Reflection of genomic selection in practice -
use of genomic Brown Swiss bulls in Slovenia

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25th International Symposium Animal Science Days
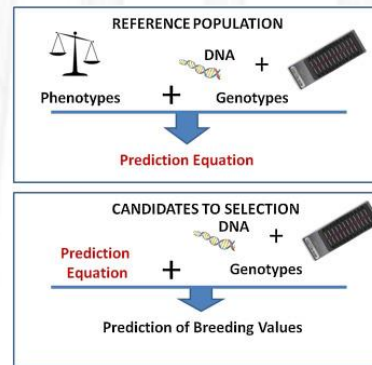September 20 – 22 2017
Brandlucken, Austria

INTRODUCTION

Success of genomic selection
- ↓ generation interval
- ↑ genetic gain
- ↑ BP production and economic performance

Voluntary international collaboration projects

Joint genomic bull evaluation

REFERENCE POPULATION

Phenotypes + Genotypes   DNA +

Prediction Equation

CANDIDATES TO SELECTION
DNA

Prediction Equation + Genotypes

Prediction of Breeding Values

Genetic gain per year = $\dfrac{\text{Accuracy in selection} \quad \text{Selection intensity} \quad \text{Additiv genetic variation}}{\text{Generation interval}}$

INTRODUCTION

Slovenia part of **inter genomics** project for 7 yrs (2010 - 2017)

- Interbull's international genomic evaluation of Brown Swiss cattle (BSW) populations
- spring 2017: 17 IG evaluations

Genomically evaluated bulls replace young bulls in sire catalogues

AIM OF THE RESEARCH

MATERIAL AND METHODS

- Routine BV (EBV12) evaluation data records – national evaluation
  (BF, UL data warehouse)

- Standardised estimated values ($\bar{x} = 100$, STD $= 12$)

- 2013 – 2016

- 802 – 877 herds/year

MATERIAL AND METHODS – Data records

- No. of all calves (herd size)

- % of calves from genomically evaluated bulls used in herd (PCGB)

- Average parity

- Estimated value for herd ← TD milk yield evaluation BV

- Herd average (EBV12):
  - protein & fat index
  - muscularity
  - total merit index for milk production (TMIM)

MATERIAL AND METHODS – Analysis of variance

Statistical model – only significant effects

$$y_{ijk} = \mu + R_i + L_j + b_I(s_{ijk} - \bar{s}) + b_{II}(u_{ijk} - \bar{u}) + b_{III}(w_{ijk} - \bar{w}) + b_{IV}(x_{ijk} - \bar{x}) + b_V(z_{ijk} - \bar{z}) + e_{ijk}$$

y_{ijk}	dependent variable (PCGB)
μ	overall mean
R_i	region as fixed effect (i = 1, 2, 3, 4, 5, 6, 7)
L_j	year of the data record as fixed effect (j = 2013, 2014, 2015, 2016)
b_I	linear regression coefficient for herd size
s_{ijk}	herd size
b_{II}	linear reg. coeff. for average parity

u_{ijk}	average parity
b_{III}	linear reg. coeff. for protein and fat index
w_{ijk}	EBV12 for protein and fat index
b_{IV}	linear reg. coeff. for muscularity
x_{ijk}	EBV12 for muscularity
b_V	linear reg. coeff. for TMIM
z_{ijk}	EBV12 for TMIM
e_{ijk}	random residual

RESULTS
% OF CALVES FROM GENOMICALLY EVALUATED BULLS USED IN HERD
– Herd size & EBV12 changes

Group	N_{herds}	$\%_{herds}$	PCGB (%)	Herd size increase 2013 - 2016 %
1	59	7.3	> 50	10.5
2	169	21.1	25 - 50	12.1
3	243	30.3	0 - 25	20.5
4	331	41.3	0	1.5

(The first four columns are grouped under the heading **2016**.)

