



Feeding on Selection Indices to Achieve Climate Friendly Breeding Goals

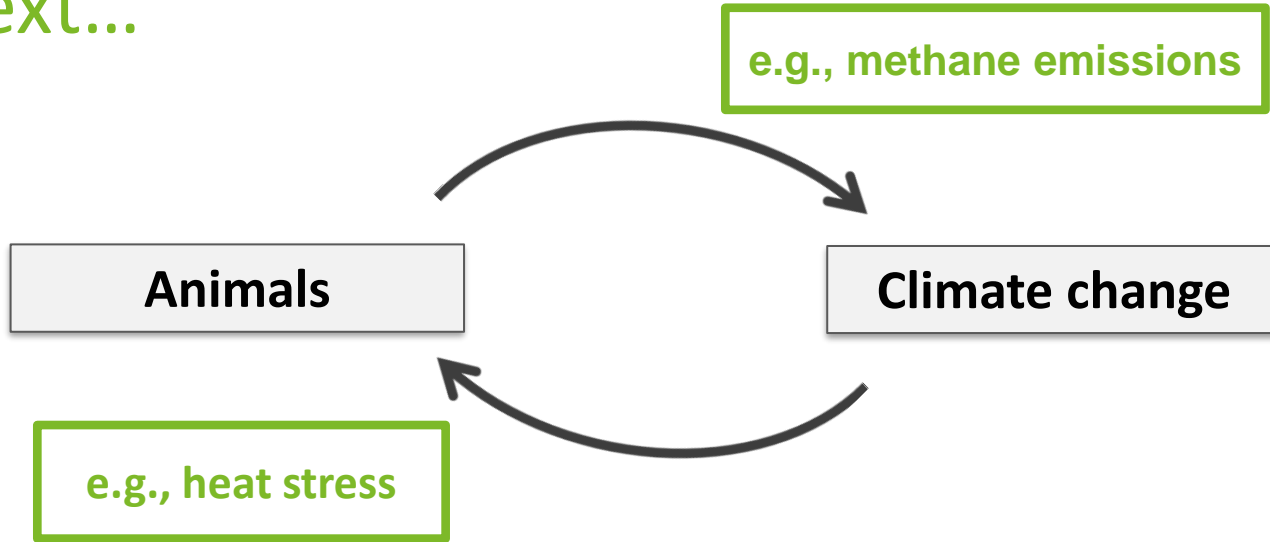
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Objective of today:

Some basics about Breeding Goals and Selection Indices
to help the general audience understand how

Breeding talks Green

Context...



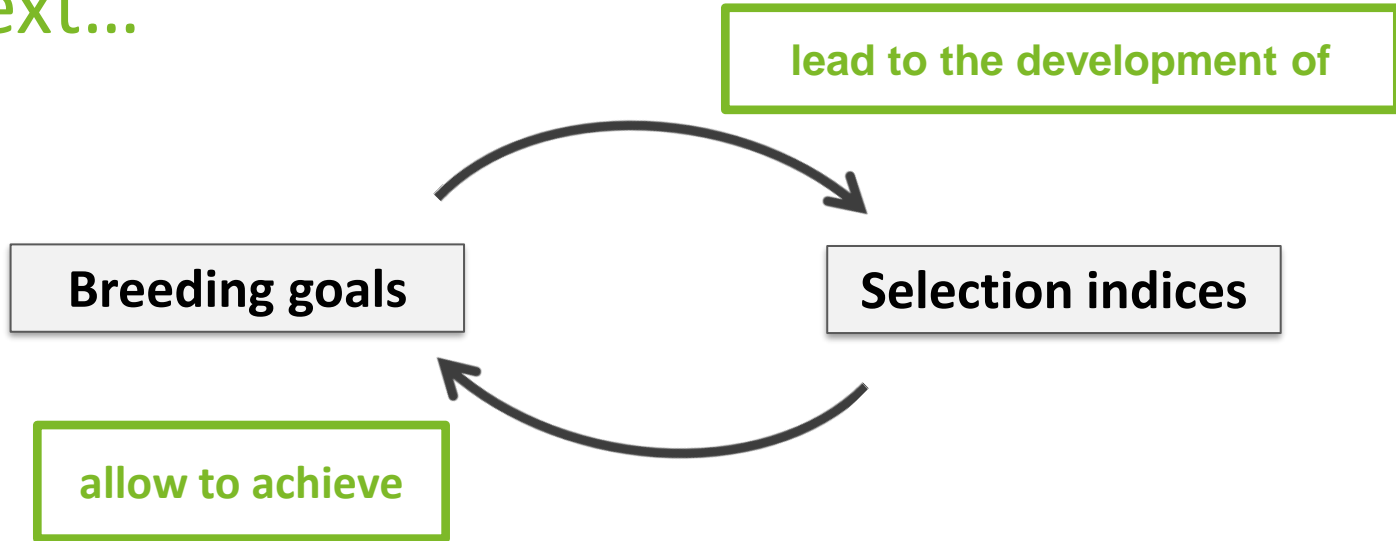
- **Mitigation and Adaptation**

- Doing management choices

- But also breeding

➔ **Permanent and Cumulative**

Context...





What is a “Breeding Goal”?

- ▶ In short: “What we want to achieve by breeding”
- ▶ In long:
 - A function of the traits to be improved
 - Considering the emphasis (weight) given to each trait

→ direction in which we want to improve our animals

- ▶ NB: concept of “**breeding goal traits**”

Climate friendly breeding goals....



▶ Defining breeding goals ...

- Complex issue
 - › Involves economic, social and other (environmental) dimensions
 - › Today often linked to “**sustainability**”
- But also dynamic → needing regular updates
 - › Changing weights
 - Changing economics, but not only (e.g., societal challenges)
 - › Adding traits
 - Novel “Mitigation” (and “Adaptation” ↔ Resilience) traits

→ allowing to make breeding goals climate friendly



Climate friendly breeding goals....

