Expressing Female Fertility in the Walloon Region of Belgium: How to do?

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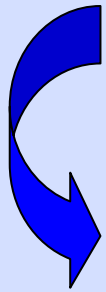
Female Fertility: INTERBULL

- Great variety in evaluated traits (e.g. conception rate, Days Open, non return rate, calving rate …)
- Some countries evaluate several traits



INTERBULL regrouped traits

➔ 5 groups, so 5 evaluations!

Female fertility evaluation in the Walloon Region

- Since September 2007, national evaluation of Pregnancy Rate (PR)
- With an animal model adapted for repeated records (BLUP)
- Participation in 3 of the 5 groups defined by INTERBULL

➔Groups 2, 4 and 5

Female fertility evaluation in the Walloon Region

- Back from INTERBULL: 1-3 international proofs on the Walloon scale for a bull

	T2	T4
T4	.90	
T5	.95	.97

➔ High correlations between proofs!

Female fertility evaluation in the Walloon Region

- Back from INTERBULL: 1-3 international proofs on the Walloon scale for a bull

How could we use these proofs to express female fertility for a bull in one value?

Principal Component Analysis: data

- Six female fertility indexes published for bulls from:
  - Canada (CAN)
  - Germany (DEU)
  - France (FRA)
  - Italy (ITA)
  - The Netherlands (NLD)
  - USA

Principal Component Analysis: data

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  - Canada (CAN)
  - Germany (DEU)
  - France (FRA) ⇨ excluded for PCA!
  - Italy (ITA)
  - The Netherlands (NLD)
  - USA

➔ 812 common bulls

Principal Component Analysis: results

- Eigenvalues and eigenvectors

	Prin1	Prin2	Prin3	Prin4	Prin5
eigenval	4.039	.365	.291	.186	.118
CAN	.442	-.585	.048	.658	.162
DEU	.470	-.205	.061	-.305	-.801
ITA	.430	.613	-.580	.315	-.068
NLD	.460	-.215	-.282	-.612	.537
USA	.433	.441	.761	-.004	.200

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➔ Good compromise on female fertility expression

Principal Component Analysis: results

- Correlation of Prin1 with the 6 indexes

	CAN	DEU	FRA	ITA	NLD	USA
Prin1	.89	.94	.86	.86	.93	.87

Direct female fertility (DFF)

- Coefficients to combine proofs into DFF

	Bulls	R^2	Regression coeff.		
			T2	T4	T5
T2	791	.525	.399		
T4	811	.684		.454	
T5	790	.682			.445
T2 & T4	790	.703	-.283	.714	
T2 & T5	790	.683	-.407		.825
T4 & T5	790	.729		.133	.315
T2 & T4 & T5	790	.730	-.407	.138	.691

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Direct female fertility (DFF)

- Correlation with proofs

	T2	T4	T5
T4	.90		
T5	.95	.97	
DFF	.83	.97	.96

- Correlation with other evaluated traits in the Walloon Region

Direct female fertility (DFF) Correlations between EBVs

	DFF
Milk	**-.53**
Fat	**-.41**
Protein	**-.50**
%Fat	.19
%Protein	.17
SCS	-.15
Longevity	.13
BCS	**.40**

	DFF		DFF
Stature [I]	-.31	Udder texture	-.43
Chest width [I]	.10	Fore udder [I]	-.17
Body depth [I]	-.24	Front teat placement [I]	-.24
Chest depth	-.26	Teat length [I]	-.01
Loin strength	-.04	Rear udder height [I]	-.33
Rump length	-.24	Rear udder width	-.36
Rump angle [I]	.09	Rear teat placement [I]	-.33
Hips width	-.16	Angularity [I]	-.49
Rump width [I]	-.10	Overall development	-.21
Foot angle [I]	-.09	Overall rump	-.21
Rear leg set [I]	-.08	Overall feet and legs [I]	-.16
Bone quality	-.28	Overall udder score [I]	-.23
Rear leg rear view [I]	-.01	Overall fore udder	-.18
Udder balance	-.23	Overall rear udder	-.25
Udder depth [I]	-.05	Dairy character	-.41
Teat placement side	-.15	Final conformation [I]	-.33
Udder support [I]	-.26		

[I] INTERBULL type trait

Indirect female fertility index (IFF)

- Why?
  - Improvement of accuracy of young bulls
  - Available information for bulls without DFF

- How?
  - Multiple regressions of Prin1 on evaluated traits in the Walloon Region

    ➔ 10 traits to estimate IFF

Indirect female fertility index (IFF)

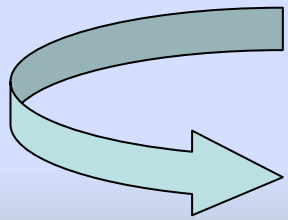
- ✓ Milk yield
- ✓ Fat%
- ✓ Protein
- ✓ SCS
- ✓ Stature
- ✓ Body depth
- ✓ Overall udder score
- ✓ Overall feet and legs score
- ✓ Final conformation
- ✓ BCS ⟺ Angularity

IFF_{BCS} or IFF_{ANG}

Combined female fertility index (CFF)

- Direct female fertility (DFF) + indirect female fertility (IFF)

- Theory of selection index to combine DFF with IFF_{BCS} or IFF_{ANG}



CFF

Combined female fertility index (CFF)

- Correlations for publishable bulls

	T2	T4	T5	DFF	IFF_{BCS}	IFF_{ANG}
T4	.90					
T5	.95	.97				
DFF	.83	.97	.96			
IFF_{BCS}	.42	.48	.50	.51		
IFF_{ANG}	.51	.57	.58	.59	**.99**	
CFF	.80	.92	.93	.96	.76	.82

→ IFF_{BCS} and IFF_{ANG} are similar !

