17 May 2018

Use of New Breeding Techniques applied to cattle

European Parliament

Committee on Agriculture and Rural Development

LIMOUSINE
LANAUD - FRANCE

Pôle de Lanaud, headquarter of the french Limousin breed

The breeding program of the french Limousin cattle

1500 Herd-Book members
107 000 cows and **3000 bulls recorded**
3000 cows and 300 bulls qualified
each year

500 RJ / Espoir

700 ♂

Lanaud

420 ♂
On-station performance test

250 RCV / evaluated
Station for beefy bulls

10 bulls
Progeny testing

♂ **On-farm fattening**

♀ **On-station rearing**

2 bulls
Terminal breeding

5 - 6 bulls
Beefing abilities

3-5 bulls
On-farm qualified

AI bulls
CreaLim

2 - 3 bulls
BA & MQ

4 - 5 bulls
Maternal qualities

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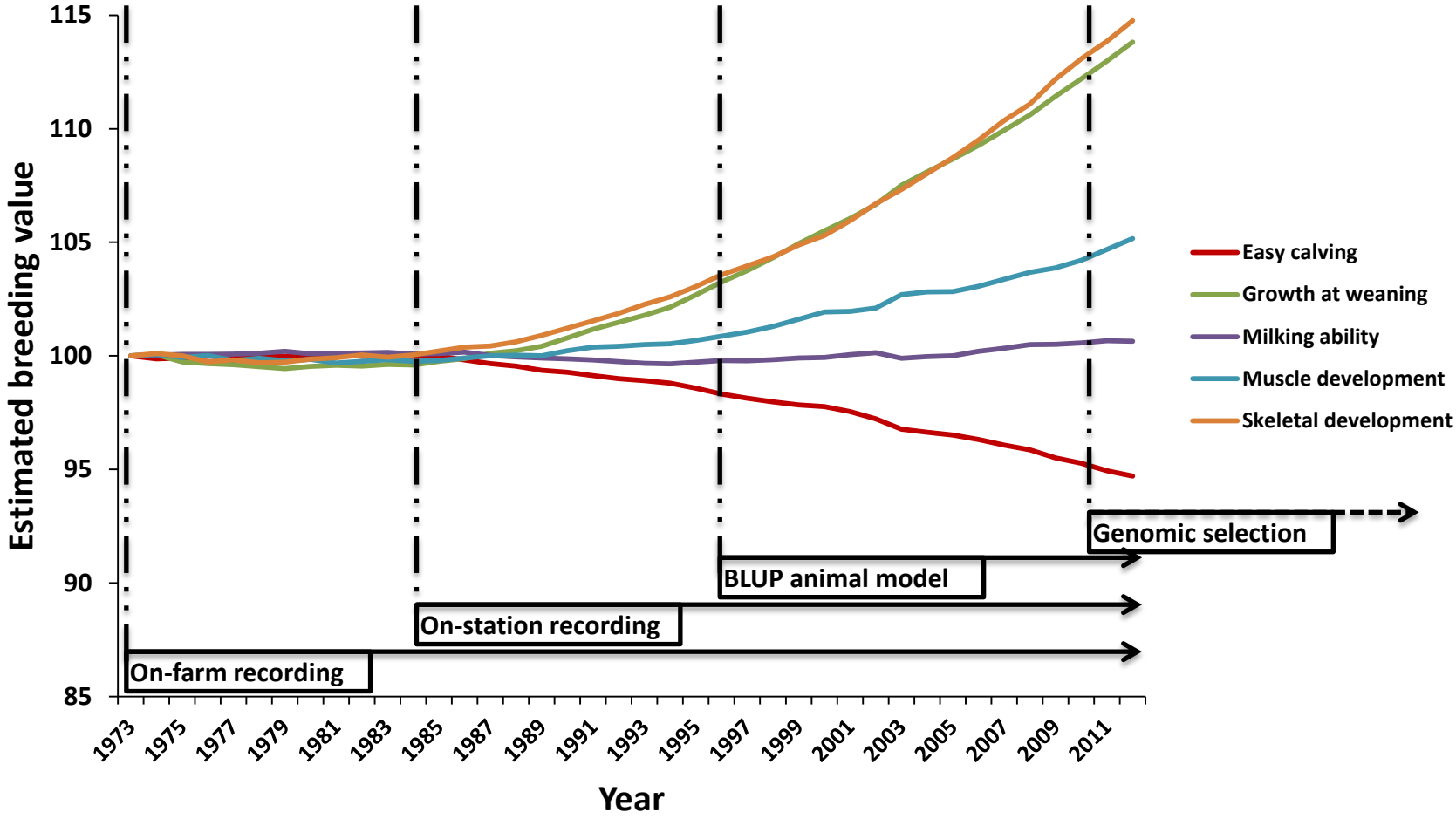
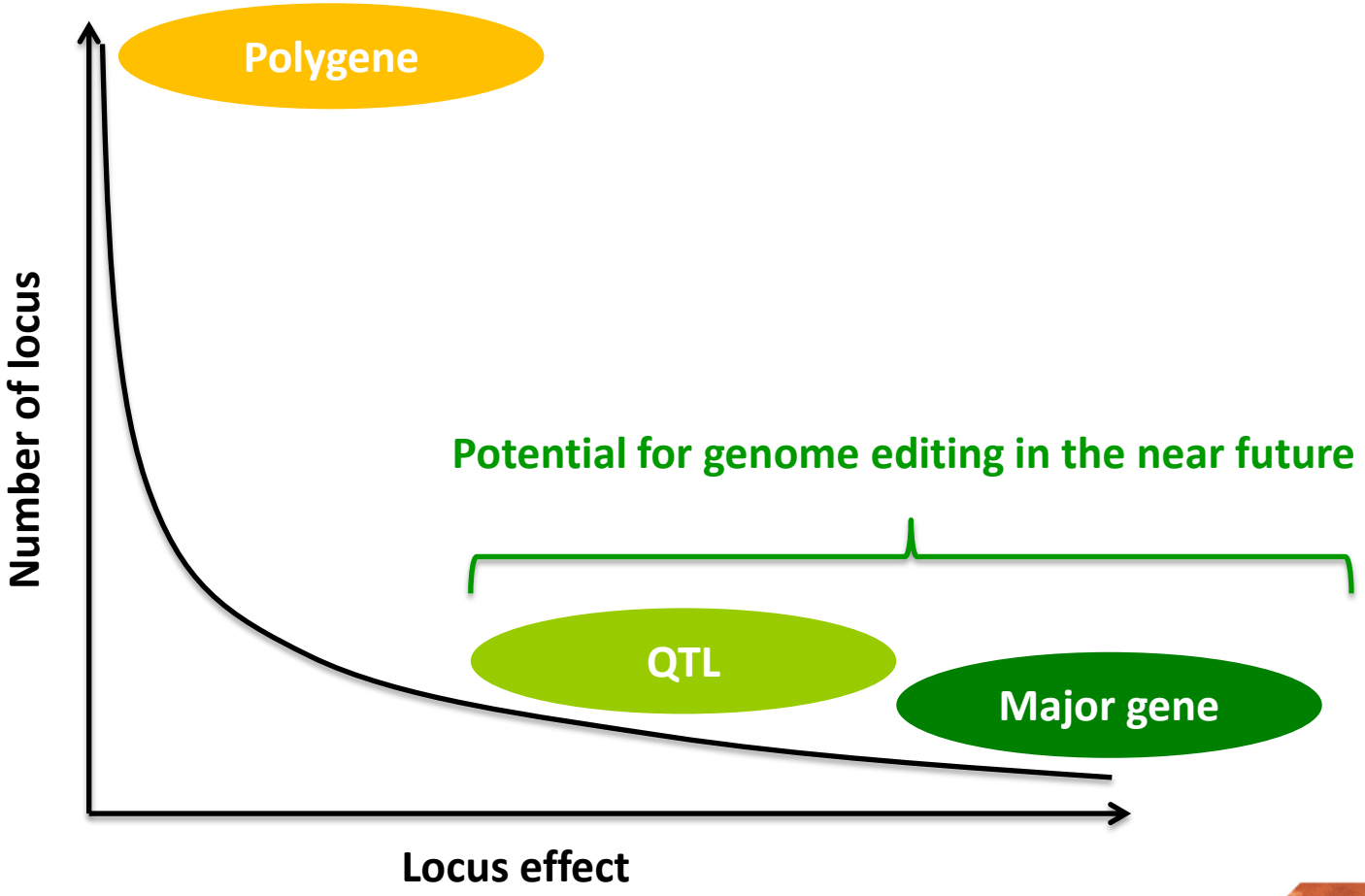
Genetic trend of the Limousin breed



