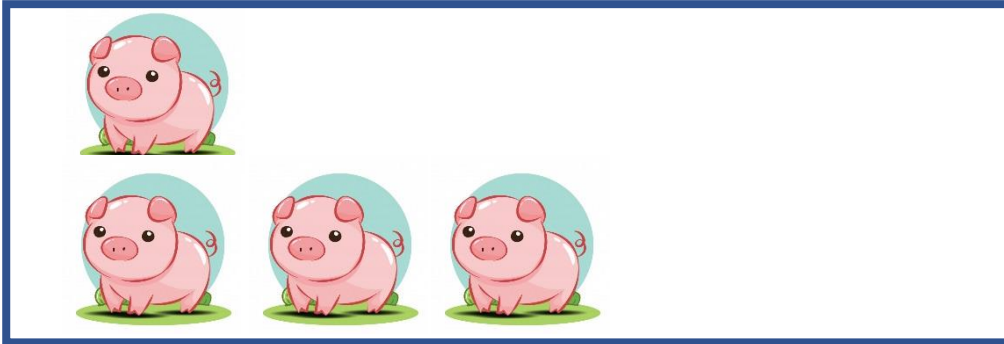


Number of groups	10 598
Min animals	1
Mean animals	11.77
Max animals	231
CG with 1 animal	1 928 (18.2%)
CG with 1 sire	2 981 (28.1%)
Mean slaughter dates per group	1

