# Organic dairy breeding lines? - Possibilities and Requirements

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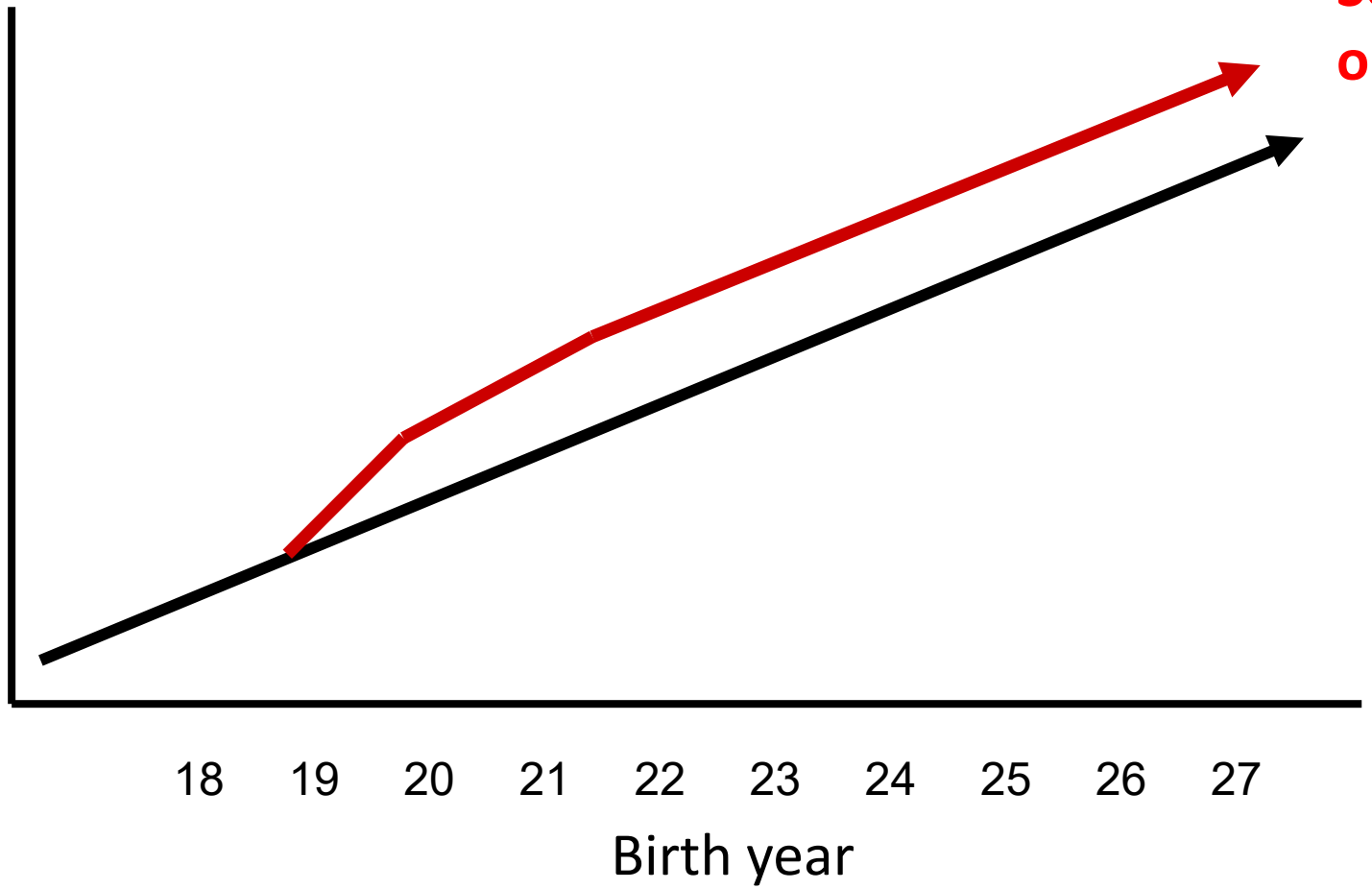
# Current status – organic dairy breeding

