



Genetic evaluation for carcass traits in French dairy cattle

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Background

▶ **Veal Calves (VC) in dairy herds**

- ▶ 86% of veal calves slaughtered in France
- ▶ 30% are crossbred between dairy dam and beef sire
- ▶ Main dam breeds: Holstein, Montbéliarde, Normande
- ▶ Main sire breeds: Holstein, Montbéliarde, Normande, Charolaise (CHA), Limousine (LIM), Blonde d'Aquitaine (BLA), Belgian Blue (BB), INRA95

▶ **Young Bulls (YB) in dairy herds**

- ▶ 25% of young bulls slaughtered in France are pure dairy breed
- ▶ Main breeds: Montbéliarde, Normande, Simmental





Background

▶ **NORMABEV database**

- ▶ Created since mid 2000's
- ▶ Commercial carcass data (weight, conformation, fatness, meat color)
- ▶ Routinely recorded
- ▶ In all French slaughterhouses
- ▶ On every animal (males, females, purebred, crossbred, ...)

▶ **2010: Convention NORMABEV - Idele**

⇒ ***NORMABEV database can be used by Idele and INRA for genetic and genomic evaluations***



Background

- ▶ French Dual-purpose breeds (Montbéliarde, Normande, Simmental) mainly selected on dairy traits

⇒ *add carcass traits in their breeding goals*

▶ First Steps

- ▶ Develop a *genetic evaluation for carcass traits of crossbred and purebred veal calves* born from dairy dams of breeds Montbéliarde and Normande (dual-purpose breeds) and Holstein
- ▶ Develop a *genetic evaluation for carcass traits of purebred young bulls* of breeds Montbéliarde, Normande, Simmental



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Veal Calves: Material and Methods

- ▶ **3 populations analyzed separately**
 - ▶ **MON** population: only phenotypes of calves born from a Montbéliarde dam
 - ▶ **NOR** population: only phenotypes of calves born from a Normande dam
 - ▶ **HOL** population: only phenotypes of calves born from a Holstein dam

- ▶ **Data Selection in each population**
 - ▶ **Purebred or crossbred calves** (only **CHA**, **LIM**, **BLA**, **BB** or **INRA95** sire breeds)
 - ▶ Calves born since 2007,
 - ▶ Age at slaughter between 70 days and 250 days
 - ▶ Carcass weight between 50 kg and 250 kg



Veal Calves: Material and Methods

- ▶ 3 populations analyzed separately
- ▶ Data Selection in each population
 - ▶ Purebred or crossbred calves (only *CHA*, *LIM*, *BLA*, *BB* or *INRA95* sire breeds)
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		Dam Breed		
		<i>HOL</i>	<i>MON</i>	<i>NOR</i>
Purebred calves		3 270 660	693 463	284 600
Crossbred Calves: Sire breeds	<i>BB</i>	238 028	51 297	15 872
	<i>LIM</i>	144 822	55 930	16 036
	<i>CHA</i>	129 284	223 304	17 254
	<i>BLA</i>	21 993	5 690	3 644
	<i>INRA95</i>	75 425	14 315	4 918



Veal Calves: Material and Methods

► Evaluated traits

- Carcass Weight (CW, in kg)
- Age at Slaughter (AGE, in days)
- Carcass Conformation score (CC, EUROP grades, each divided in 3 subclass: -,=,+)
- Meat Color score (COLOR, 4 points scale)

Trait	<i>HOL</i>	<i>MON</i>	<i>NOR</i>
CW (kg)	133 ± 19	136 ± 24	131 ± 21
CC * (cl)	0 ± 2 subcl	R ± 2 subcl	R- ± 2 subcl
COLOR* (cl)	2 ± ½ cl	2 ± ½ cl	2 ± ½ cl
AGE (days)	175 ± 16	166 ± 22	167 ± 22

