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Nafferton Ecological Farming Group

LowInputBreeds & Genomic breeding

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http://www.nefg-organic.org/

COMMUNITY RESEARCH

LowInputBreeds

- Developing integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and *low input* milk, meat and egg production (EU grant agreement No 222623)
- Cattle (dairy and beef), sheep (dairy and meat), pigs, poultry
- Coordination: Newcastle University and Research Institute of Organic Agriculture (FiBL)
- Check out the website: www.lowinputbreeds.org
  - Technical notes
  - Newsletters
  - Conference papers
  - Scientific publications

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LowInputBreeds

Search

Development of integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and 'low input' milk, meat and egg production

The project acknowledges the financial support of the Commission of the European Community under the Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities.

Project coordination

Newcastle University FiBL

Home

LowInputBreeds - Development of integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and 'low input' milk, meat and egg production was a 5-year (2009-2014) EU Collaborative Project, funded under the Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities.

On this website the project results are presented.

News

Final LowInputBreeds Newsletter now online

(26.08.2014) This Newsletter includes an executive summary of project outputs - 5 years' work by the project partners distilled down to 4000 characters - and the abstracts of papers... read more

More LowInputBreeds Technical Notes now online

(16.06.2014) The European LowInputBreeds project is producing a number of Technical Notes. The Technical Notes cover key themes and results from the LowInputBreeds project. read more

Proceedings of the 14th International Seminar of the FAO-CIHEAM Network on Sheep and Goats Sub-Network on Nutrition now available

(15.04.2014) The second LowInputBreeds Symposium took place in the framework of the 14th International Seminar of the FAO-CIHEAM Network on Sheep and Goats Sub-Network on Nutrition.... read more

LowInputBreeds: Key facts & figures

Development of integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and 'low input' milk, meat and egg production - LowInputBreeds

- 5-year EU Collaborative Project, funded under the Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities
- Contract No. 222623
- 94 person-years of research
- Over 60 scientists
- 21 leading research and industrial organisations
- 15 countries
- 4 livestock species: cattle (dairy and beef), sheep (dairy and meat), pigs, poultry
- Running from 2009-2014
- Project coordination: Newcastle University and Research Institute of Organic Agriculture FiBL
- www.lowinputbreeds.org

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Large Collaborative Project

- 2009 – 2014
- 17 research centres
- 6 industrial partners
- 4 non-European partners
- 17 countries

- 94 person-years of research
- > 60 scientists

- Budget: 8.9 Mi €
- EC contribution: 6 Mi €

Why LIB?

- Animal breeding focus on **intensive production** systems
- Dominated by big business
- Selection on **performance**
- Modern genotypes only successful if supported by **high inputs**
- **Functional traits** low priority
- Organic and low-input systems need **robust** animals
- Diverse & relatively small *market*

www.ploegint.nl/dutch/frames/frames-breeds.html

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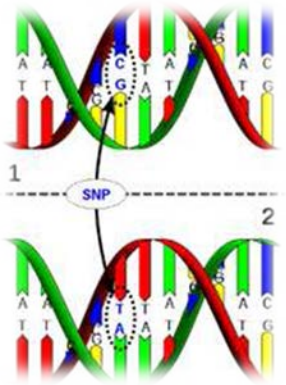
Cattle



1. Variation/selection within **Brown Swiss** dairy cattle (D & CH)
   - 1200 bulls - **genomic breeding** value for high & low heritability traits (54 K SNP *chip*)
   - Record 1300 cows under organic management – phenotype and genotype (HD 800 & 54K chips)
   - Milk quality - fatty acid profiles
2. **Cross breeding** for robust cows (UK)
3. ***Multicriteria evaluation*** trade off between traits eg yield vs fertility (also beef value of dairy calves)

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Genomic breeding values?

We need to improve selection of the ***best*** cows and bulls to breed the next generation

Challenges to identifying the best animals – ***traits*** may be:

1. impossible to express eg bulls & milk yield or mastitis
2. not obvious until late in life eg longevity
3. challenging to measure or quantify eg behaviour
4. only expressed if challenged eg disease resistance
5. influenced by more than just genetics eg fertility
6. expressed differently under contrasting circumstances

Breeding priorities (SAC)

rank	**Trait**
1	General disease resistance
2	Mastitis resistance
3	Longevity
4	Somatic cell count (sub-clinical mastitis resistance)
5	Female fertility
6	Forage intake capacity
7	Feet and leg strength
8	Susceptibility to lameness
9	Resistance to parasite infestation
10	Robustness/hardiness

How **do** we identify the **best** cows and bulls?