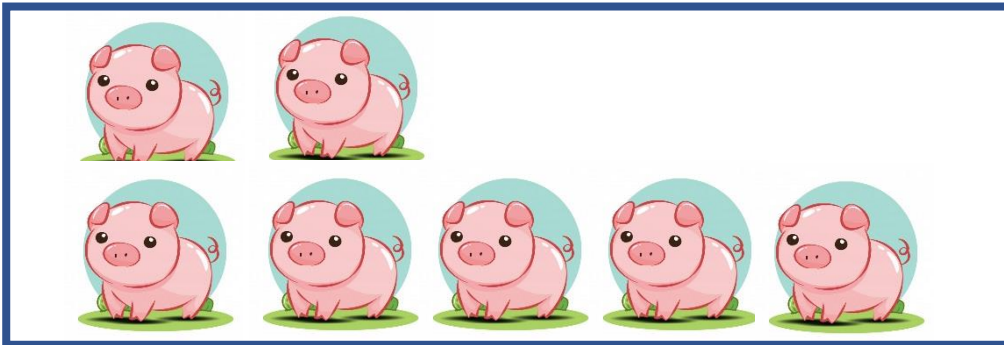
CG_week

Farm + Line + Sex + Birth year + Birth week + Slaughter week

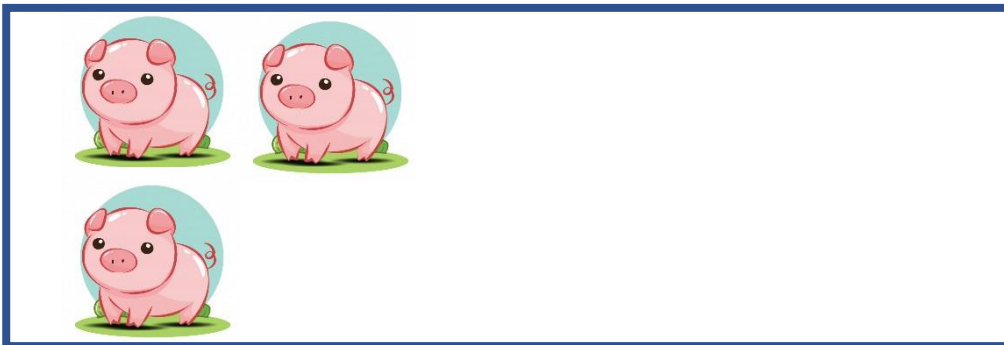
Week 1



Week 2



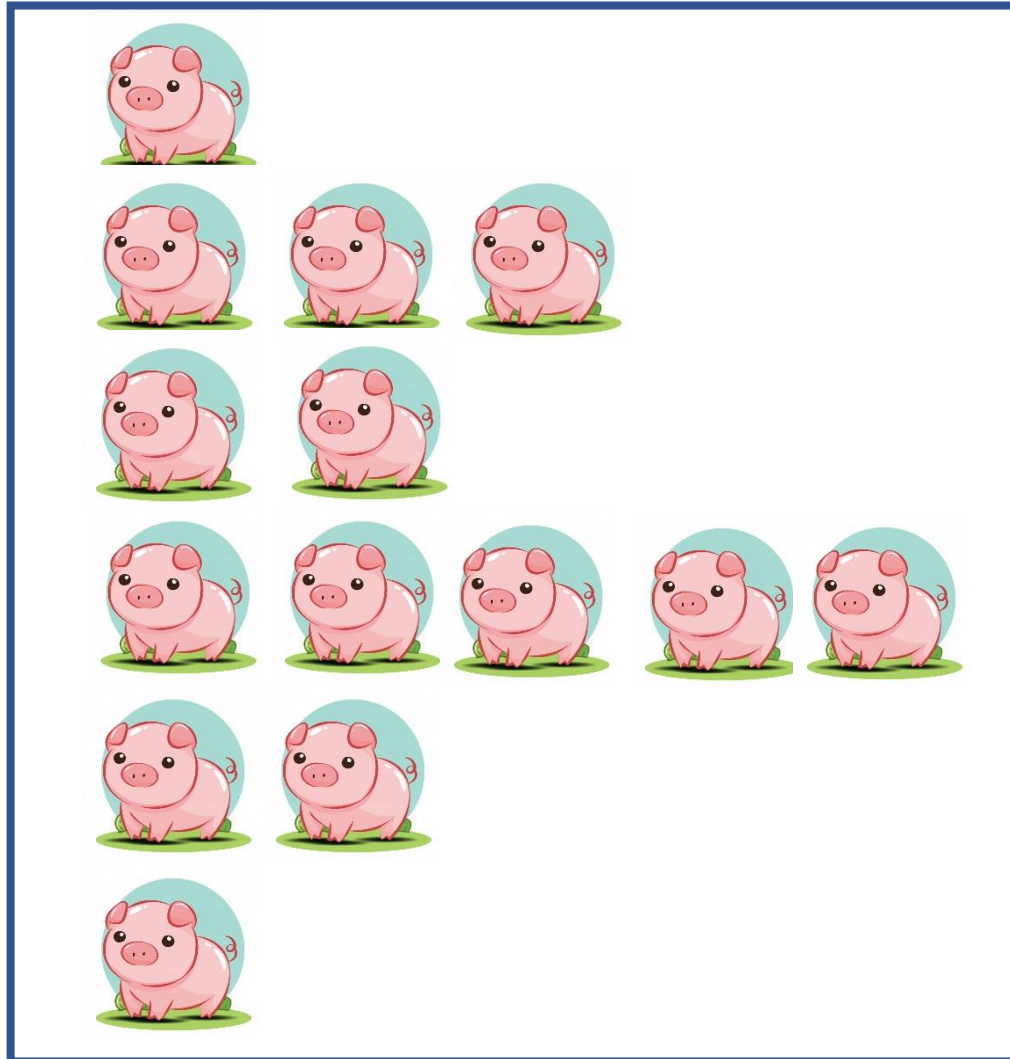
Week 3



Number of groups	5 850
Min animals	1
Mean animals	21.32
Max animals	266
CG with 1 animal	532 (9.09%)
CG with 1 sire	813 (13.9%)
Mean slaughter dates per group	1.49