Phenotypic statistics



Veal Calves: Material and Methods

▶ Statistical model

- ▶ Animal multitrait mixed model : AGE, CW, CC and COLOR

For AGE in MON and NOR population only

$$y_{ijklmn} = \mu + C_i + b_j + p_k + s_l + W_m + a_n + \varepsilon_{ijklmn}$$

- ▶ y_{ijkl} : performance
- ▶ μ : mean
- ▶ C_i : fixed effect of contemporary group (fattening herd*birth year*slaughter season)
- ▶ b_j : fixed effect of sire breed
- ▶ p_k : fixed effect of age at calving of dam
- ▶ s_l : fixed effect of sex of calves
- ▶ W_m : maternal permanent environment effect for AGE in MON and NOR population only
- ▶ a_n : animal genetic effect
- ▶ ε_{ijklmn} : residual error



Veal Calves: Results

Population	NOR			
	CW	AGE	CC	COLOR
CW	0,24 (0,01)	-0,03 (0,00)	0,68 (0,00)	0,05 (0,00)
AGE	0,09 (0,02)	0,09 (0,00)	0,16 (0,00)	0,51 (0,00)
FLESH	0,66 (0,01)	-0,04 (0,02)	0,34 (0,01)	-0,42 (0,00)
COLOR	-0,03 (0,02)	0,05 (0,02)	-0,09 (0,03)	0,11 (0,00)

heritabilities on diagonal, genetic correlations above, *phenotypic correlations* below

- ⇒ ***h^2 moderate for CW and CC for all breeds***
- ⇒ ***h^2 low for COLOR for all breeds***
- ⇒ ***High genetic correlations between CW and CC for all breeds***



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Young Bulls: Material and Methods

- ▶ **3 populations analyzed separately**
 - ▶ **MON** population: only phenotypes of **purebred** Montbéliarde young bulls
 - ▶ **NOR** population: only phenotypes of **purebred** Normande young bulls
 - ▶ **SIM** population: only phenotypes of **purebred** Simmental young bulls

- ▶ **Data Selection in each population**
 - ▶ Young bulls born since 2006
 - ▶ Age at slaughter between 12 months and 24 months
 - ▶ Carcass weight between 170 kg and 600 kg



Young Bulls: Material and Methods

- ▶ **3 populations analyzed separately**
 - ▶ **MON** population: only phenotypes of **purebred** Montbéliarde calves
 - ▶ **NOR** population: only phenotypes of **purebred** Normande calves
 - ▶ **SIM** population: only phenotypes of **purebred** Simmental calves

▶ Data Selection in each population

Breed	Nb of young bulls	Nb of sires
Montbéliarde	156,226	4,282
Normande	160,361	2,061
Simmental	8,691	368



Young Bulls: Material and Methods

► Evaluated traits

- Carcass Weight (CW, in kg)
- Age at Slaughter (AGE, in days)
- Carcass Conformation score (CC, EUROP grades, each divided in 3 subgrades: -,=,+)

Trait	MON	NOR	SIM
CW (kg)	382,9 ± 51,4	381,9 ± 49,9	387,7 ± 54,2
CC * (cl)	R- ± 1 subcl	O+ ± 1 subcl	R- ± 1 subcl
AGE* (cl)	621,9 ± 67,5	633,5 ± 63,1	615,2 ± 78.8

Phenotypic statistics



Young Bulls: Material and Methods

► Statistical model

- Animal multitrait mixed model : AGE, CW and CC

$$y_{ijkl} = \mu + C_i + p_j + s_k + a_l + \varepsilon_{ijkl}$$

- y_{ijkl} : performance
- μ : mean
- C_i : fixed effect of contemporary group (finishing herd*season of slaughter*year of slaughter)
- p_j : fixed effect of parity*age at calving of dam
- s_k : fixed effect of season of birth
- a_l : animal genetic effect
- ε_{ijkl} : residual error



Young Bulls: Results

breed	MON			
		CW	AGE	CC
CW	0,19 (0,01)	-0,58 (0,05)	0,52 (0,03)	
AGE	0,27 (0,01)	0,09 (0,01)	-0,25 (0,06)	
FLESH	0,55 (0,01)	0,08 (0,01)	0,23 (0,01)	

heritabilities on diagonal, genetic correlations above, *phenotypic correlations* below

- ⇒ *h^2 moderate for CW and CC for all breeds*
- ⇒ *high genetic correlations between CW and CC for all breeds*