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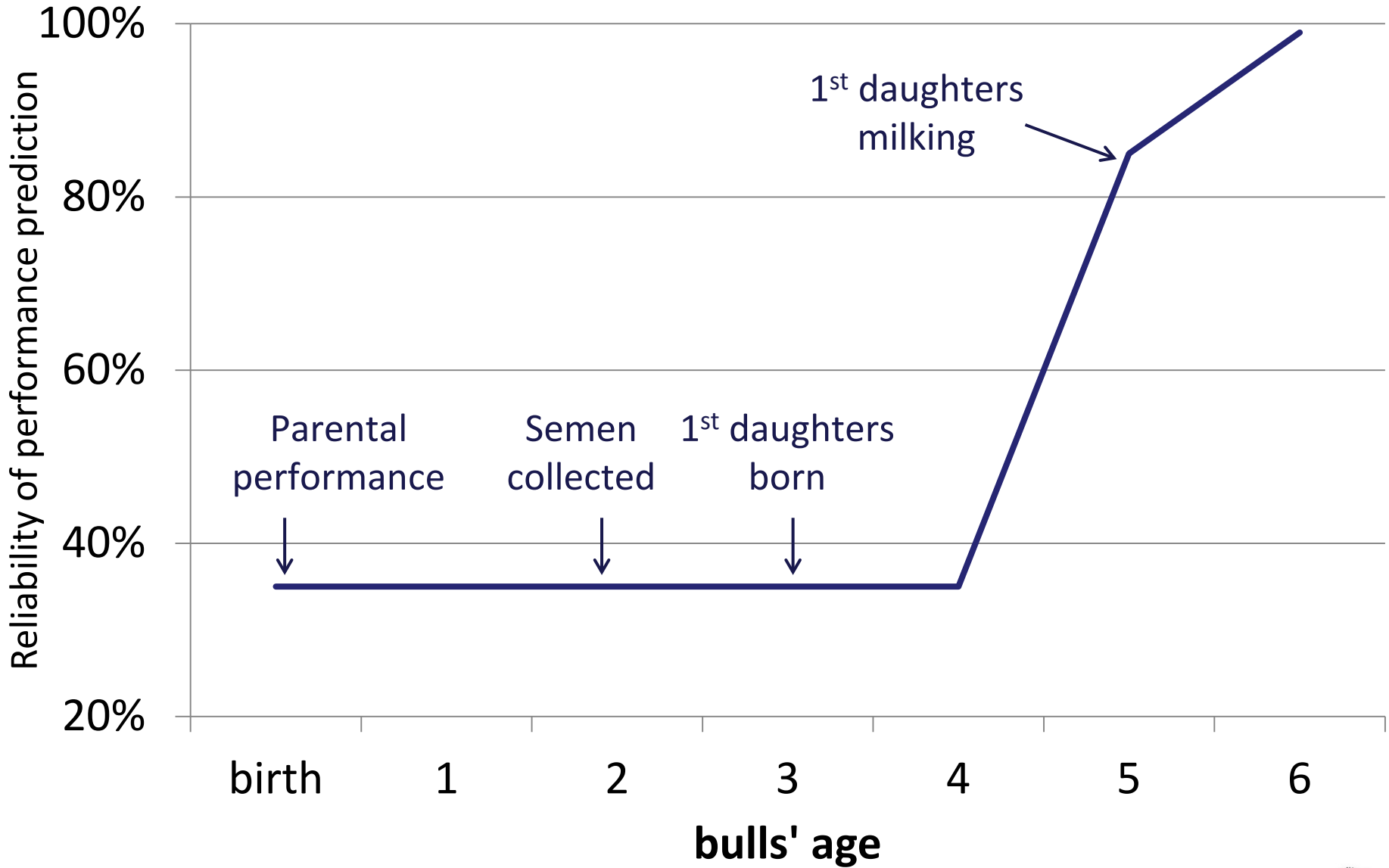
Parent, [sibling] & *progeny* selection

- Used to identify bulls' potential
- Originally dominated by performance but now with more (68%) emphasis on functional traits
- Bulls need to breed to generate daughters
- Daughters need to milk to assess performance
- Accuracy of prediction increases with population size
- Bulls might be 6 years old before enough reliable data accumulates

Reliability time scale for selecting bulls (DairyCo)