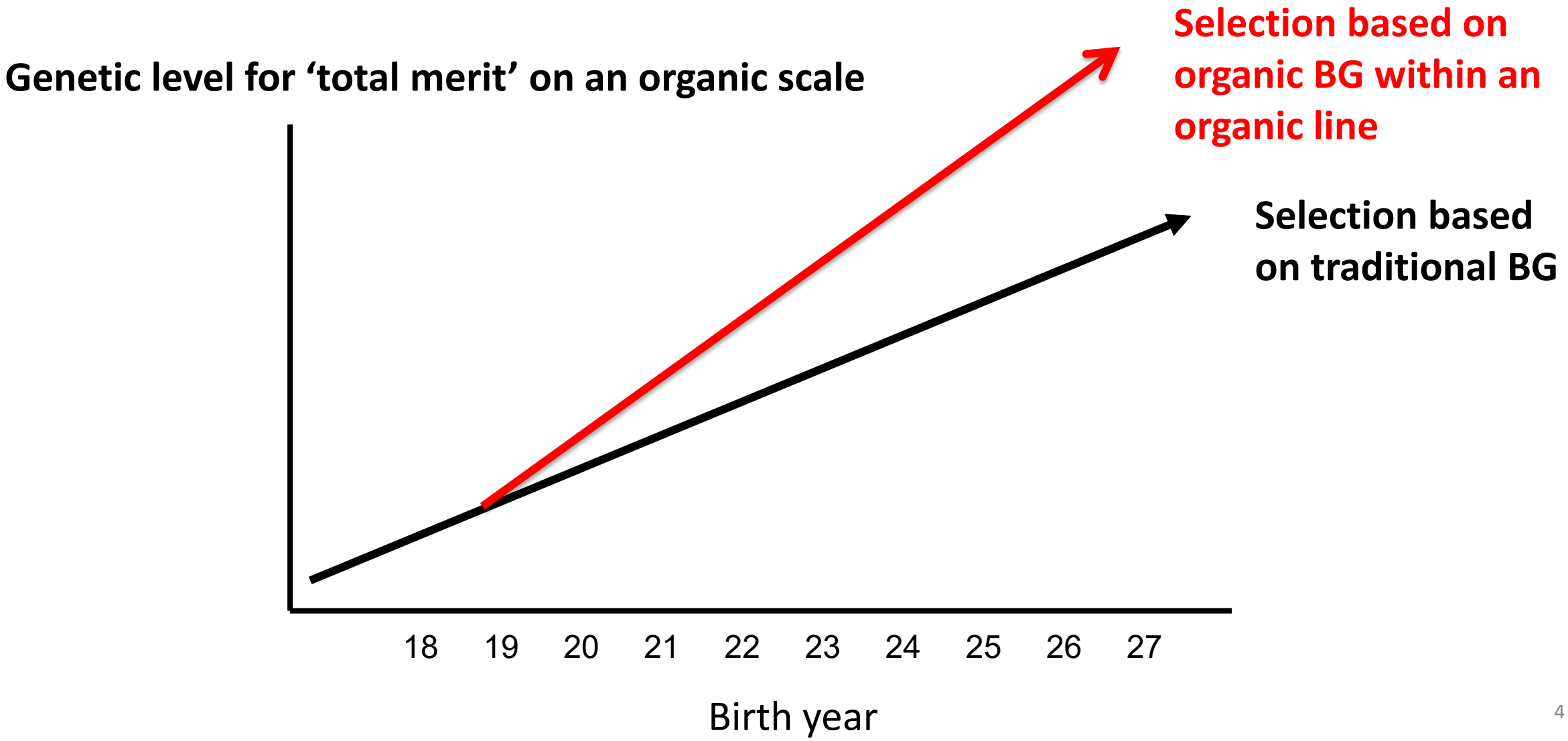
- Most genetic material originates from ‘conventional’ breeding schemes
- Some organic farmers select sires based on customized farm indices
- ‘Organic’ breeding schemes have not been used on a large scale

