

Genetic and Genomic Evaluation of Claw Health Traits in Spanish Dairy Cattle

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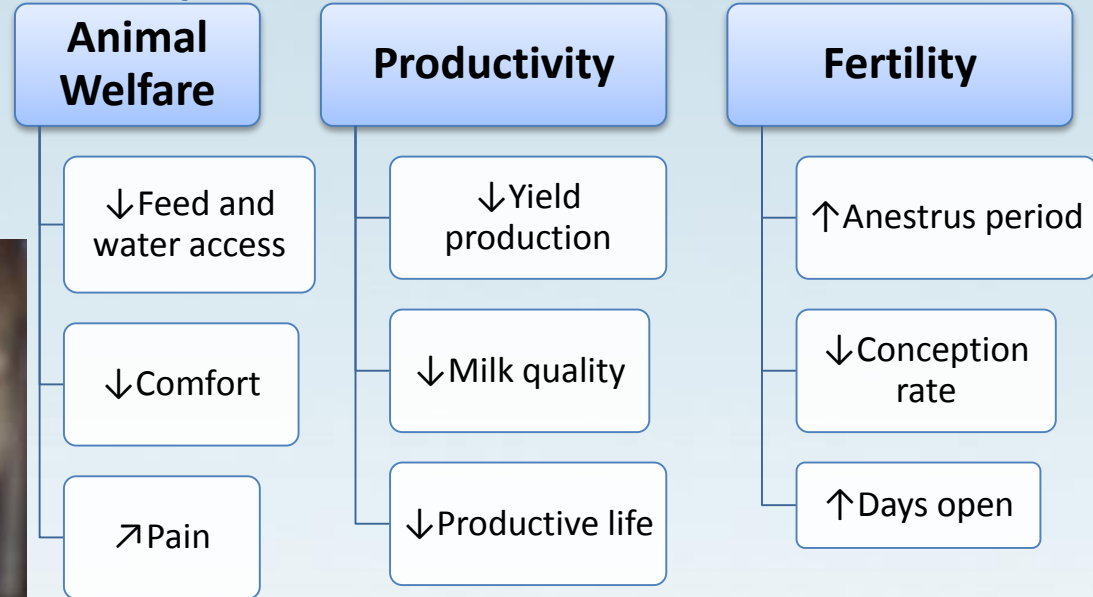
7 – 11 February 2018

Aotea Centre
Auckland,
New Zealand



Claw disorders are one of the main causes of involuntary culling in Spanish dairy herds

Claw disorders are responsible for most lameness cases which compromise:



1.- Fertility

2.- Mastitis

3.- Claw lesions



Feet & legs type traits fail in improving claw health

In 2012 was launched the Spanish program for recording claw health data in order to prevent and to control lameness

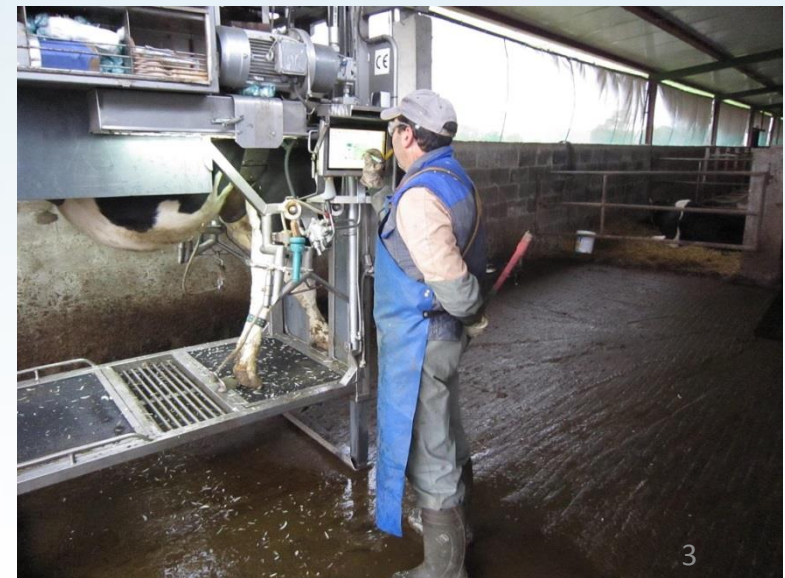
- **CONAFE provides:**

- A tactile PC-tablet
- An electronic friendly application called DATPAT
- An access to the national database
- Herd reports and animal information
- Training courses

- **Trimmers should:**

- Register at least 2,000 records per year during trimming routine visits.