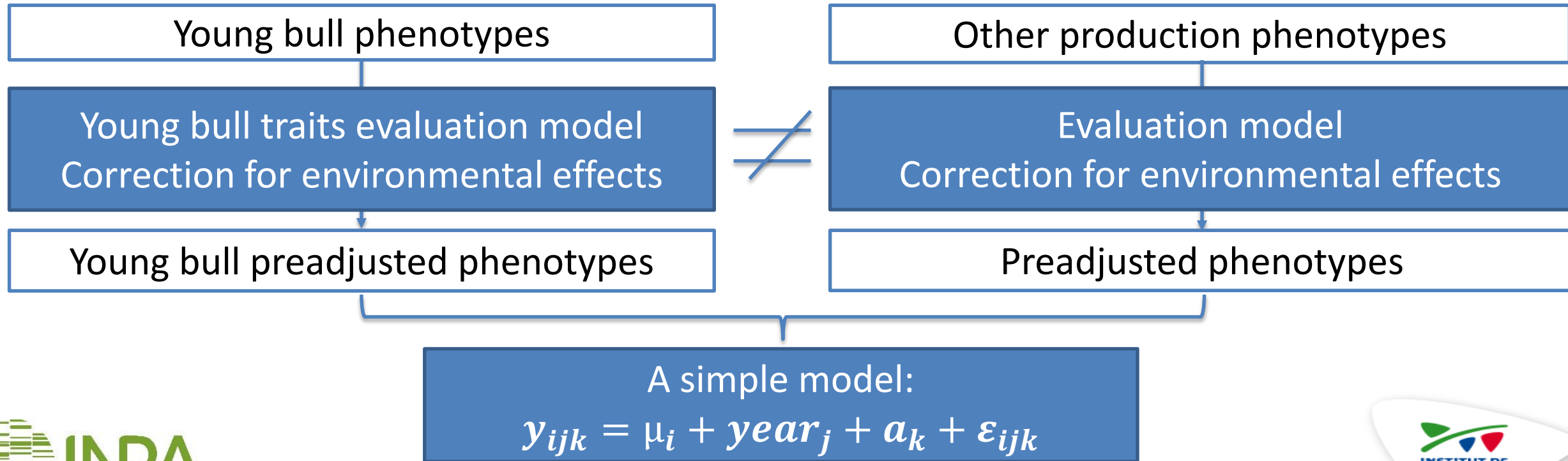
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Correlations of YB traits with other traits: Materials and Methods

- ▶ **Population = young bulls + paternal half-sibs**
 - ▶ Milk production trait: half-sisters evaluated for milk production
 - ▶ Veal calf production traits: half-brothers with carcass phenotypes





Correlations of YB traits with other traits : Results

▶ Correlations young bulls and veal calves carcass traits

	CW	AGE	CC
MON	0,43 (0,05)	0,40 (0,08)	0,54 (0,04)
NOR	0,44 (0,06)	0,32 (0,09)	0,70 (0,03)

▶ Correlations between young bulls and milk production trait

	CW	AGE	CC
MON	0,18 (0,04)	-0,21 (0,06)	-0,02 (0,04)
NOR	0,08 (0,05)	-0,21 (0,05)	-0,13 (0,04)
SIM	0,26 (0,09)	-0,36 (0,14)	-0,01 (0,09)



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Conclusion

- ▶ **Genetic parameters of VC and YB carcass traits**
 - ▶ Consistent for VC and YB
 - ▶ Consistent in all breeds
- ▶ **Carcass Weight and Carcass Conformation**
 - ▶ Moderate heritabilities for both VC and YB
 - ▶ High correlations for both VC and YB
 - ⇒ *can be improved by selection*
- ▶ **Favorable correlations between YB and VC carcass traits**
- ▶ **No unfavorable correlations between YB carcass traits and milk production trait**



Conclusion

- ▶ **National genetic evaluation for VC carcass traits officially implemented in April 2015**
- ▶ **National genetic evaluation for YB carcass traits will be officially implemented in 2017**
- ▶ **Next steps:**
 - ▶ Implementation of a national genomic evaluation for VC and YB underway
 - ▶ Update breeding goals for dual-purpose breeds



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