# Trend with customized indices

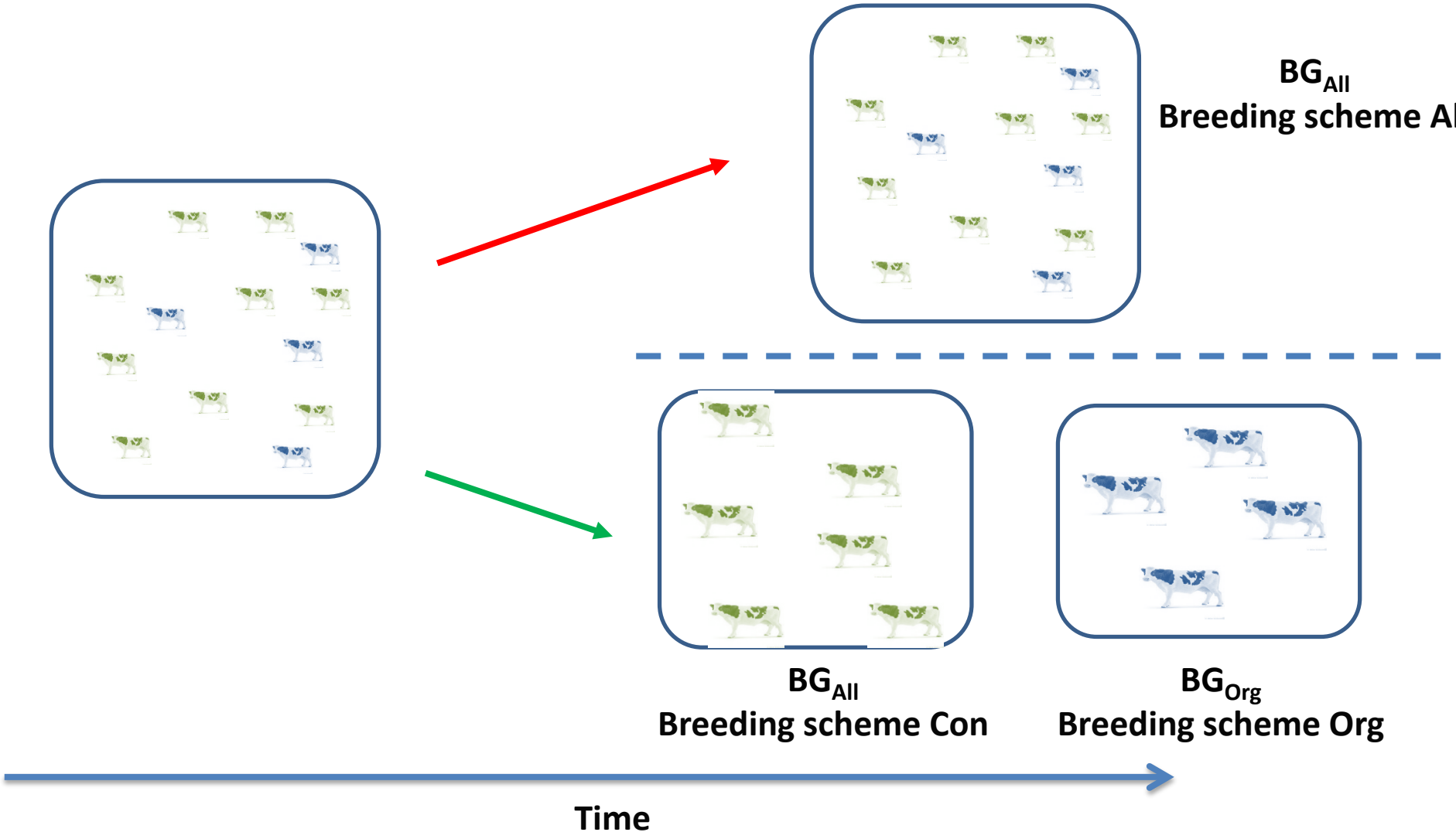
**Genetic level for ‘total merit’ on an organic scale**



# Trend with an organic breeding line



# Specific organic breeding lines?



# Correlations between breeding goals depends on:

- Economic values (EV) (discussed by Slagboom et., 2016 and Slagboom et al., 2018)
  - Given by production circumstances
  - Given by non-market values
    - Farmer preferences
    - Principles of production
- G*E interactions (see eg. Liu et, 2018)
  - Biologically defined
    - cannot be changed
- Registration methods
  - Can be harmonized

