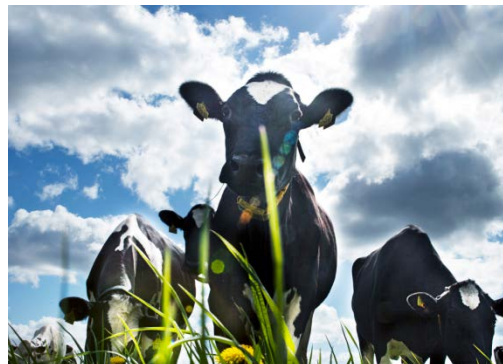# Possibilities and requirements for organic dairy breeding lines

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1) Aarhus University, Center for Quantitative Genetics and Genomics,
2) SEGES, Cattle, 3) VikingGenetics

# 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?
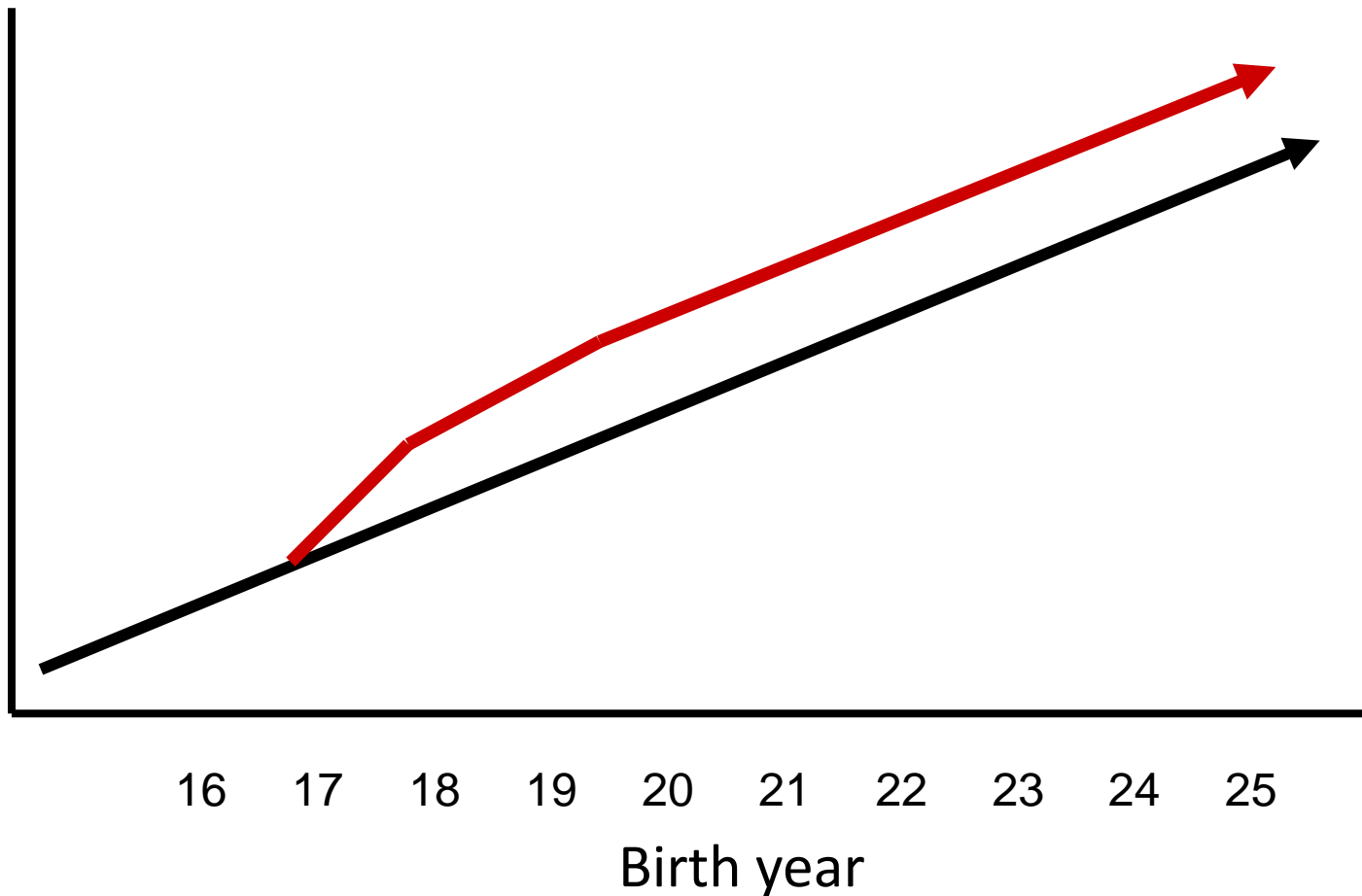
# Current status – organic dairy breeding