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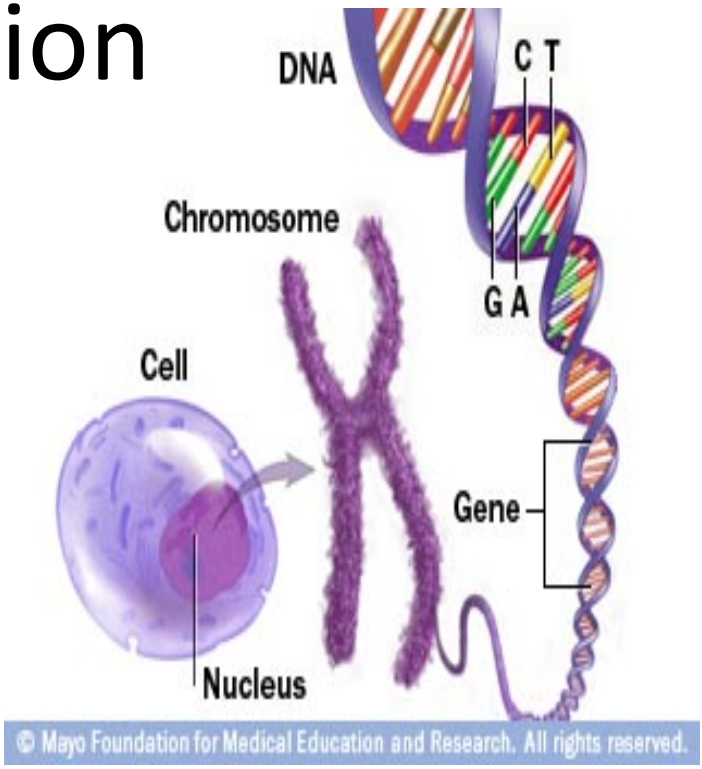
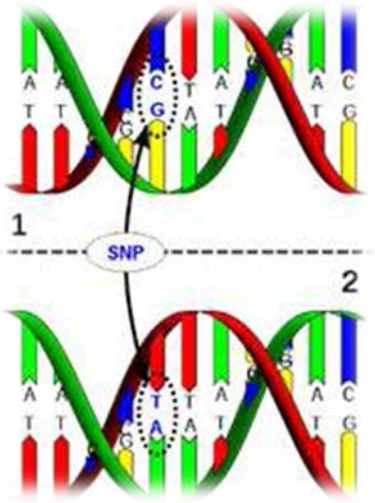
Genetic variation



- Cattle have 60 chromosomes
- DNA – a series of paired **nucleotide**
- Variation caused by differences in nucleotides at any given point on the chromosomes - **s**ingle **n**ucleotide **p**olymorphism (**SNPs** or *snips*)
- Standard tests
  - 2009: 54 001 SNPs
  - 2014: 770 000 SNPs



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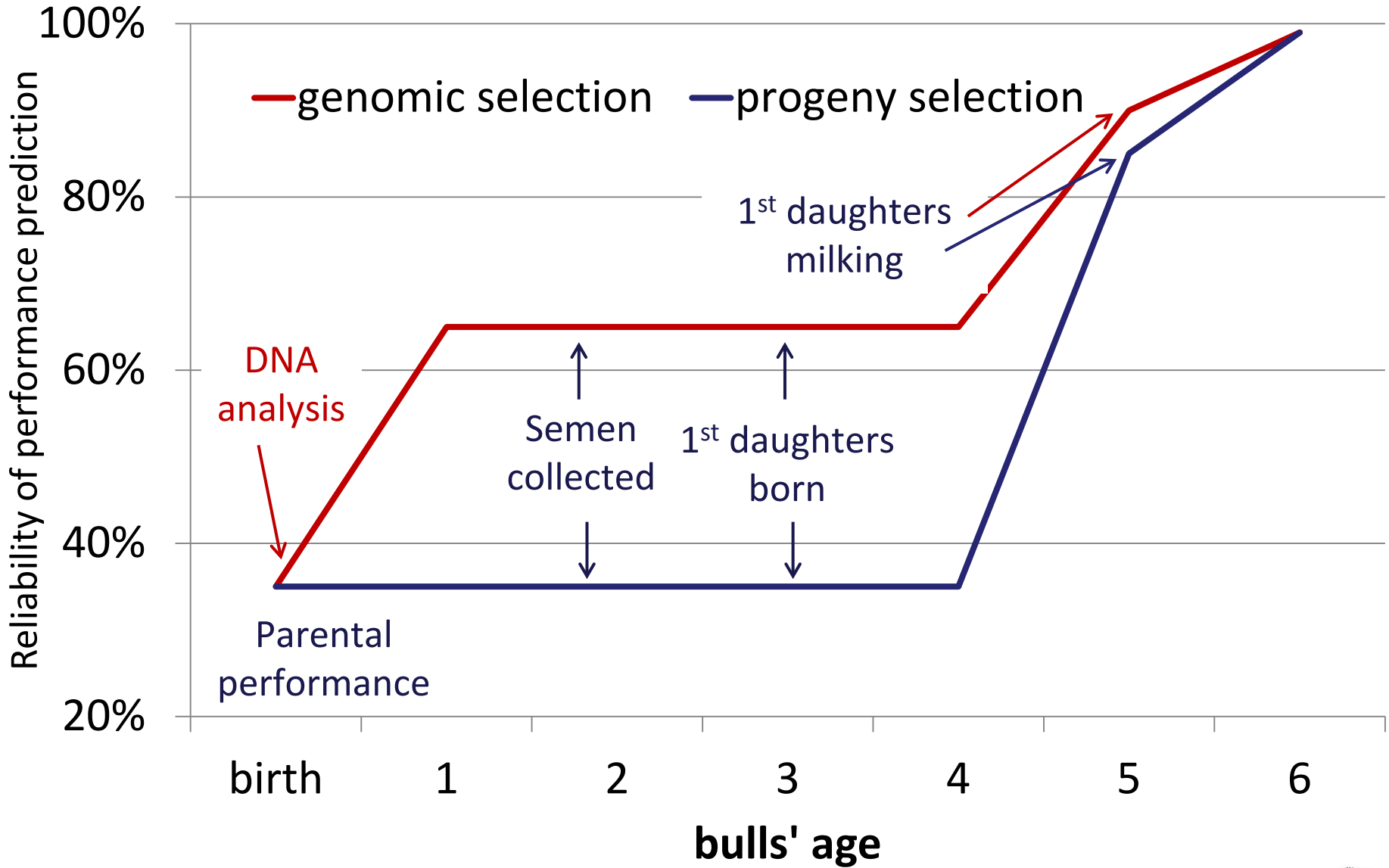
Genomic selection

