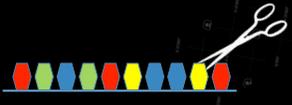


THE USE OF GENE EDITION IN ANIMAL PRODUCTION

GENE EDITION

It is a type of genetic engineering where DNA is inserted, eliminated or replaced in the genome of a living organism using "molecular scissors"



GENE EDITION

- It allows to reinforce or inhibit certain characteristics of an organism, without interfering with the other characteristics
- A change that would take years in nature through natural mutations or artificial selection can be accelerated using this technology

GENE EDITION

- REMOVE or INSERT new genes into the gene sequence
- Can insert genes from the same species or from other species
- Biggest advantage: all other parts of the genome remain unchanged

GENE EDITION OF FARM ANIMALS

IMPROVED MUSCLE GROWN



IMPROVED HEAT RESISTANCE



HORNLESSNESS



HEAT RESISTANT CATTLE

HOLSTEIN CATTLE

- Highly productive dairy breed
- Originally from cold regions
- Suffers at high temperatures

WITHOUT SHADOW →

Reduced animal welfare

Reduced milk production



HEAT RESISTANT CATTLE

Breeds with the SLICK gene are more resistant to heat

- less hair
- shorter hair
- larger sweat glands

GENE EDITION

- Holstein cattle: removal of a small segment of DNA and introduction of the SLICK allele of Senepol cattle
- The allele is hereditary and **dominant** and therefore the subsequent generations will have greater tolerance to heat.

HORNLESSNESS CATTLE

Holstein dairy cattle naturally have horns



HORNS

- **Muddles** management
- Can be dangerous to humans and other animals

DISBUDDING / DEHORNING



Pain
Stress

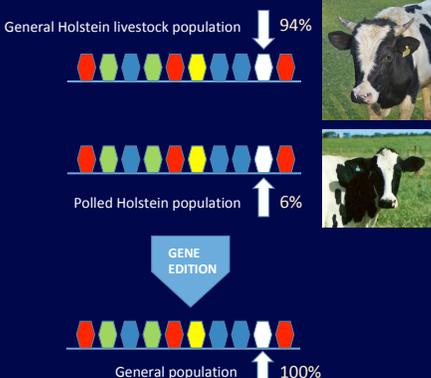
HORNLESSNESS CATTLE

Some cattle are born without horns (polled gene)

GENE EDITION

Replacement of the 'horn gene' of Holstein cattle by the 'polled gene'

- The rest of the DNA sequence is left unchanged
- Other characteristics of the breed are maintained



General Holstein livestock population ↓ 94%

Polled Holstein population ↑ 6%

GENE EDITION

General population ↑ 100%

DOUBLE-MUSCLED CATTLE

Myostatin deficiency → lean muscle continues to develop, causing muscle hypertrophy

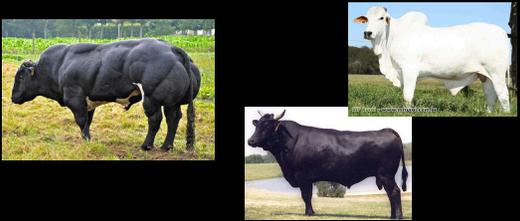
The Belgian Blue breed has a gene that inhibits myostatin

- An ox normally weighs an average of 450 kg at the time of slaughter
- Belgian Blue with this gene can weigh up to 1000 kg



DOUBLE-MUSCLED CATTLE

GENE EDITION → This gene has been successfully inserted into Wagyu and Nellore cattle



DOUBLE-MUSCLED CATTLE

Better feed conversion

- Dystocic delivery (100% cesarean)
- Lower viability of offspring
- Reduced female fertility and delayed sexual maturation

Higher meat production per area

- Meat with less fat

Walking difficulty due to weight



DEBATE

What are the **BENEFITS** for:

- the animals?
- society?
- the producers?

What are **RISKS** for:

- the animals?
- society?
- the producers?

DEBATE

Is gene edition using genes found in the own species a genetic modification; can it be considered natural?

Which application do you find most acceptable?
What are the reasons for considering one application more acceptable than other?

DEBATE

Who do you trust when it comes to these themes?

MUITO OBRIGADA!!!

Note: translated to English exclusively for publication in Sustainability. All interviews were done in Brazilian Portuguese