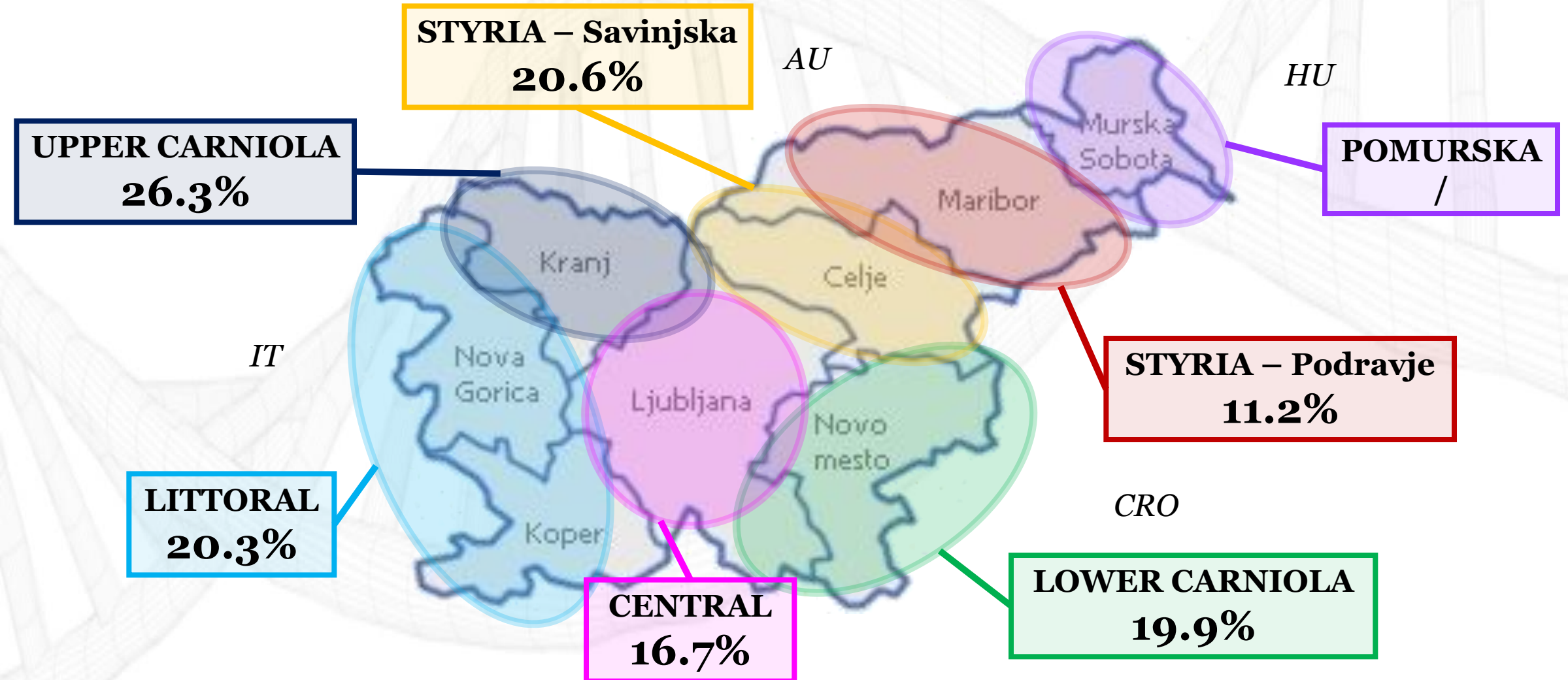| EBV12	GROUP CHANGES 2013 - 2016 +	-
estimated value for herd (TD)	2	1, 4, 3
average parity	4, 2, 3	1
calving interval	1	3, 4, 2
protein & fat index	ALL (1)	
exterior index for milk prod.	ALL (3)	
muscularity		ALL (4)
TMIM	ALL (1)	
TMID	2	3, 1, 4

RESULTS

% OF CALVES FROM GENOMICALLY EVALUATED BULLS USED IN HERD
– Year of the data record ($P = 0.0063$)

PCGB by the year of data record (LSM ± SE)

YEAR	N	LSM ± SE	P - value
2013	877	21.2 ± 3.9	< 0.0001
2014	852	19.7 ± 3.9	< 0.0001
2015	815	18.2 ± 3.9	< 0.0001
2016	802	17.6 ± 3.9	< 0.0001

RESULTS
% OF CALVES FROM GENOMICALLY EVALUATED BULLS USED IN HERD
- Region ($P = 0.0032$)

STYRIA – Savinjska 20.6%

AU

HU

POMURSKA /

UPPER CARNIOLA 26.3%

STYRIA – Podravje 11.2%

IT

LITTORAL 20.3%

CRO

CENTRAL 16.7%

LOWER CARNIOLA 19.9%

RESULTS

% OF CALVES FROM GENOMICALLY EVALUATED BULLS USED IN HERD – Regression coefficients

Regression coefficients on PCGB and standard errors (b ± SE) with corresponding p-values

INDEPENDENT VARIABLE	b ± SE (%)	P - value
Protein and fat index (EBV12)	0.44 ± 0.13	0.0008
Herd size (number of calves)	0.14 ± 0.05	0.0105
Average parity	-3.93 ± 0.74	< 0.0001
Total merit index for milk production (EBV12)	-0.41 ± 0.12	0.0004
Muscularity (EBV12)	-0.12 ± 0.06	0.0405

CONCLUSIONS

First attempt to assess the justification of GS implementation in BSW

Limited, decreasing use of genomically evaluated BSW bulls in Slovenia

Genetic potential is overtaking the herd management

Time (= more data) will tell

Thank you for your attention!