# Possible reasons for different EV between conventional and organic dairy production

- Different production circumstances, e.g.:
  - Higher roughage consumption
  - Reduced use of antibiotics
- Different prices
  - Higher prices for output
  - Higher prices for input
- Legislation
  - Based on national and international principles for organic production
- A consumer wish for differentiation on genetic material to be used in organic production compared to conventional production

# G*E interactions between organic and conventional production systems

- Few and inconsistent estimates in the literature
- We do however see G*E interactions between grass based production systems and systems primarily confinement based (Interbull, 2017)
- Our expectation is that conventional and organic production systems will differentiate more in the future

# The break-even correlation

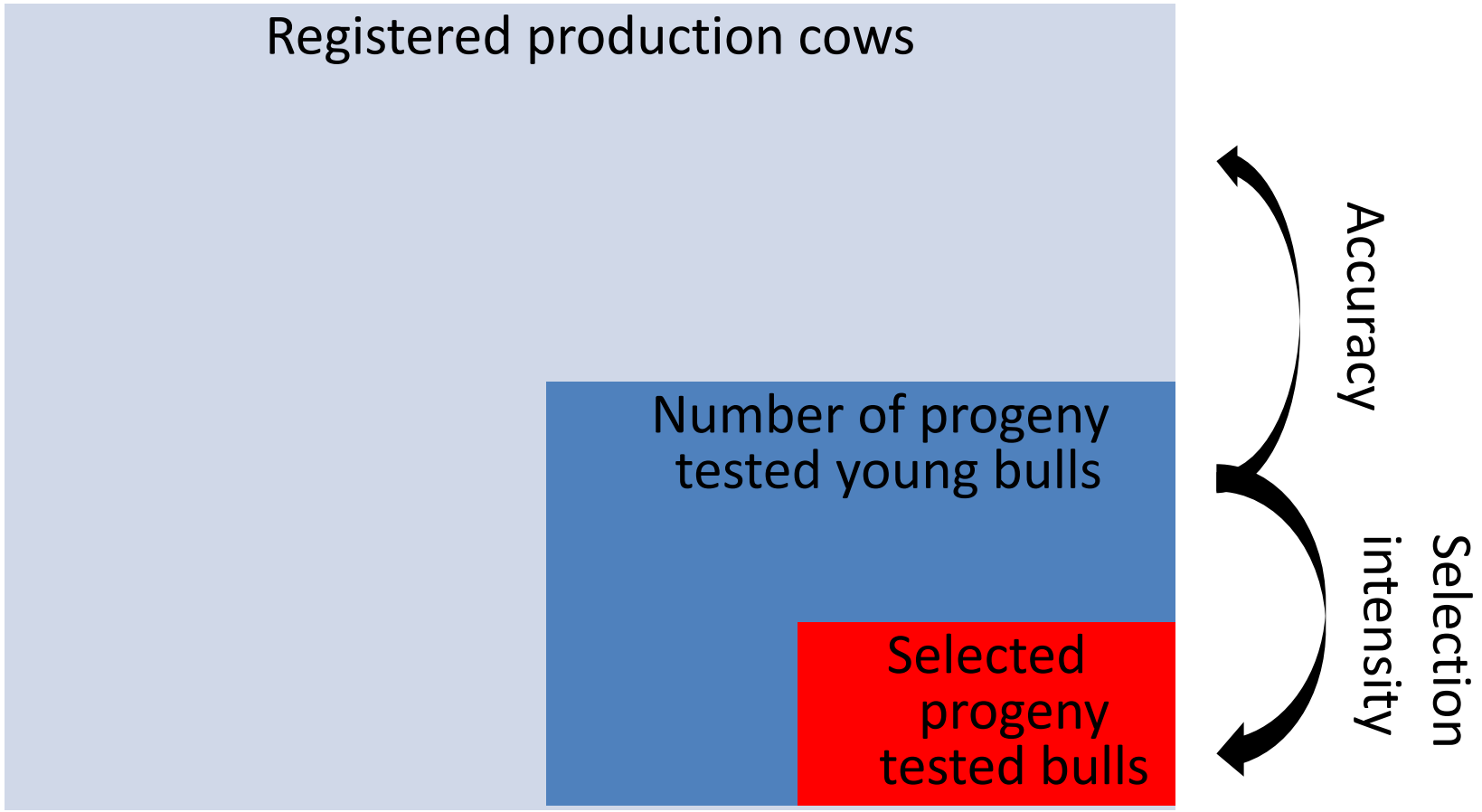
- If the correlation between $BG_{All}$ and $BG_{Org}$ is equal to the breakeven correlation then the value of the genetic gain in the two productions systems is the same whether or not the breeding scheme is divided
- In case the correlation between the two breeding goals are **below** the break-even correlation then a division results in higher genetic gain