- Most genetic material originates from 'conventional' breeding schemes

- Some organic farmers select sires based on customized farm indices

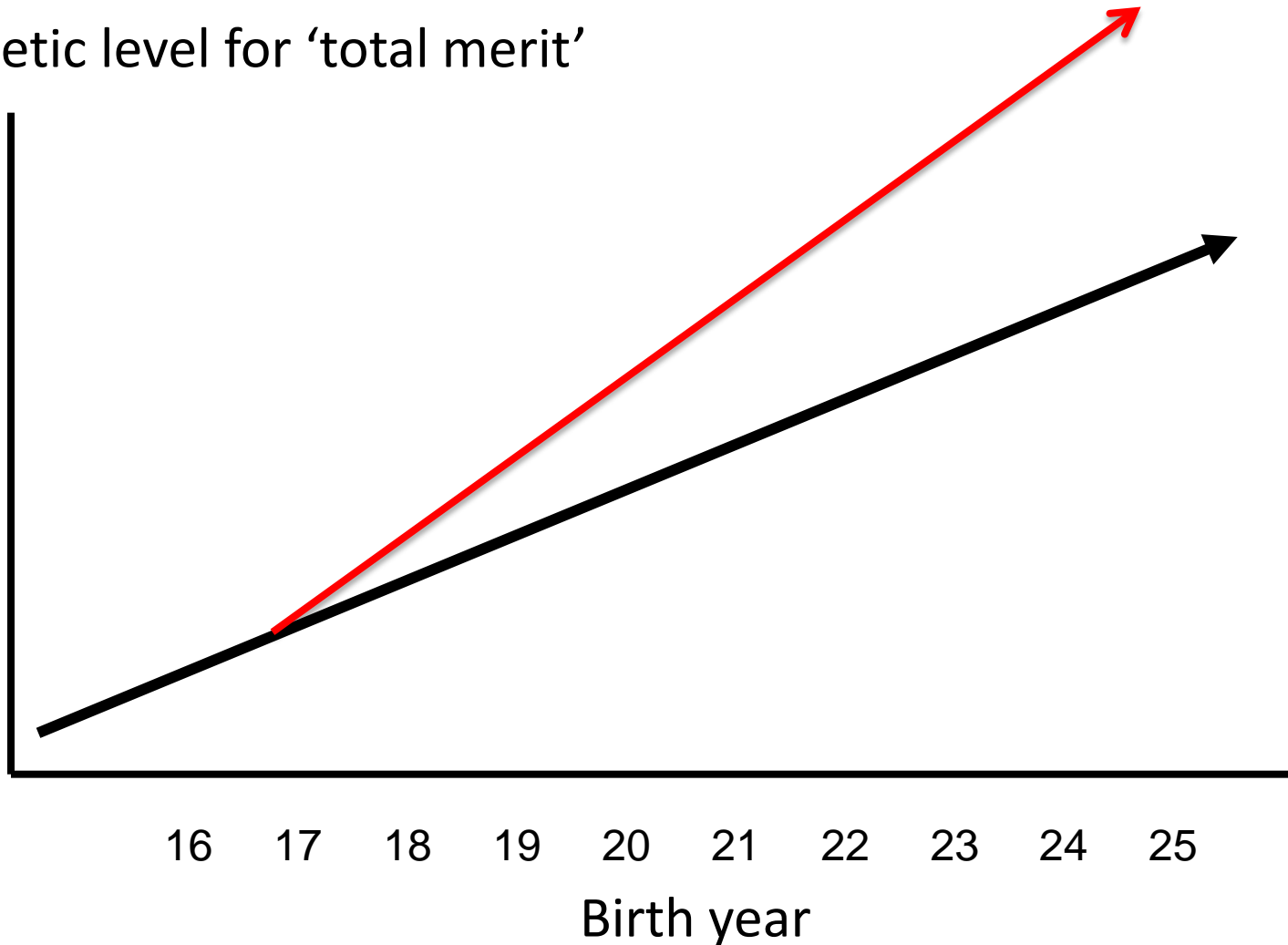- 'Organic' breeding schemes have not been used on a large scale

# Trend with customized indices

Genetic level for 'total merit'



Birth year

# Trend with an organic breeding scheme



Genetic level for 'total merit'

Birth year

16  17  18  19  20  21  22  23  24  25

# When may different breeding lines be relevant?

Climate zones

|  | Temperate | Tropic |
|---|---|---|
| Conventional | X | X |
| Organic | X | X |
| High tech | X | X |

