Breeding in organic dairy production

Wytze J. Nauta

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What is the best cow?

- Breeding:

→ Select the best cows and bulls and use them for production of next generation.

→ what is the best for organic?

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Do we need a distinct organic breeding?

- Questions about:
  - Use and Adaptation of animals/type of animal
  - Reproduction technologies

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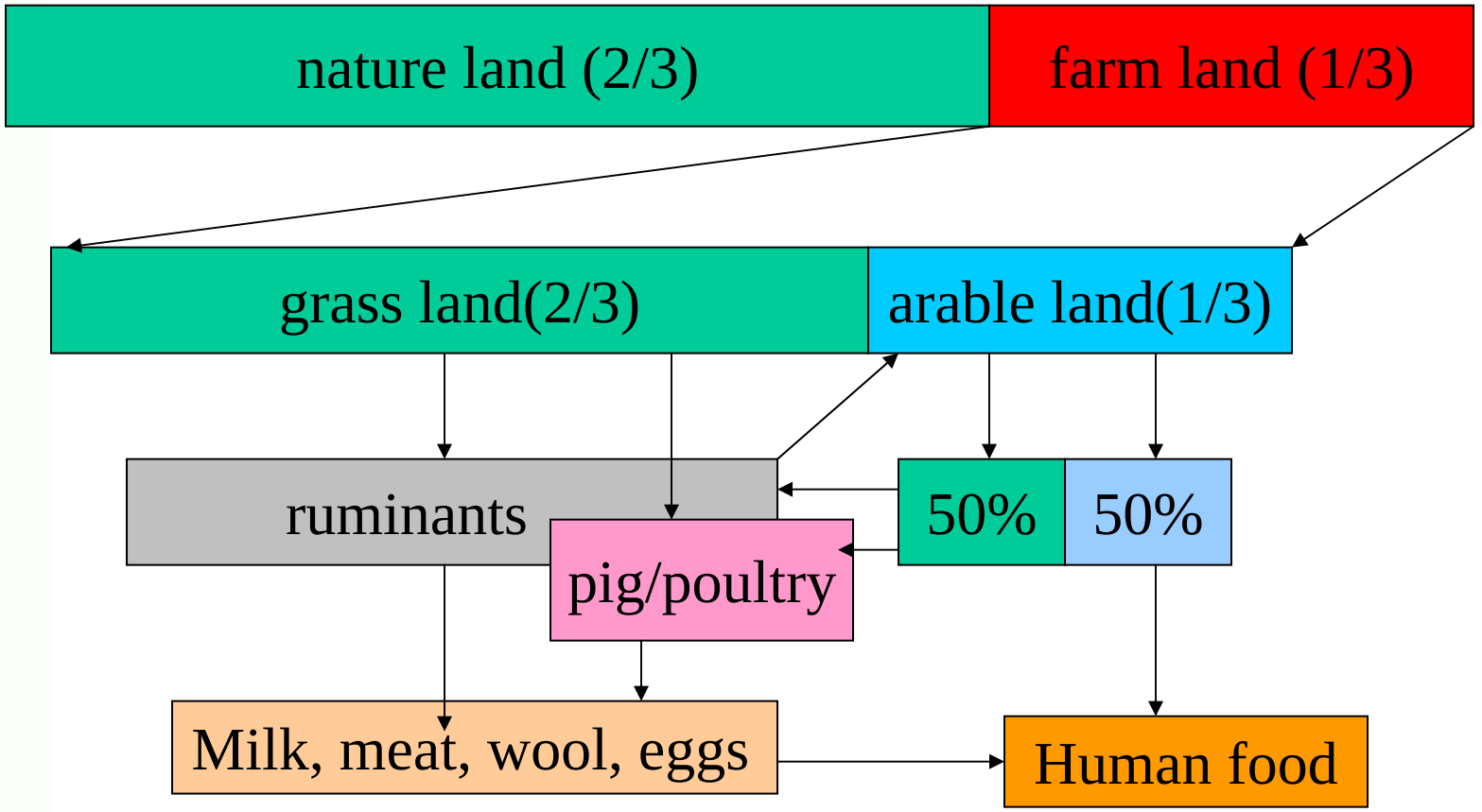
World situation, Haiger, (1988):