- The break-even correlation is however dependent of the “size” (efficiency) of breeding schemes All, Con and Org
  - Corresponding to the money being put into the breeding programs
  - In case the organic breeding Scheme Org is “increased” then the breakeven correlation is increased as well

# Break-even correlations are dependent on breeding schemes and have changed over time

- Before the genomic era
  - Many progeny tested bulls needed for substantial ΔG
  - Large populations needed
  - Break-even correlation approximately 0.85

# The driving force behind genetic gain - before GS

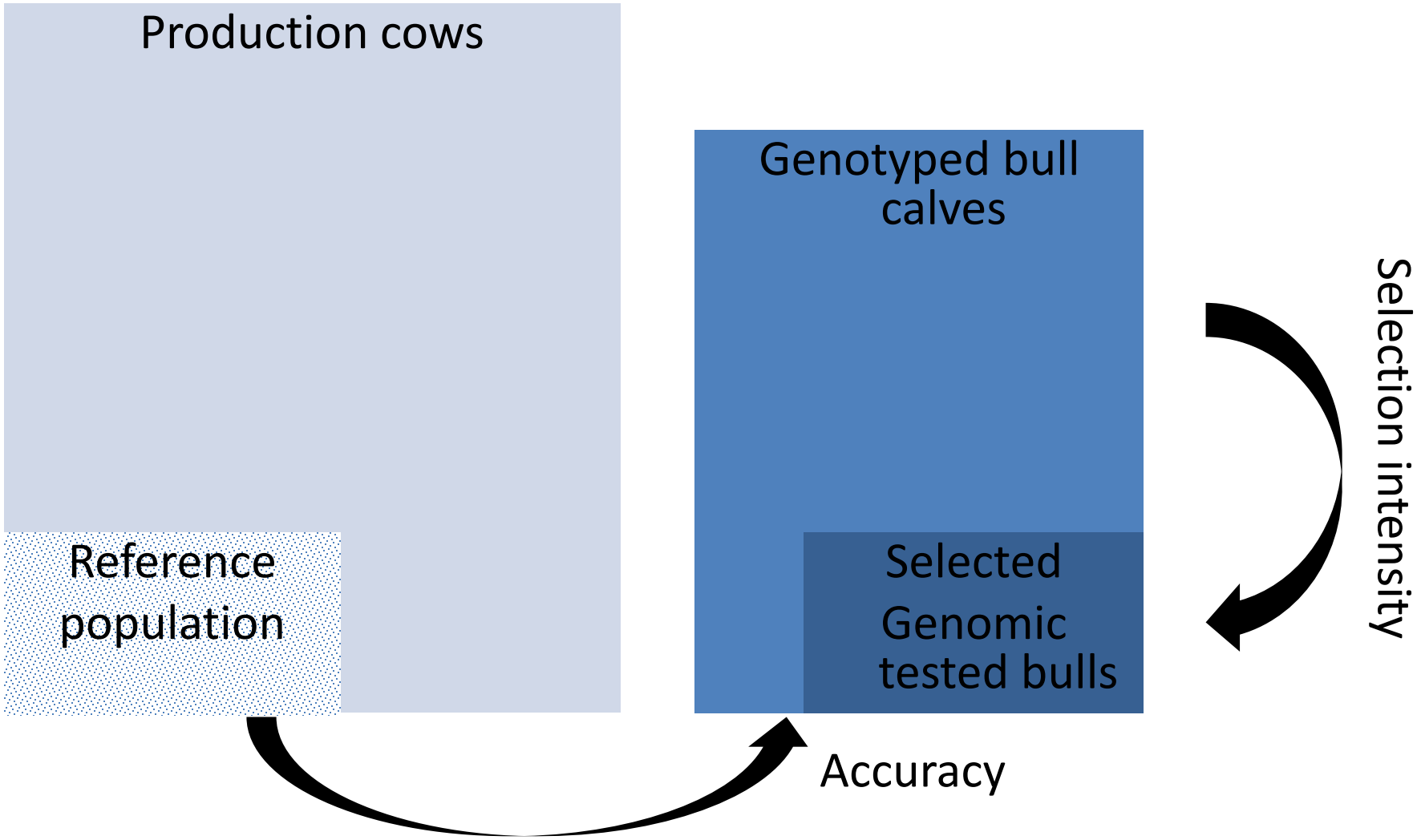


