Genomics, sexed semen: changes in reproduction choices in French dairy herds

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New innovative tools for genetics and reproduction strategies

**Genomics:**
- GEBV available for young $\text{♂}$
- GEBV available for $\text{♀}$ in 2011
- High reliability for all traits
- Possibility to increase genetic progress, especially for functional traits

**Sexed semen:**
- Success: 90% $\text{♀}$ calves after sexed $\text{♀}$ AI
- Possibility to select females on farm

**For farmers:** changes in herd management and reproduction strategies

**In breeding programs:** changes in genetic orientations, because of the genetic progress allowed for functional traits; changes in the selection designs for males and for females

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66th EAAP Annual Meeting, Warsaw, Poland, 2015
The French dairy population for breeding and insemination

- Available bulls per year – Breeding programs

<table>
<thead>
<tr>
<th>Breed</th>
<th>2009 Progeny testing</th>
<th>2009 Proven bulls</th>
<th>2014 Genomic EBV without progeny</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>600</td>
<td>50</td>
<td>180</td>
</tr>
<tr>
<td>Montbéliarde</td>
<td>180</td>
<td>20</td>
<td>130</td>
</tr>
<tr>
<td>Normande</td>
<td>150</td>
<td>15</td>
<td>80</td>
</tr>
</tbody>
</table>

- Inseminations (AI) – Main dairy breeds

<table>
<thead>
<tr>
<th>Breed</th>
<th>2014 Number AI</th>
<th>Number of bulls &gt;1000 AI</th>
<th>Number of inseminated cows and heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>4,050,774</td>
<td>527</td>
<td>2,450,032</td>
</tr>
<tr>
<td>Montbéliarde</td>
<td>828,105</td>
<td>201</td>
<td>634,263</td>
</tr>
<tr>
<td>Normande</td>
<td>523,453</td>
<td>135</td>
<td>340,550</td>
</tr>
</tbody>
</table>
A reversal in the use of AI bulls

2014: 70% AI with genomic evaluated young bulls

<table>
<thead>
<tr>
<th>definition</th>
<th>use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classical evaluation</strong></td>
<td></td>
</tr>
<tr>
<td>Proven bulls (progeny tested)</td>
<td>Few bulls, thousands of AI</td>
</tr>
<tr>
<td>Bulls under progeny testing</td>
<td>Lot of bulls, 300 1st AI</td>
</tr>
<tr>
<td><strong>Genomic evaluation</strong></td>
<td></td>
</tr>
<tr>
<td>Young bulls with genomic EBV without daughters</td>
<td>Hundred of bulls, few AI</td>
</tr>
<tr>
<td>Proven bulls with genomic EBV</td>
<td>Dozen of bulls, medium use of AI</td>
</tr>
</tbody>
</table>

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Two phases of bulls contributing to genetic progress

Genetic evolution of Holstein 1st AI - Functional traits and Net Merit

2009: 1st genomic evaluation = breeding values available for 4 years of waiting progeny testing dairy bulls. Large choice, higher precision for functional traits.

Since 2012: evaluated bulls come from genomic breeding programs. **Higher selection intensity, increased reliability.**
More genetic progress for functional traits

2004-2014 Genetic trends for Holstein 1\textsuperscript{st} AI in France:

<table>
<thead>
<tr>
<th></th>
<th>2004-2009</th>
<th>1\textsuperscript{st} genomic EBV</th>
<th>2009-2014</th>
<th>2004-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional traits</td>
<td>↗ +0.3 EBV STD</td>
<td>↗ ↗ +0.8 EBV STD</td>
<td></td>
<td>+1.1</td>
</tr>
<tr>
<td>Production traits:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>↗ +0.7 EBV STD</td>
<td>→ 0 EBV STD</td>
<td>↗ +0.5 EBV STD</td>
<td>+0.7</td>
</tr>
<tr>
<td>Protein Contents</td>
<td>↘ -0.2 EBV STD</td>
<td></td>
<td></td>
<td>+0.3</td>
</tr>
<tr>
<td>Type</td>
<td>↗ ↗ +1.0 EBV STD</td>
<td>↗ ↗ +1.3 EBV STD</td>
<td></td>
<td>+2.3</td>
</tr>
<tr>
<td>ISU = Total Merit index</td>
<td>↗ ↗ +1.3 EBV STD</td>
<td>↗ ↗ +1.5 EBV STD</td>
<td></td>
<td>+2.8</td>
</tr>
</tbody>
</table>

In 2012, the composition of the Total Merit Index (ISU) was updated with more weight for functional traits: \textbf{37.5\% ↗ 50\%} (Holstein)
Genotyping females

2014: 100,000 genotyped females on farms (cumulated)

Commercial dairy farms:
• More than 100,000 females with genomic EBV
• Expected 75,000 new genotyped females in 2015
• 96% under 18 months old
• About 6,000 farms tried genotyping
  Increasing ++

Breeding programs in dairy breeds:
• About 25,000 genotyping /year Stable =
New tools to put emphasis on females

• French breeders **ask and pay** genotyping for their **own use**

• Allowed by

  The availability of the **LD chip** since 2012
  The **low price**

• More tools for mating advices:

  A **early** genetic information for females

  A **complete** genetic information for females (for all traits)

  → highlight of the diversity of females

• To **sort** among females with different genetic profiles

And more services:

• Parentage testing

• Haplotype and mutation tests for genetic characteristics or defects
  (more than 20 tests / 4 breeds)
2010-2014: great increase of sexed semen

2014: 35% dairy heifers with ♀ sexed semen AI

2014: 91% female calves after female sexed AI in 2013 (/115,000 dairy calves)

Montbéliarde cows can sustain sexed AI due to the higher female fertility of the breed
Sexed semen: not only for genetic purposes

Reasons to use sexed semen with 90% hope of getting a female calf:

• To develop the herd without buying outside
• To sell females when good market opportunities
• To avoid heifers calving difficulties
• To avoid dairy males with a bad economic value
• To allow beef crossbreeding for a part of the herd

• To sort among a larger number of females
Combining sexed semen and genotyping: a new strategy in herds

Developing sexed semen → to sort among a larger number of females = more selection intensity

Genotyping → to sort among females with different genetic profiles = more reliable informations

→ to target appropriate bulls and females according to selection objectives at the herd level

2014: 35% dairy heifers with ♀ sexed semen AI

2014: 70% AI with genomic evaluated young bulls

2014: 100,000 genotyped females on farms

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Perspectives in France

- Farmers and Breeders are **confident**: they massively **adopt innovations** in order to better match animals and their environment **according to their objectives** and in a **sustainable way**

- Genetic progress for functional traits is expected **soon** at the herd level

- Genomic selection will be extended to **other cattle breeds** (local and beef) and **other species** (dairy sheep and goats) in **2015-2016**
Thank you for your attention