Combined female fertility index (CFF)

- Correlations for publishable bulls

	T2	T4	T5	DFF	IFF_{BCS}	IFF_{ANG}
T4	.90					
T5	.95	.97				
DFF	.83	.97	.96			
IFF_{BCS}	.42	.48	.50	.51		
IFF_{ANG}	.51	.57	.58	.59	.99	
CFF	.80	.92	.93	.96	.76	.82

slightly higher for IFF_{ANG} !

Combined female fertility index (CFF)

- Correlations with Prin1

	T2	T4	T5	DFF	IFF_{BCS}	IFF_{ANG}	CFF
Prin1	.72	.82	.82	**.85**	.55	.55	**.86**

No loss of information !

Combined female fertility index (CFF)

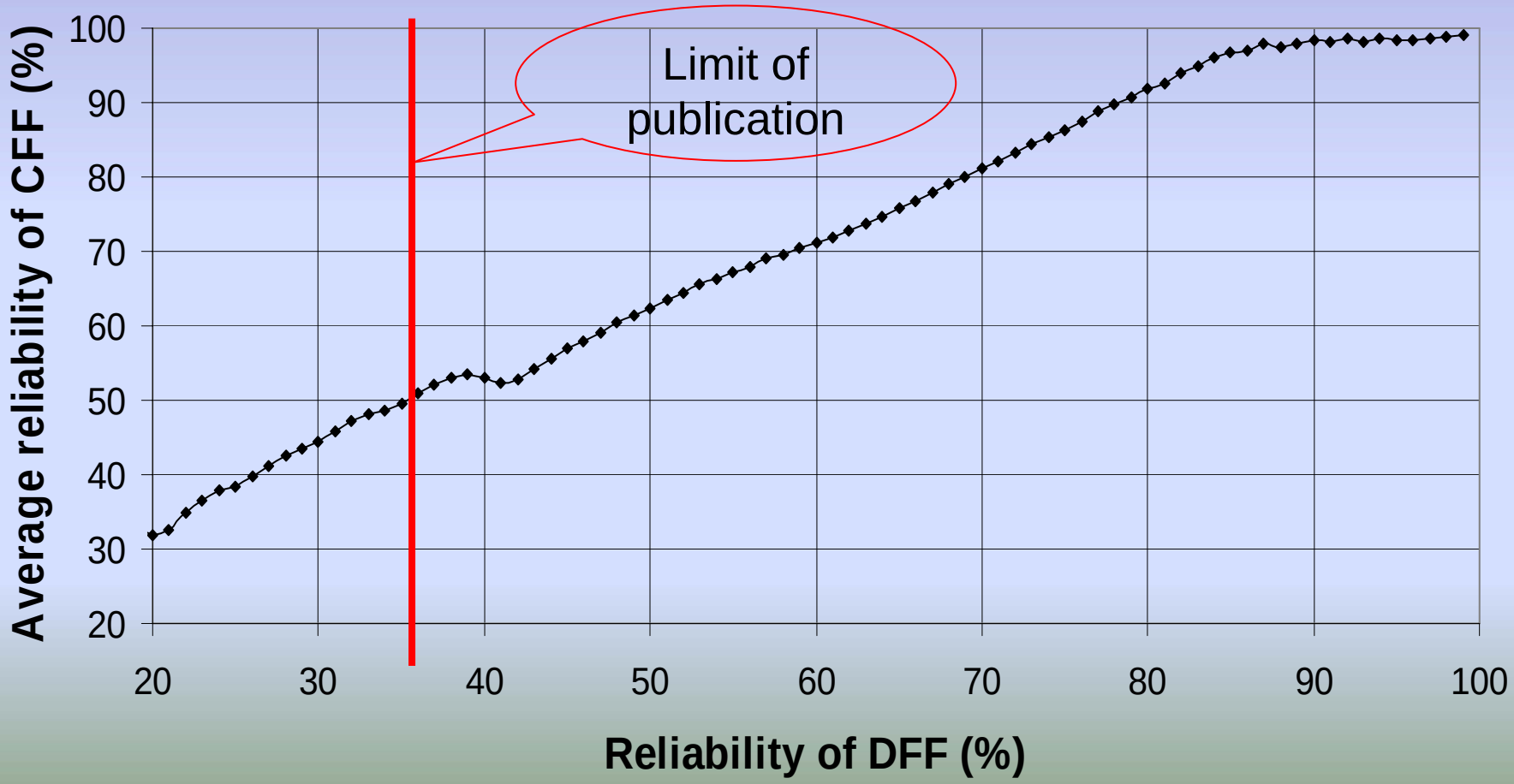
- Correlations with Prin1

	T2	T4	T5	DFF	IFF_{BCS}	IFF_{ANG}	CFF
Prin1	.72	.82	.82	**.85**	.55	.55	**.86**

	CAN	DEU	FRA	ITA	NLD	USA
Prin1	.89	.94	.86	.86	.93	.87

Combined female fertility index (CFF)

- Reliabilities of DFF *vs.* Reliabilities of CFF



Conclusions

- Post-treatment of the international female fertility proofs → CFF
  - Good expression of female fertility in Walloon Region
  - Provides a better accuracy to young bulls
  - Useful first indication of female fertility potentiality
  - New tool of management for Walloon breeders

Conclusions

- Next steps:
  - Integration of CFF in our economic index system
  - Improvement of our global economic index (V€G)
  - Improvement of BCS genetic evaluation ➔ better estimation of BCS

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Thank you for your attention !

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awe association wallonne de l'élevage

FNRS