# Break-even correlations dependent on breeding schemes and have changed over time

- Before the genomic era
  - Many progeny tested bulls needed for substantial ΔG
  - Large populations needed
  - Break-even correlation approximately 0.85

- Today
  - Cow reference populations needed
    - Much smaller than the number of test daughters needed before
  - Break-even correlation >> 0.85
    - As higher gain can be achieved in smaller population (or lines)

# The driving force behind genetic gain - using GS



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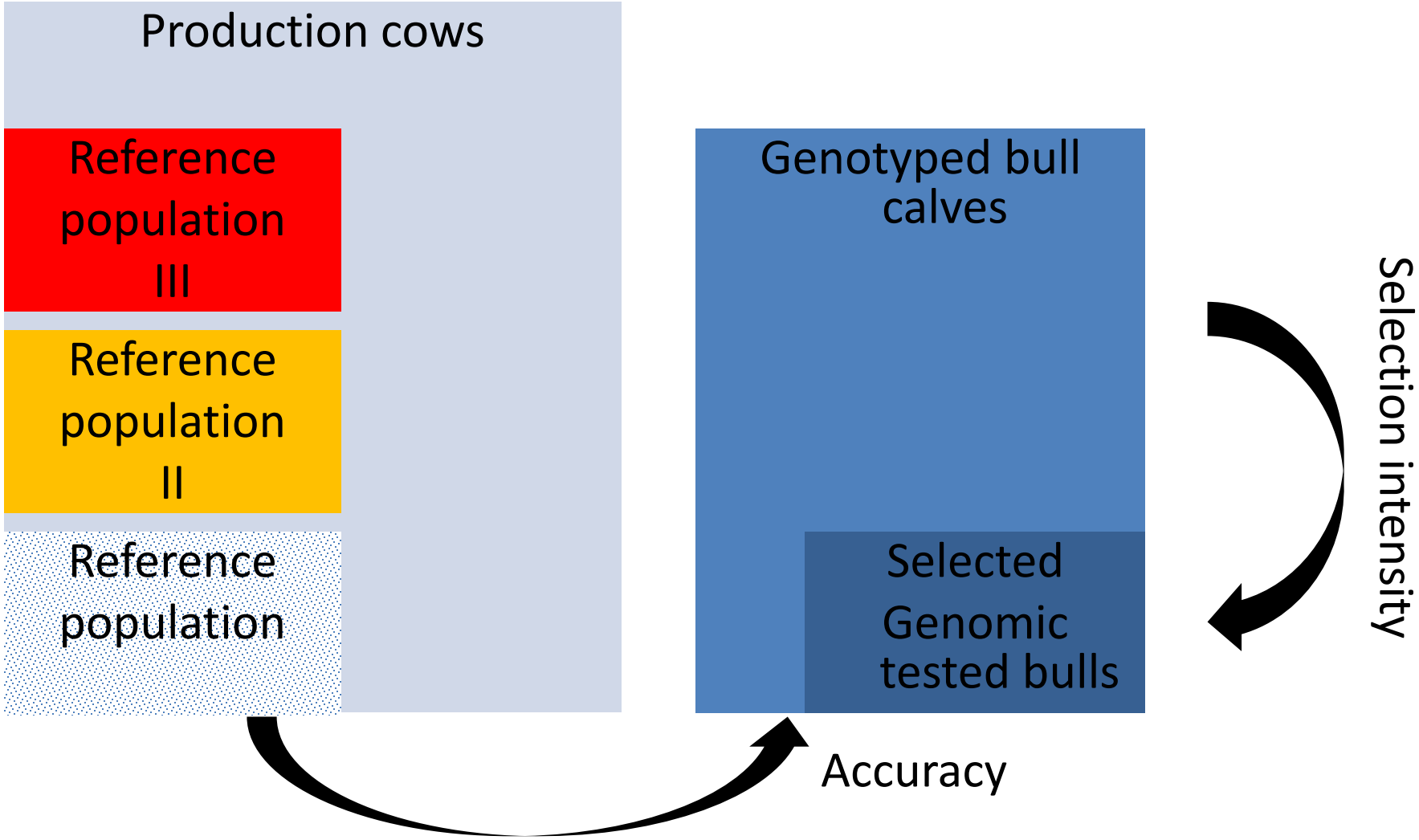