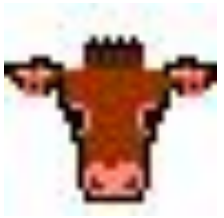
And now, what about the potential of gene editing to increase genetic gain ?

Genetic architecture of traits usually selected in cattle breeding programs



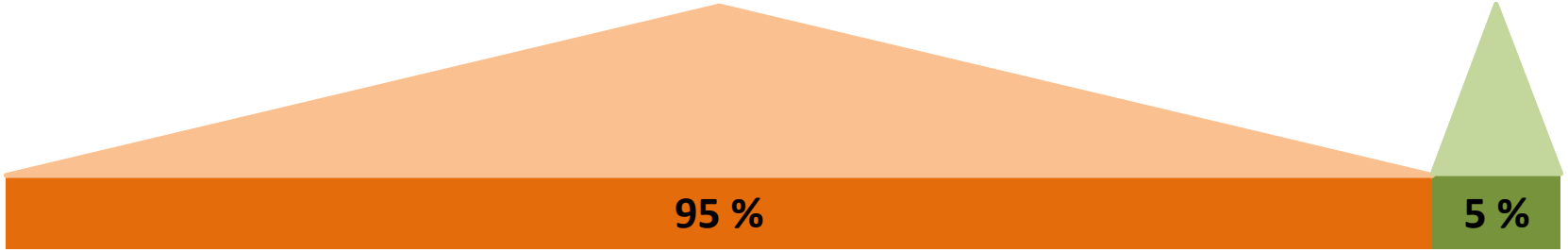
Polled gene : an interesting candidate for gene editing technique

- The polled gene (P) is dominant to the horned gene (p)