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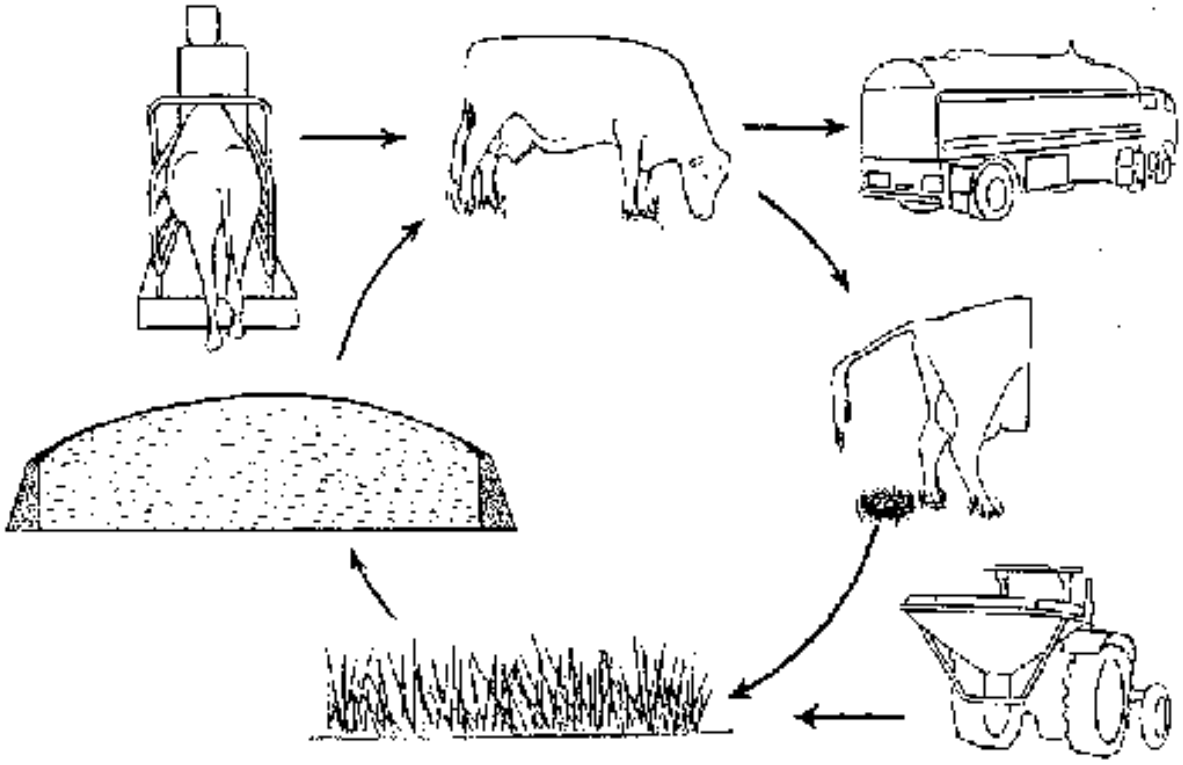
So, we need the ruminants to turn grass into human food



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de waarde van kennis

Conventional production:

- High input (from all over the world)
- Maximum profit
- High yields per cow
- Optimizing housing and animals

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Therefore:

- High concentrates level
- High milk quota / ha
- Holstein cows
- Free stalls with cubicles

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Holstein:

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And using:

- AI and ET
- Superovulation, IVF
- Quantitative genetics
- Genomics
- Sperm sexing

→ For a short generation interval

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Organic approach:

- Natural processes
- Animal integrity
- Balance in animal-plant production
- Animals that can adapt (robust)
- No ET and other reprod. Technol.
- No manipulation of animals

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This means:

- Production from local resources
- No (or less) antibiotics
- Local/dual purpose breeds
- Horned cows, pigs with a tail
- Natural service ?

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The PhD research:

1. Vision of farmers
2. Analysis of means
3. Analyses of G x E
4. Breeding goal and farming style
5. Analyses of the situation and possibilities