# (Improved) Possibilities for organic breeding lines

- An assumed diversification of organic and conventional breeding goal
- High probability for significant G*E interactions
- In general increased break-even correlation due to genomic selection
  - Genetic progress in smaller population (lines of populations)
  - Genetic progress at a lower cost

# However still requirements before any division

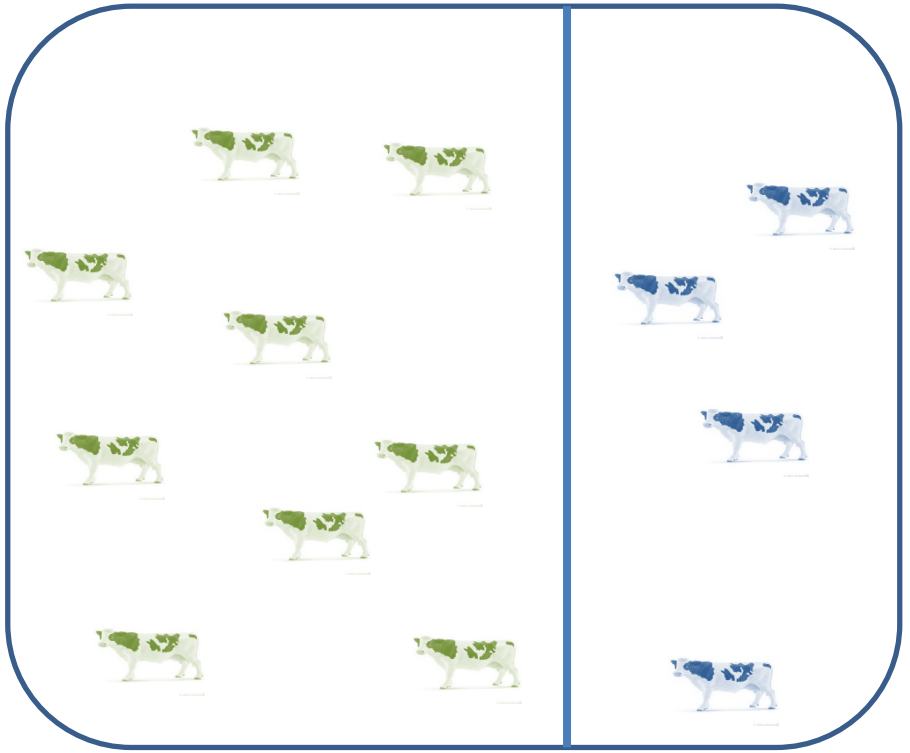
- Estimate correlations between breeding goals
  - Derive economic values
  - Estimate genetic parameters for all breeding goal traits
  - Estimate G*E interactions between production systems
- Estimate the consequences of establishing lines on genetic gain and inbreeding and relate that to the costs
  - Results expected by Slagboom within this year ☺

# Key issue

How much can breeding goals deviate before it is relevant to split the breed in two or more lines when the breed is used for more than one purpose?

# Specific organic breeding lines?

or



**One joint breeding population**
**BG A**
**Breeding scheme A**

**A conventional breeding population**
**BG A**
**Breeding scheme B**

**An organic breeding population**
**BG C**
**Breeding scheme C**