- Uses DNA as indicator of animals' potential
- Allows exploitation of **young** bulls and decisions on young heifers – sampling from birth
- Allows selection on the **potential** without the need to actually exhibit traits eg disease resistance

BUT

- Crucial step is to link the genome or DNA to performance – what do the SNPs mean in reality?
- Extensive recording of desirable (& undesirable) traits and identify association with variation in the genetic make up (matching *phenotype* with *genotype)*

Reliability time scale for selecting bulls



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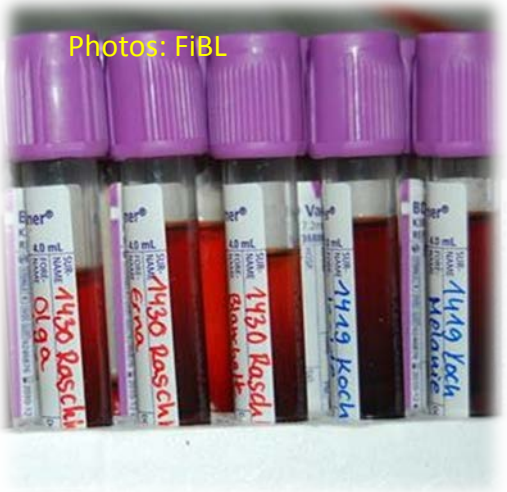
Genomics and functional traits

- Functional traits; fertility, temperament, behaviour, disease resistance, locomotion, longevity, robustness….
- Not easily to change by breeding – influenced by feeding and other aspects of management and often not easy to identify superior animals
- Traditionally slow genetic progress
- Investing in intensive testing and recording representative animals (matching genotype with phenotype) will allow prediction in the wider population



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Genomics in LIB

- 1799 Brown Swiss cows on 40 Swiss organic farms
- Detailed records 5 times 2009-2011
- Assessing (combination of farmers and technician):
  - General[$] & milking temperament and aggressiveness
  - Rank order
  - Milking speed
  - Udder depth
  - Position of labia
  - Days to 1st heat[$]
- Identified candidate genes relating to these traits [$]

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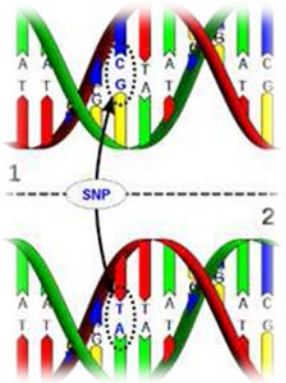
Cattle



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Optimum genotypes for crossbreeding

- Carried out in UK 2011-2012
- 17 dairy farms
  - 10 Low-input (*NZ* management)
  - 7 Organic
- 1069 individual cows
- Milk samples and management information collected
  1. October-November 2011
  2. March-April 2012
  3. June-July 2012
  4. October-November 2012

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LIB: other key findings

- For many of low input traits, genomic prediction is promising & provides accurate breeding values
- No major differences in *'gene relationships'* between Swiss organic, high input Brown Swiss and German Holstein/Friesian populations
- Concentrations of the nutritionally desirable FA inversely related to highly selected US BS genetics
- Confirming crossbreeding offers potential in low-input & organic systems with considerable variation between individual cows

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cheers!

I gratefully acknowledge funding from the European Community financial participation under the Sixth and Seventh Framework Programme for Research, Technological Development & Demonstration Activities, for IPs: LowInputBreeds Contract No. 222623

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