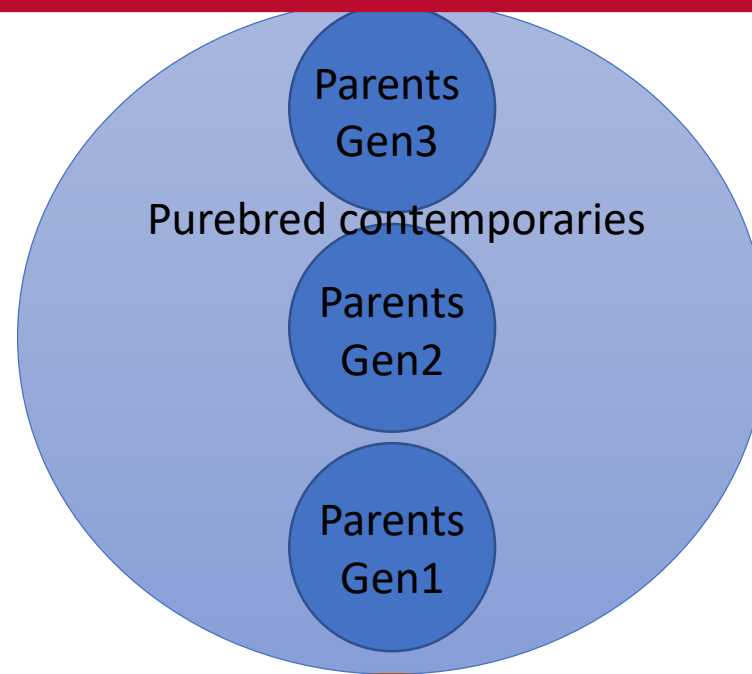
CG_all

Farm + Line + Sex + Birth year + Birth week

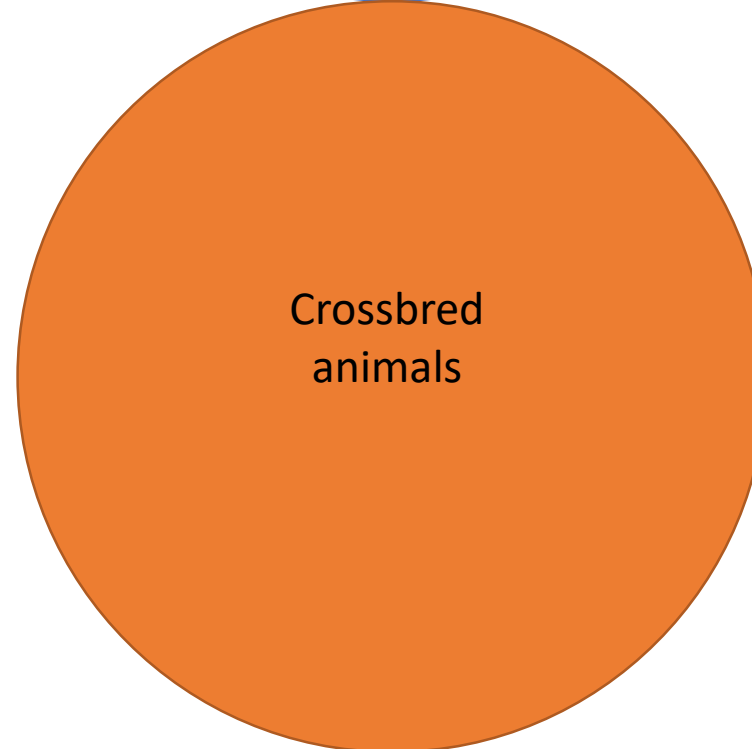


Number of groups	970
Min animals	1
Mean animals	128.57
Max animals	566
CG with 1 animal	2 (0.21%)
CG with 1 sire	12 (1.24%)
Mean slaughter dates per group	8.98