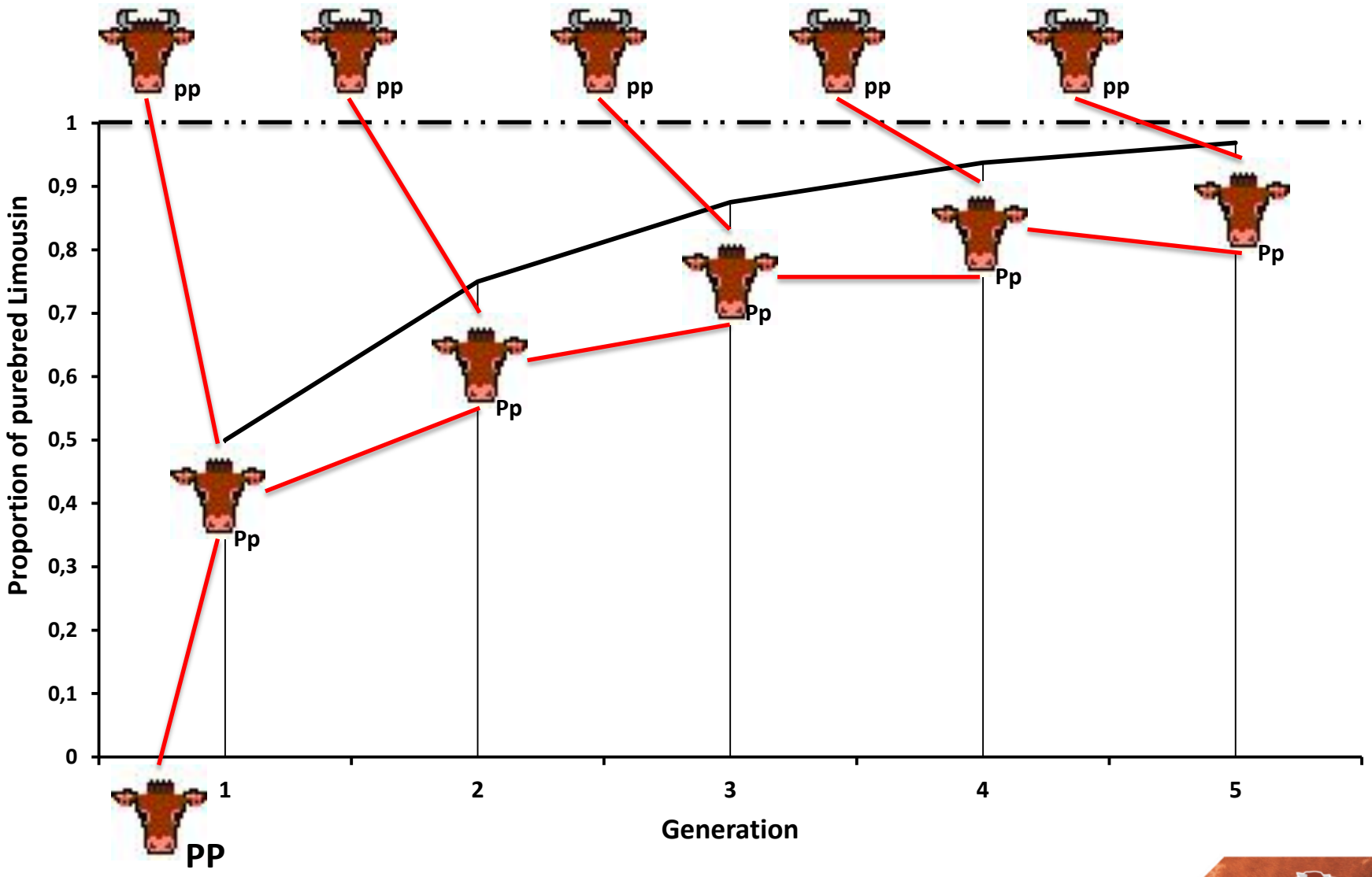
Genotype pp

Genotype Pp or PP



Polled phenotype rate in the french Limousin cows population

Current introgression pattern of the polled gene by backcrossing



More than 10 years to introgress only one copy of the polled gene…

The benefits of gene editing

- **This new breeding technique give us opportunity to :**
  - **Both maintain genetic gain and genetic diversity and select low frequency desirable allele**
  - **Increase efficiency of breeding programs of livestock production with a long cycle like cattle**
  - **Better select negatively correlated traits**
  - **Select efficiently low heritability traits and new traits related to welfare and resilience**

- **Gene editing will complement conventional breeding programs and not substitute them because traditional selection tools are essential to increase allele frequency of low effect genes**

- **Even if only few QTL are known in beef cattle currently, this knowledge will improve quickly thanks to the increase of genotyped and sequenced animals**

Social and policy current limits of gene editing technique

- If edited animals are considered as GMO in EU, we may face an economic loss and a lack of competitiveness at the international level :
  - Our breeding programs worldwide renowned will be overpassed by the ones leaded outside EU
  - If there is no traceability for edited animals and if ones of them or their genetic materials are imported in EU, it will be very difficult to trace these animals
  - Also, our genomic selection breeding programs would be very impacted because with gene editing technique, the genetic marker effect close to the edited gene isn't related to the « new gene » effect