Win-Win Agreement



Objectives

- Implementation of a routine genetic evaluation for claw health traits.
- Assessment of the accuracy of genomic proofs for claw disorders in Spanish dairy cattle.

Seven claw disorders are recorded:

| | Prevalence (%) |
|-------------------------------|----------------|
| Dermatitis (DE) | 10.07 |
| Sole ulcer (SU) | 11.37 |
| White line disease (WL) | 8.03 |
| Interdigital hyperplasia (IH) | 0.54 |
| Interdigital phlegmon (IP) | 0.95 |
| Concave dorsal wall (CD) | 1.50 |
| Overall claw disorders | 29.91 |

- Corkscrew claws (CC) has being recorded since 2017

CD and CC are scored as 0/1



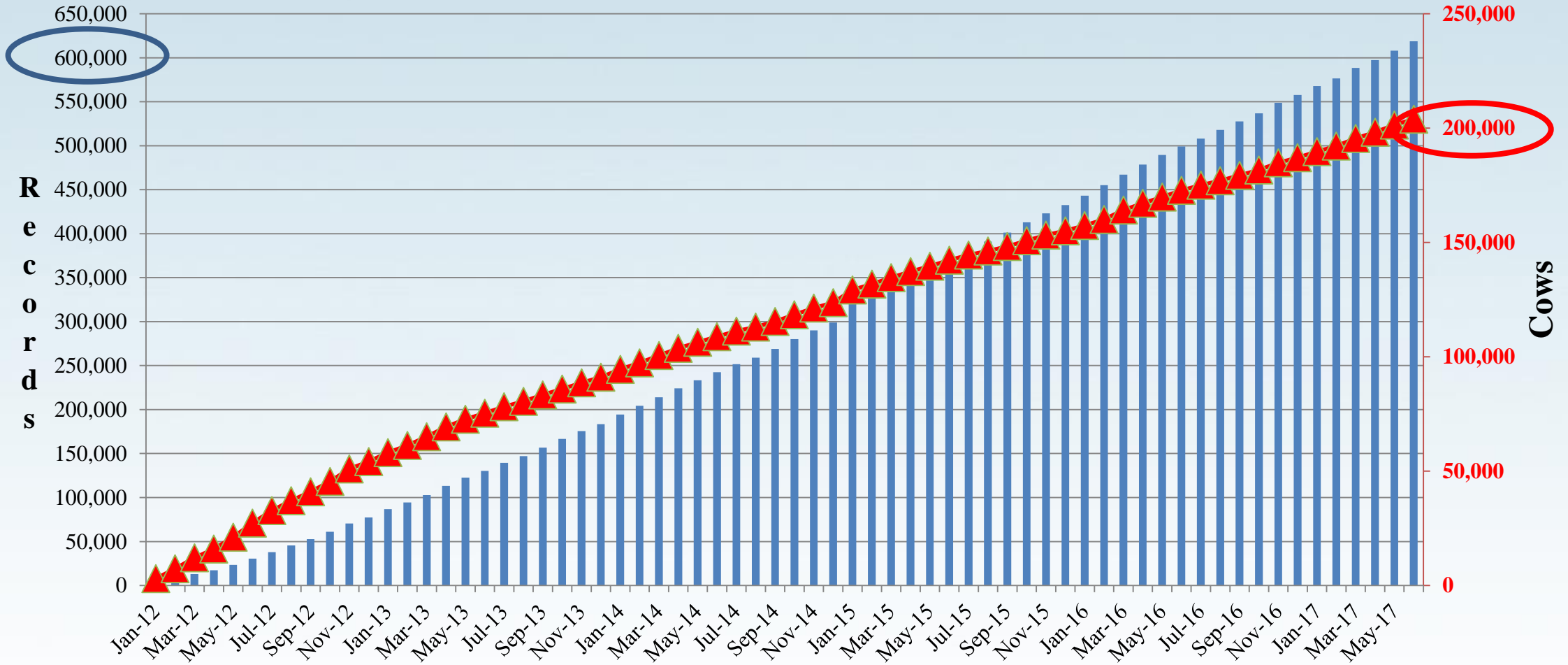
Scoring for each lesion:

0 : Absence

1 : mild

2 : severe

■ Records ▲ Cows



Data Editing

Initial set of data: 628,228 records from 2012 to 2017
(In 1821 herds by 46 trimmers)

Data selection:

- Records before 2013 were eliminated
- Parity 1 to 5
- Records from day 1 to day 500 after calving
- Only trimmers with at least 2000 records/year
- At herd level: Only herd-year with at least 30% of present cows trimmed

Final set of data: 441,248 records (34 trimmers)

Non trimmed cows were included: **81,228 records**

Genetic evaluation: Linear Models

2 multi-trait animal analyses:

- Scenario 1: Only claw disorders
- Scenario 2: Claw disorders and feet and leg type traits

■ Claw disorders

- Herd-year-season
- Lactation-age
- Lactation stage
- Trimmer
- Permanent environmental effect
- Additive animal effect

■ Type traits

- Herd-visit-classifier
- Lactation-age
- Lactation stage
- Additive animal effect

Mix99 Software

Genomic evaluation: GBLUP with polygenic effect

Reference population: 1,317 bulls

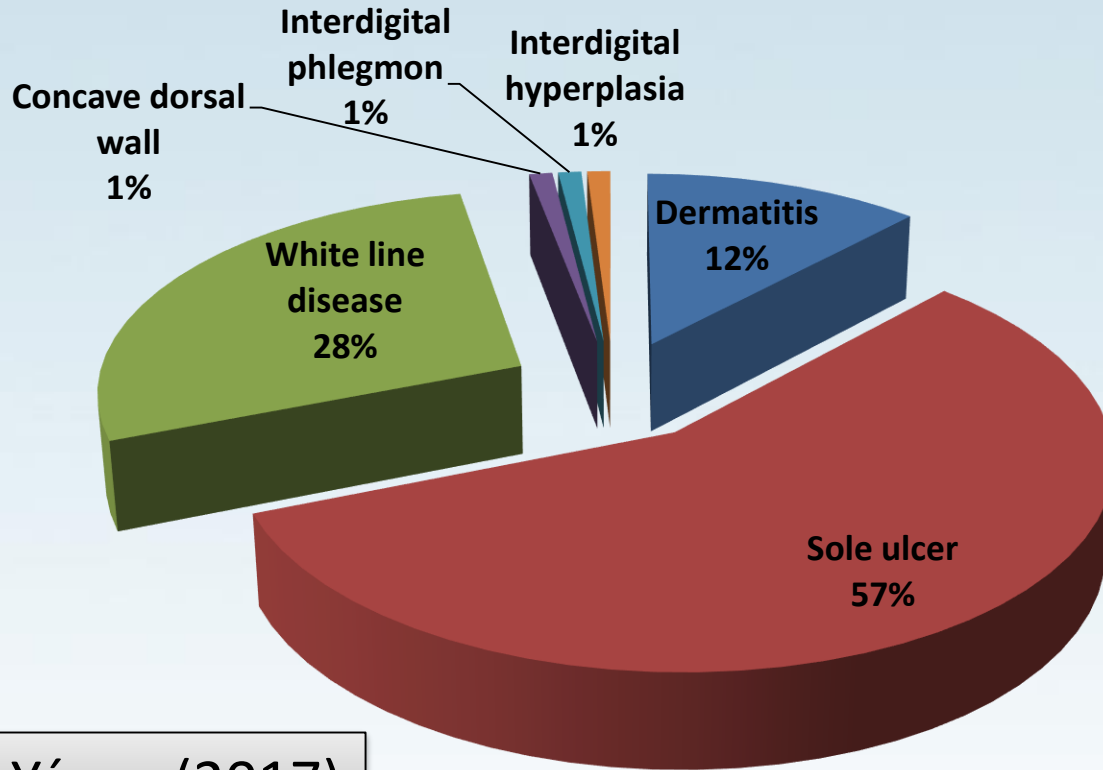
- 2-step evaluation
- Polygenic effect: 30%
- 10-fold cross validation
- Mix99 software