Production system

# Relative EW for Danish Holstein across environments

| Trait | Conventional | Organic | High tech |
|---|---|---|---|
| Yield | 100 | 121 | 93 |
| Feed efficiency | 100 | 123 | 103 |
| Cow mortality | 100 | 102 | 112 |
| Milk fever | 100 | 338 | 202 |
| Mastitis (infectious) | 100 | 205 | 109 |
| Digital dermatitis | 100 | 101 | 81 |
| Conception rate, cows | 100 | 48 | 82 |
| Conception rate, heifers | 100 | 110 | 106 |
| Longevity | 100 | 108 | 121 |

To be published soon

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# Correlation between breeding goals depends on:

- ## Economic weights
  - – Given by production circumstances

- ## G*E interactions
  - – Biologically defined – cannot be changed

- ## Registration methods
  - – Can be harmonized

# Breakeven correlations for line division or not

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

- ## Today
  - Cow reference populations needed
    - Much smaller than the number of test daughters needed before
  - Break-even correlation >> 0.85

# The driving force behind genetic gain – before GS
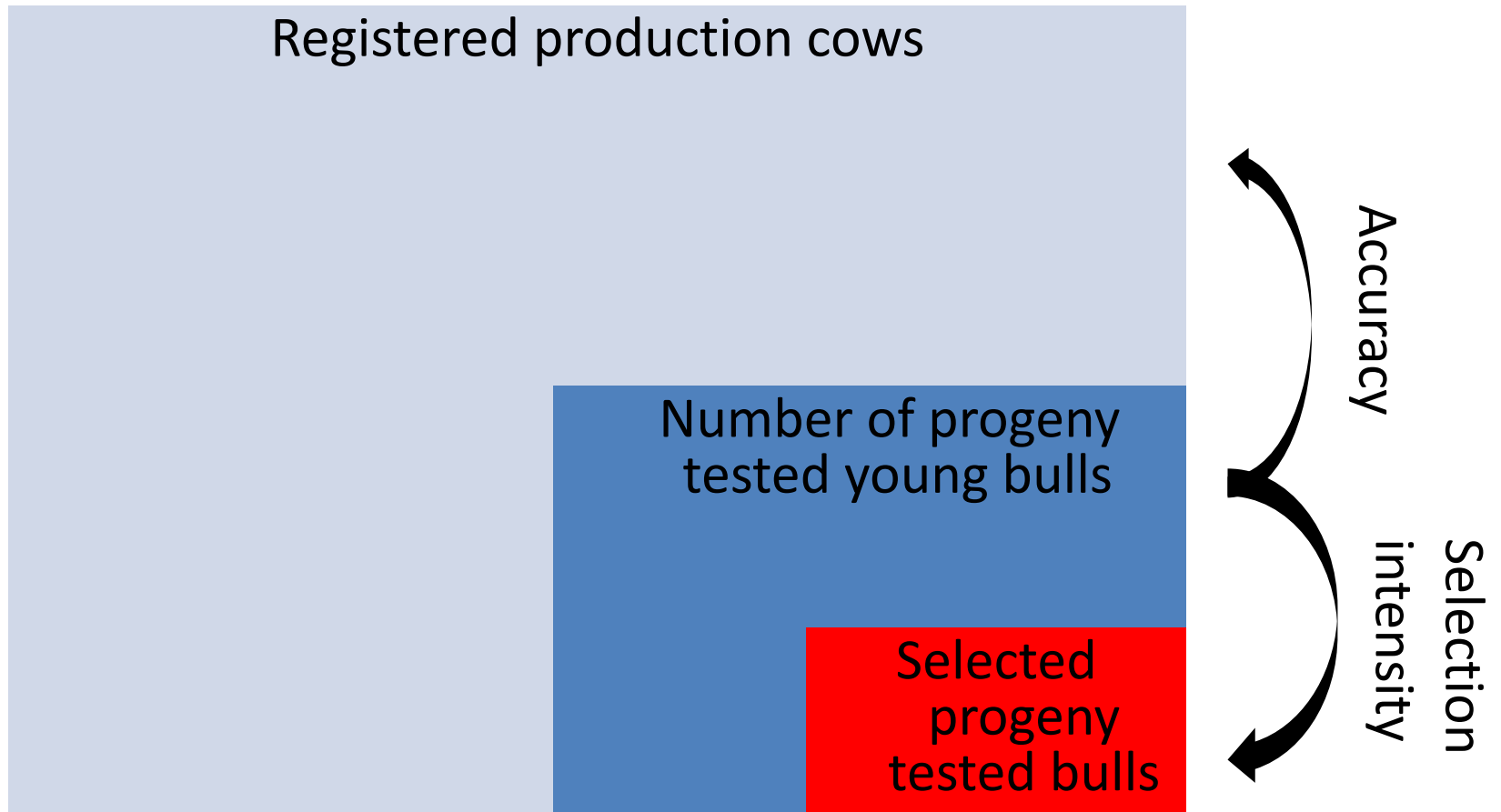
# The driving force behind genetic gain – using GS
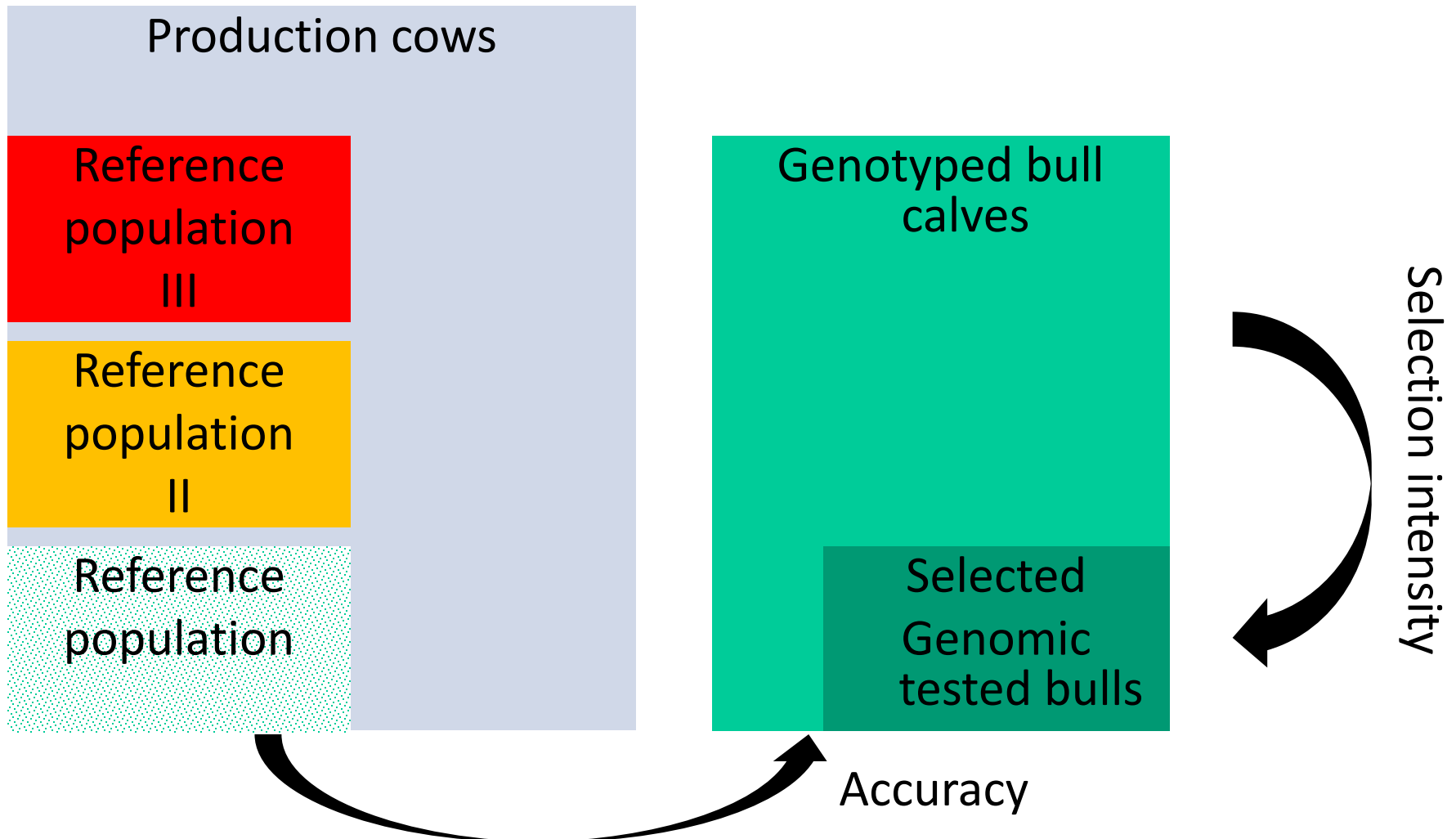
# (Improved) possibilities for organic breeding lines

- Genomic selection
  - Genetic progress in smaller population (lines of populations)
  - Genetic progress at a lower cost

# Before any division we need to:

- Estimate correlations between breeding goals
  - Derive economic weights
  - Estimate genetic parameters for all breeding goal traits
  - Estimate G*E interactions between production systems

- Estimate the consequences of lines on genetic gain and inbreeding
  - To be investigated in SOBcows and OrganicDairyHealth