▶ But also:

- Being foreseeing → often nearly a “**crystal ball**” is needed

▶ Also permanent point for scientific “dispute”

- **Unique** breeding goal vs. **Specific** breeding goals
- Advantage being specific
 - › Adapts animals to production circumstances (e.g., organic farming)
- Disadvantage being specific
 - › Slows down genetic progress

→ **Important point also in our context!!!**



What is a “Selection Index”?

▶ Definition

- Best (linear) predictor of the **breeding objective**

▶ Combination of information from many traits

- NB: concept of “**information**” vector

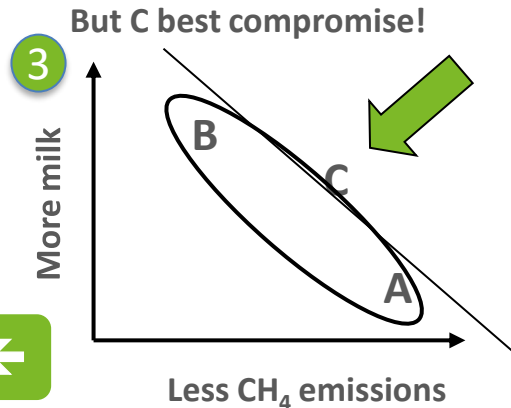
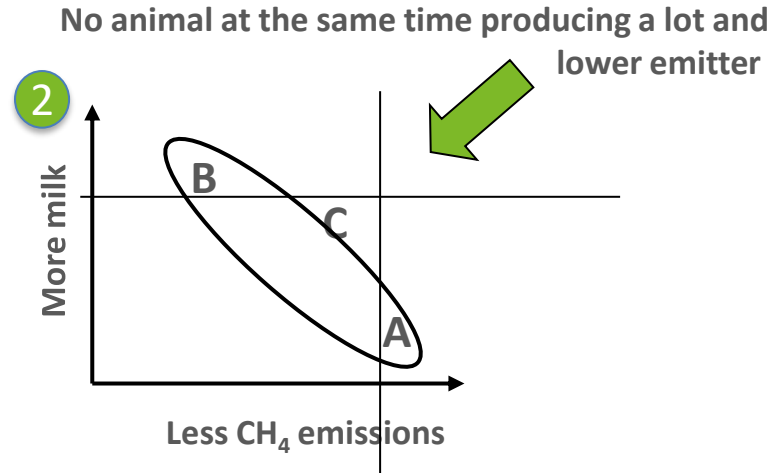
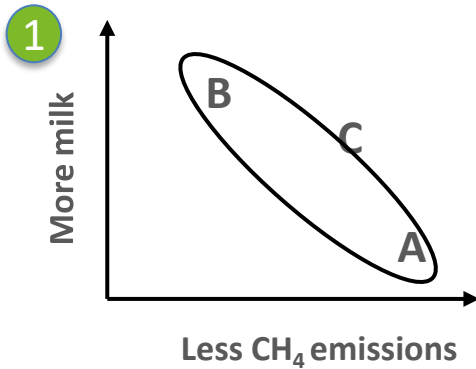
▶ Traits

- Weighted into a single “combined” index value
- NB: concept of “**selection index traits**”

Simple example:

► Breeding goal:

- Producing milk with less CH₄



According to Selection Index: C > A > B ←





Defining “Selection Index” weights

▶ Selection index also based on correct emphasis of each individual trait in the index as a function of:

- Its link to the breeding objective

→ **what can it contribute?**

- The correlations amongst the index traits to:
 - › Avoid double-counting
 - › Take (negative) correlations into account

→ **therefore avoiding undesired effects**



However: need for adapted phenotypes...

- ▶ Because in the age of climate smart breeding....



<https://pixabay.com/users/talpeanu-2135075>

...the phenotype is also King

A variation to © of Mike Coffey



Acquiring climate related phenotypes...

- ▶ **High investments** needed in measuring emissions
- ▶ Often associated also to (feed) **efficiency**
→ important for producers
- ▶ And not to forget “**Adaptation**” traits (less our topic today)
- ▶ Emphasis on advanced technologies but this:
 - Limits number of herds (e.g., research herds)
 - Reduces number of records (or better number of animals)
- ▶ Strong link to genotyping efforts → **Genomic Selection**

→ **but no genomic selection without phenotypes....**



Selection Index to the rescue...

▶ Important disclaimer:

“Breeding goal traits” can be ≠ from “Selection index traits”

▶ Therefore (illustrating by an example):

- Direct CH₄ emission in breeding objectives
→ few thousand records
- But proxies for CH₄ emission (i.e., based on milk composition)
→ tenth of millions of records

▶ Strong interest to find appropriate indirect proxies

→ Importance of international collaboration



Selection Index to the rescue...



- ▶ Last important issue.... what about the **risk**?
 - Climate friendly traits ↗ but current breeding goals traits ↘ ???
- ▶ Fortunately:
 - Some current index traits → + link to climate friendly breeding
 - › Health fertility, productivity (part being proxy for efficiency)
 - **But** first results showed also that there could be risks
 - › As selection for CH₄ ↘ linked to less body condition and fertility ↘

→ use of selection index able to avoiding undesired effects



General Conclusion

- ▶ In the age of climate friendly breeding goals....



[https://commons.wikimedia.org/wiki/
File:Holy_Roman_Empire_Crown_\(Imperial_Treasury\)2.jpg](https://commons.wikimedia.org/wiki/File:Holy_Roman_Empire_Crown_(Imperial_Treasury)2.jpg)

...the Selection Index will rule as Emperor!

Thank you for your attention!

Questions?

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