- Cloning technique, to get edited animals through somatic cells, would not be applied because the rearing of livestock clones in EU is forbidden

- Social and breeders acceptance should play a huge role in the implementation of this new biotechnology

- We need « guarantees » for this new breeding technique if we want breeders and meat consumers keep trusting the quality of our work

Conclusions and prospects

- **Genome editing is a new genetic engineering technology with a prospective future application for increasing the responses for quantitative traits in livestock breeding programs and for fostering sustainable agriculture**

- **French Limousin breeding society has always been a driving force for innovation in the field of genetic improvement, only if tools suggested to the breeders are efficient and safe**

- **This new breeding technique is a real opportunity to :**
  - **Face climate change by rapidly introgressing adaptated genes (heat stress, tick resistance…)**
  - **Quickly implement genetic research results to the field**

- **Gene editing is a promising breeding techniques and its success is based on its acceptance by breeders and people in general**

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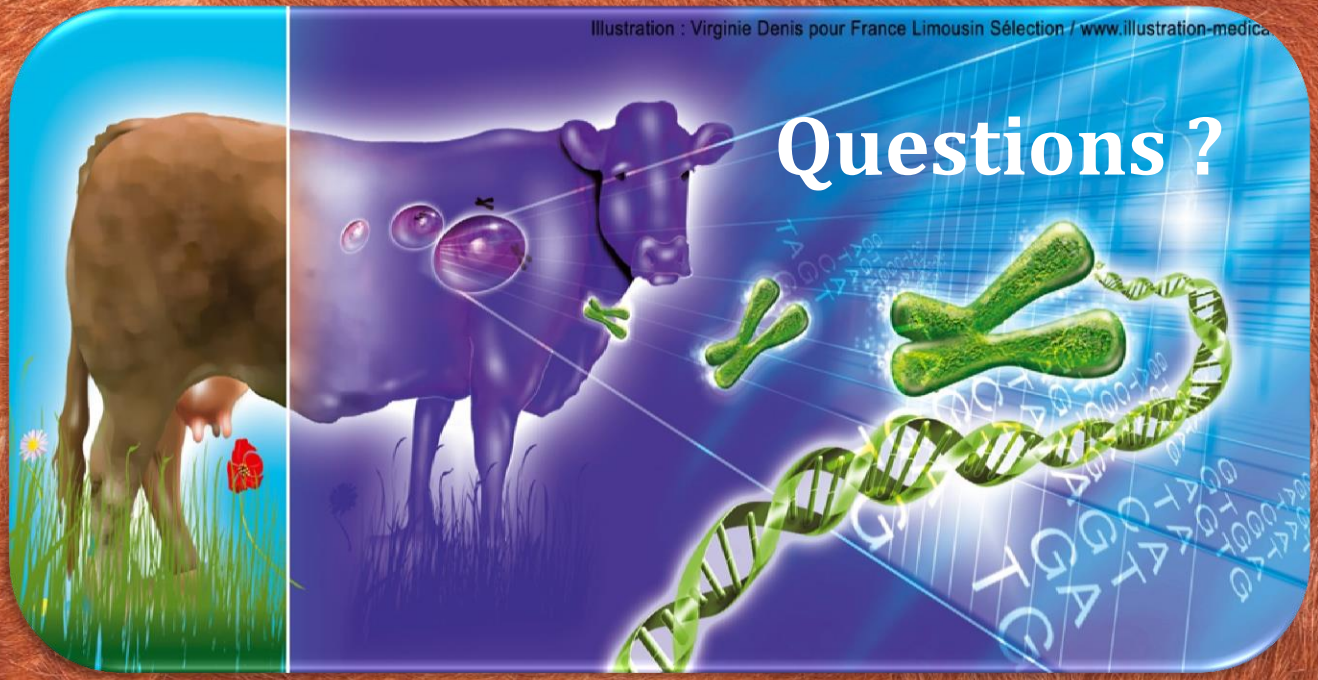
Thank you for your attention



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