| | h^2 | r |
|--------------------------|-------|------|
| Dermatitis | 0.06 | 0.11 |
| Sole Ulcer | 0.06 | 0.11 |
| White line disease | 0.02 | 0.07 |
| Concave dorsal wall | 0.02 | 0.22 |
| Interdigital phlegmon | 0.01 | 0.03 |
| Interdigital hyperplasia | 0.13 | 0.07 |

| | h^2 |
|----------------------------|-------|
| Feet & legs (F&L) | 0.15 |
| Rear legs rear view (RLRV) | 0.13 |
| Foot angle (FA) | 0.09 |
| Bone quality (BQ) | 0.26 |
| Locomotion (LOC) | 0.12 |

| | F&L | RLRV | FA | BQ | LOC |
|--------------------------|-------|-------|-------|-------|-------|
| Dermatitis | -0.18 | -0.20 | 0.23 | -0.09 | -0.25 |
| Sole Ulcer | -0.30 | -0.10 | 0.15 | -0.15 | -0.31 |
| White line disease | -0.24 | -0.09 | -0.16 | -0.30 | -0.22 |
| Concave dorsal wall | -0.25 | -0.12 | -0.12 | -0.02 | -0.35 |
| Interdigital phlegmon | -0.26 | -0.23 | -0.11 | -0.19 | -0.32 |
| Interdigital hyperplasia | -0.11 | -0.11 | -0.04 | -0.08 | -0.11 |

Claw health index: ISP*



| Economic weights for claw disorders. | |
|--------------------------------------|------------|
| Claw disorders | €/cow/year |
| Dermatitis | - 9.30 |
| Sole Ulcer | - 44.00 |
| White line disease | - 37.40 |
| Concave dorsal wall | - 4.52 |
| Interdigital phlegmon | - 3.55 |
| Interdigital hyperplasia | - 1.45 |

*Iván Yánez (2017)

ISP net profit: 4.10€/cow/year

Proofs reliabilities

Bull with at least 20 daughters in 10 herds with Reliability \geq 50%

| Average reliabilities (%) | Scenario 1 Without type traits | Scenario 2 With type traits | Rel gain (%) |
|---------------------------|-----------------------------------|--------------------------------|--------------|
| Dermatitis | 68 | 74 | 9% |
| Sole Ulcer | 68 | 75 | 10% |
| White line disease | 63 | 72 | 14% |
| Concave dorsal wall | 63 | 68 | 8% |
| Interdigital phlegmon | 50 | 66 | 32% |
| Interdigital hyperplasia | 67 | 81 | 22% |
| ISP | 66 | 74 | 12% |