Data used



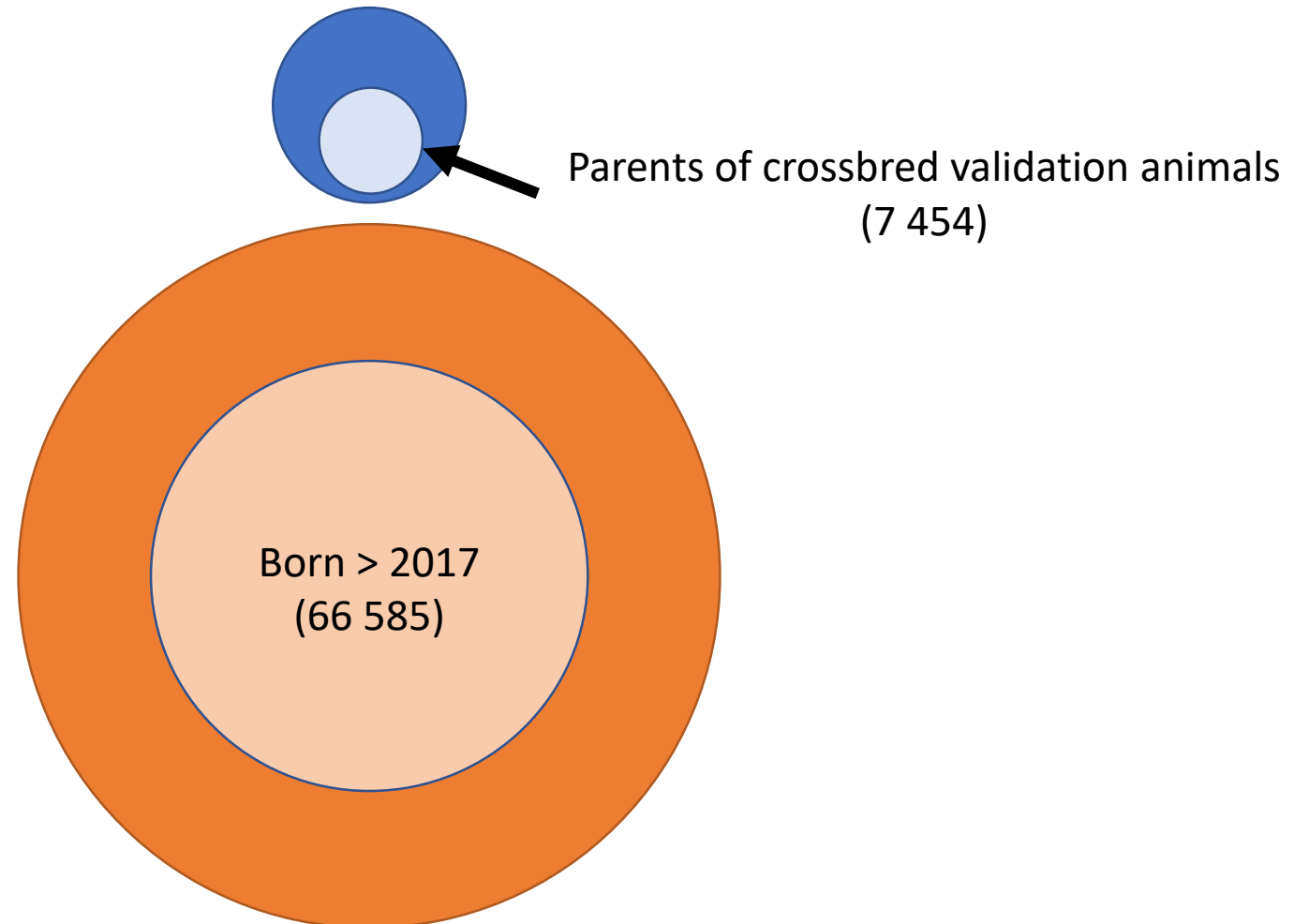
Purebred animals
3 generations
62 274 animals



Crossbred animals:
3 farms
2016-2019
124 709 animals



Purebred validation



Crossbred validation



LR Validation

- Partial data = remove phenotypes of **crossbred** validation animals
- Bias: $\bar{u}_{whole} - \bar{u}_{partial}$



LR Validation

- Partial data = remove phenotypes of **crossbred** validation animals

- Bias: $\bar{u}_{whole} - \bar{u}_{partial}$

- Slope: $\frac{\sigma(EBV_{whole}, EBV_{partial})}{\sigma^2_{partial}}$

$$LR: \sqrt{\frac{cov(EBV_{whole}, EBV_{partial})}{(1 - \bar{F}_{validation})\sigma^2_a}}$$



LR Validation

- Partial data = remove phenotypes of **crossbred** validation animals

- Bias: $\bar{u}_{whole} - \bar{u}_{partial}$

- Slope: $\frac{\sigma(EBV_{whole}, EBV_{partial})}{\sigma^2_{partial}}$ LR: $\sqrt{\frac{cov(EBV_{whole}, EBV_{partial})}{(1 - \bar{F}_{validation})\sigma^2_a}}$

- Predictive ability: $\frac{cor(y_{adjusted}, EBV_{partial})}{h}$



Variance components

	Additive variance		Litter variance		Residual variance	
	G_x	BF_x	G_x	BF_x	G_x	BF_x
CG_all	812 ± 36	4.28 ± 0.13	322 ± 11	0.50 ± 0.03	1790 ± 20	5.69 ± 0.07
CG_week	257 ± 15	4.03 ± 0.12	116 ± 5	1.72 ± 0.03	1130 ± 9	5.16 ± 0.07
CG_day	204 ± 13	4.00 ± 0.12	78 ± 4	0.36 ± 0.03	1084 ± 8	5.04 ± 0.07