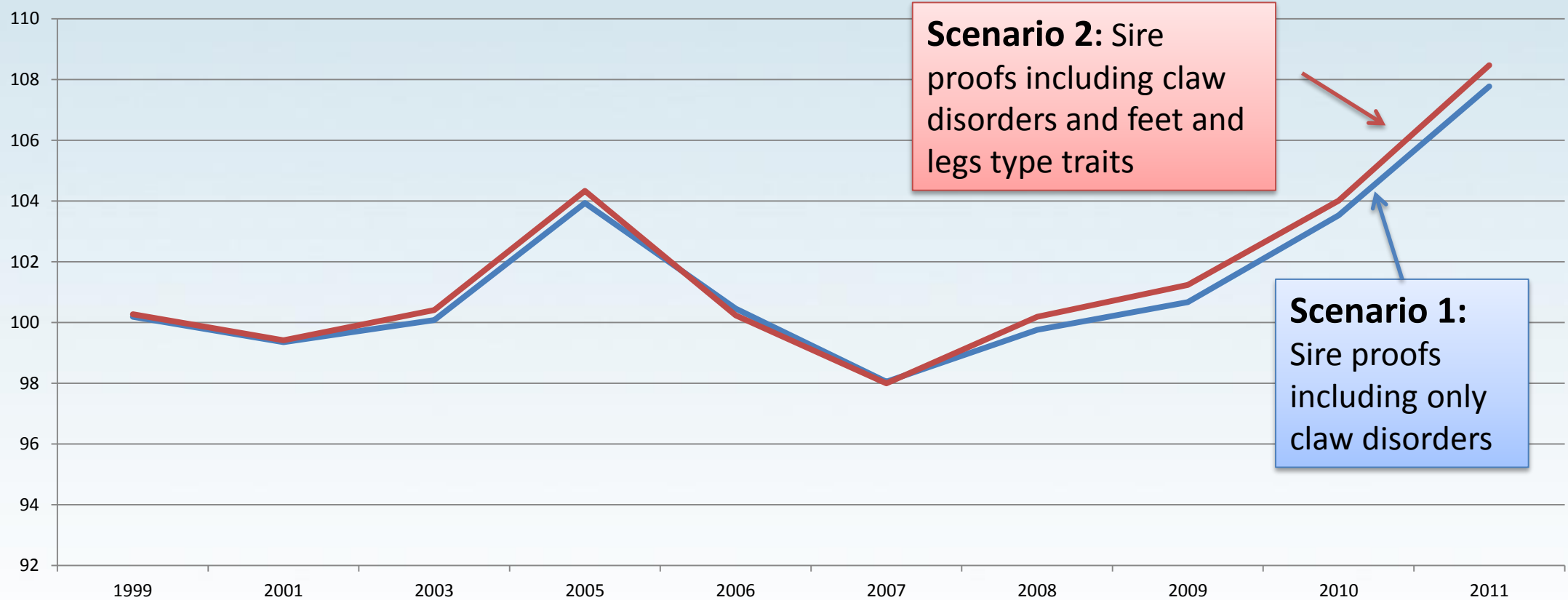
Correlations between EBVs with and without type traits

EBVs were standardized to relative breeding values with a mean of 100 and a standard deviation of 10 and reversed in sign

| | Pearson correlations | Spearman correlations |
|--------------------------|----------------------|-----------------------|
| Dermatitis | 0.98 | 0.97 |
| Sole Ulcer | 0.96 | 0.96 |
| White line disease | 0.91 | 0.90 |
| Concave dorsal wall | 0.92 | 0.90 |
| Interdigital phlegmon | 0.93 | 0.94 |
| Interdigital hyperplasia | 0.96 | 0.94 |
| ISP | 0.97 | 0.97 |

Genetic Trends

Claw health index: ISP



Scenario 2: Sire proofs including claw disorders and feet and legs type traits

Scenario 1: Sire proofs including only claw disorders

Validation of Genomic proofs

Results of 10-fold cross-validation

| | R^2 | b_{VALUE} | (S.E.) |
|--------------------------|-------|--------------------|--------|
| Dermatitis | 0.19 | 0.72 | (0.11) |
| Sole Ulcer | 0.34 | 0.99 | (0.08) |
| White line disease | 0.27 | 0.94 | (0.10) |
| Concave dorsal wall | 0.35 | 0.94 | (0.08) |
| Interdigital phlegmon | 0.36 | 1.03 | (0.08) |
| Interdigital hyperplasia | 0.15 | 0.76 | (0.15) |

Conclusions and Next steps

- Despite the low heritabilities, large genetic variation between best and worst bulls is observed.
- The inclusion of feet and legs type traits in multi-trait analyses increased reliabilities of claw disorders EBVs.
- Accuracy of genomic proofs are low to moderate.

Next Steps:

- **March 2018:** Interim release for breeding companies
- **June 2018:** first official release

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Thanks

FRISONA
Española