Genetic parameters

	G_x	BF_x
CG_all		
G_p	0.56 ± 0.06	0.23 ± 0.05
BF_p	0.17 ± 0.06	0.78 ± 0.03
G_x	0.28 ± 0.01	0.27 ± 0.02
BF_x		0.41 ± 0.01
CG_week		
G_p	0.44 ± 0.07	0.21 ± 0.06
BF_p	0.11 ± 0.06	0.78 ± 0.03
G_x	0.17 ± 0.01	0.24 ± 0.03
BF_x		0.42 ± 0.01
CG_day		
G_p	0.49 ± 0.07	0.22 ± 0.05
BF_p	0.10 ± 0.06	0.78 ± 0.03
G_x	0.15 ± 0.01	0.19 ± 0.03
BF_x		0.42 ± 0.01



Accuracy – Purebred animals

	Scenario	Slope	Bias	LR acc
Growth G_x	CG_all	1.01	0.06	0.36
	CG_week	1.00	0.05	0.31
	CG_day	1.01	0.02	0.33

BF_x was unaffected by CG definition



Accuracy – Crossbred animals

	Scenario	Slope	Bias	LR acc	Pred
Growth G_x	CG_all	0.86	0.88	0.27	0.27
	CG_week	0.97	0.38	0.26	0.28
	CG_day	1.00	0.03	0.28	0.30

BF_x was barely affected by CG definition



What is real?

- Assume correct variance components
- No fixed benchmark
- “Best fit” vs. “Best model”
- Inflated predictive ability
- True CG?

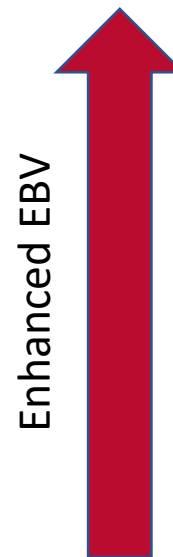
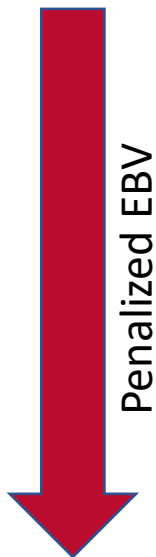
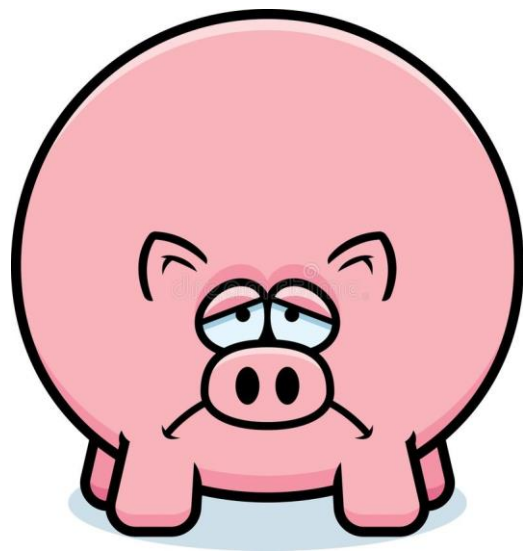


Correlations

	CG	Cor ($EBV_{whole, y}$)
Growth G_x	CG_all	0.70
	CG_week	0.47
	CG_day	0.43
Backfat BF_x	CG_all	0.72
	CG_week	0.69
	CG_day	0.67



Will animals rank differently?



Correlations

EBV_{whole} based on different CG definitions

	Crossbred		Purebred	
Comparison	G _x	BF _x	G _x	BF _x
CG_all, CG_week	0.76	0.97	0.79	0.97
CG_day, CG_week	0.95	0.98	0.94	0.97
CG_day, CG_all	0.73	0.95	0.76	0.94



Conclusion

- Excluding slaughter dates slightly favors purebred
- Including slaughter dates slightly favors crossbreds
- Reranking will occur

- Alternative traits?

- Pen information for further investigation



Thank you



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