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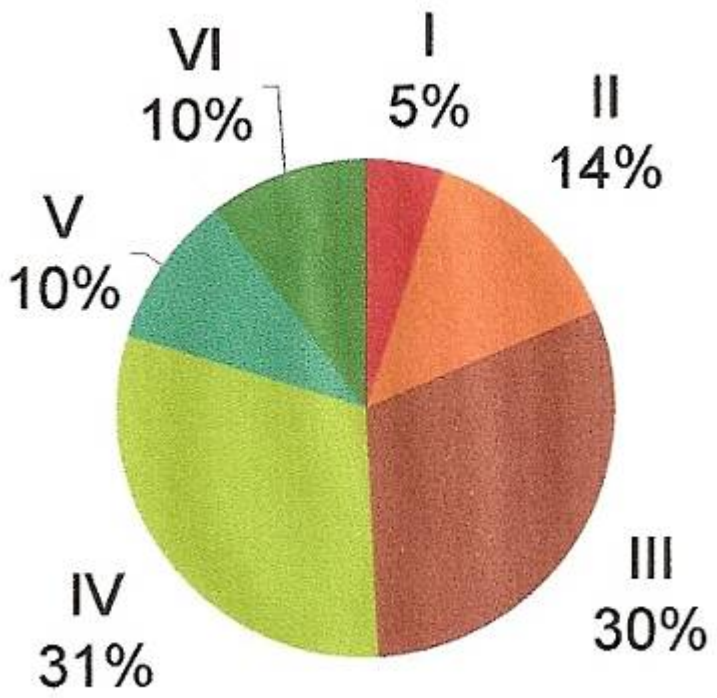
Vision of the farmers:



I = conventional

II = conv., no ET,

III = conv, adapted

IV= organic programme

V = regional breeding

VI = farm based breeding

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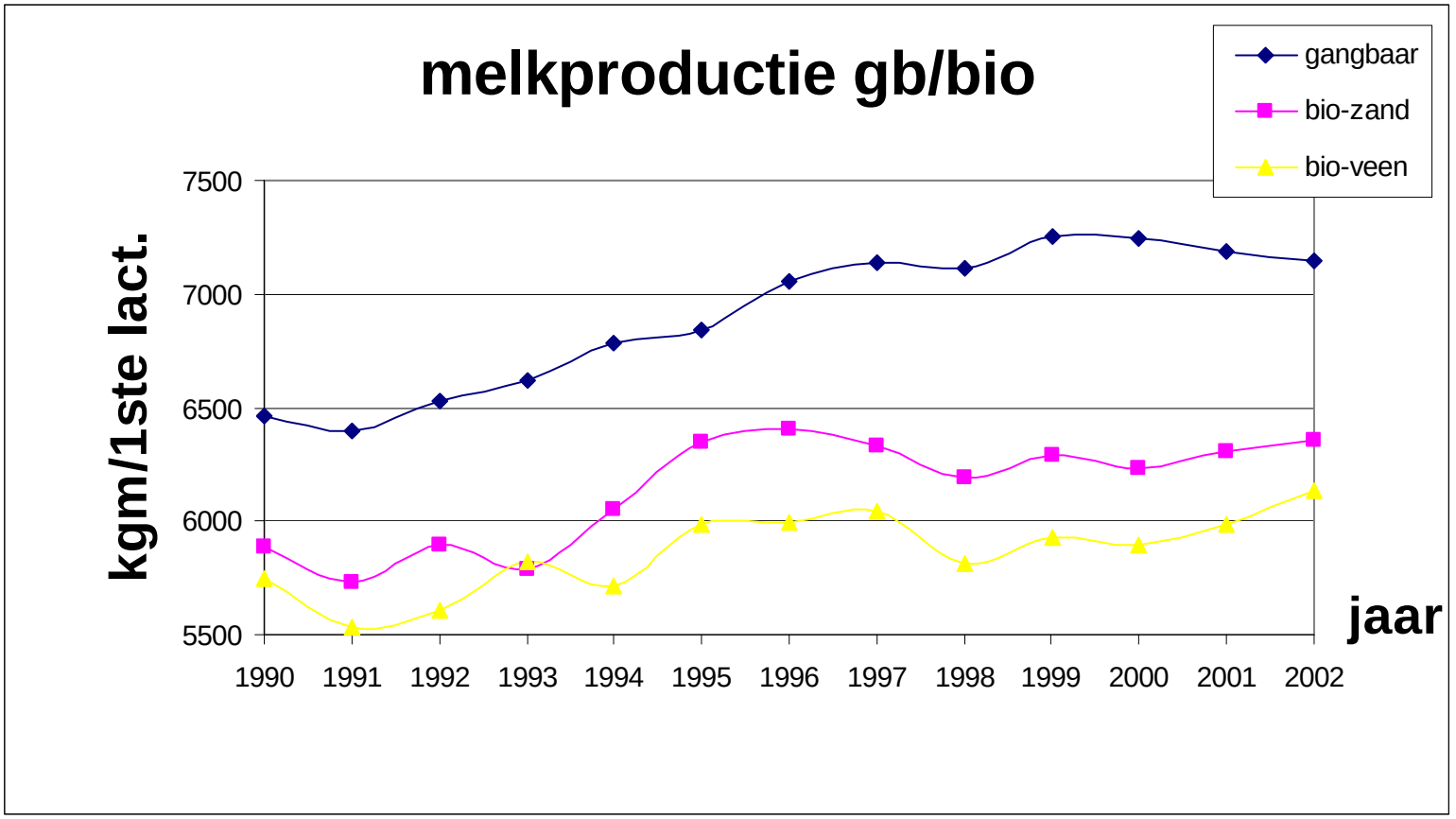
Phenotypic trends:



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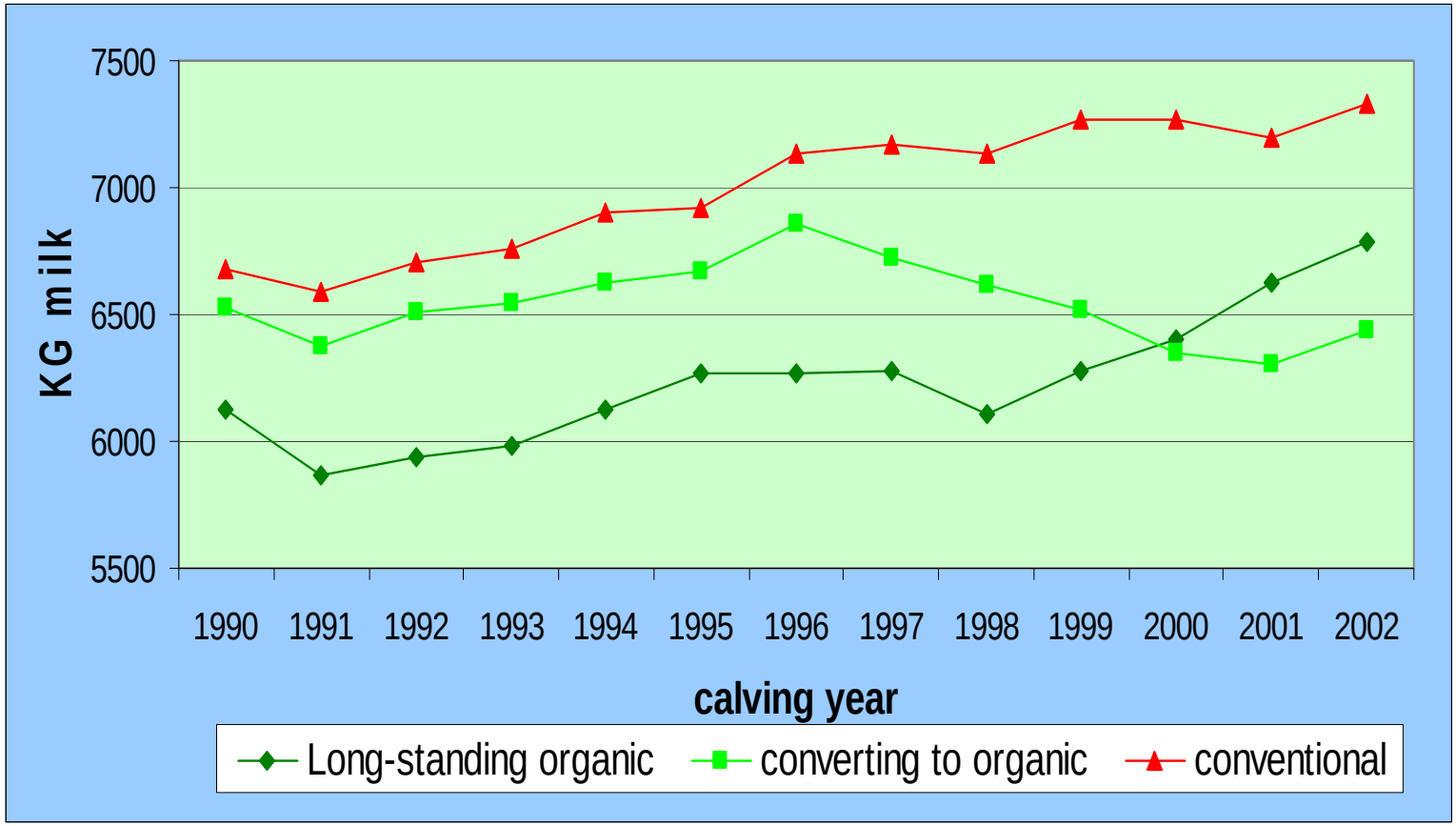
Phenotypic trends:



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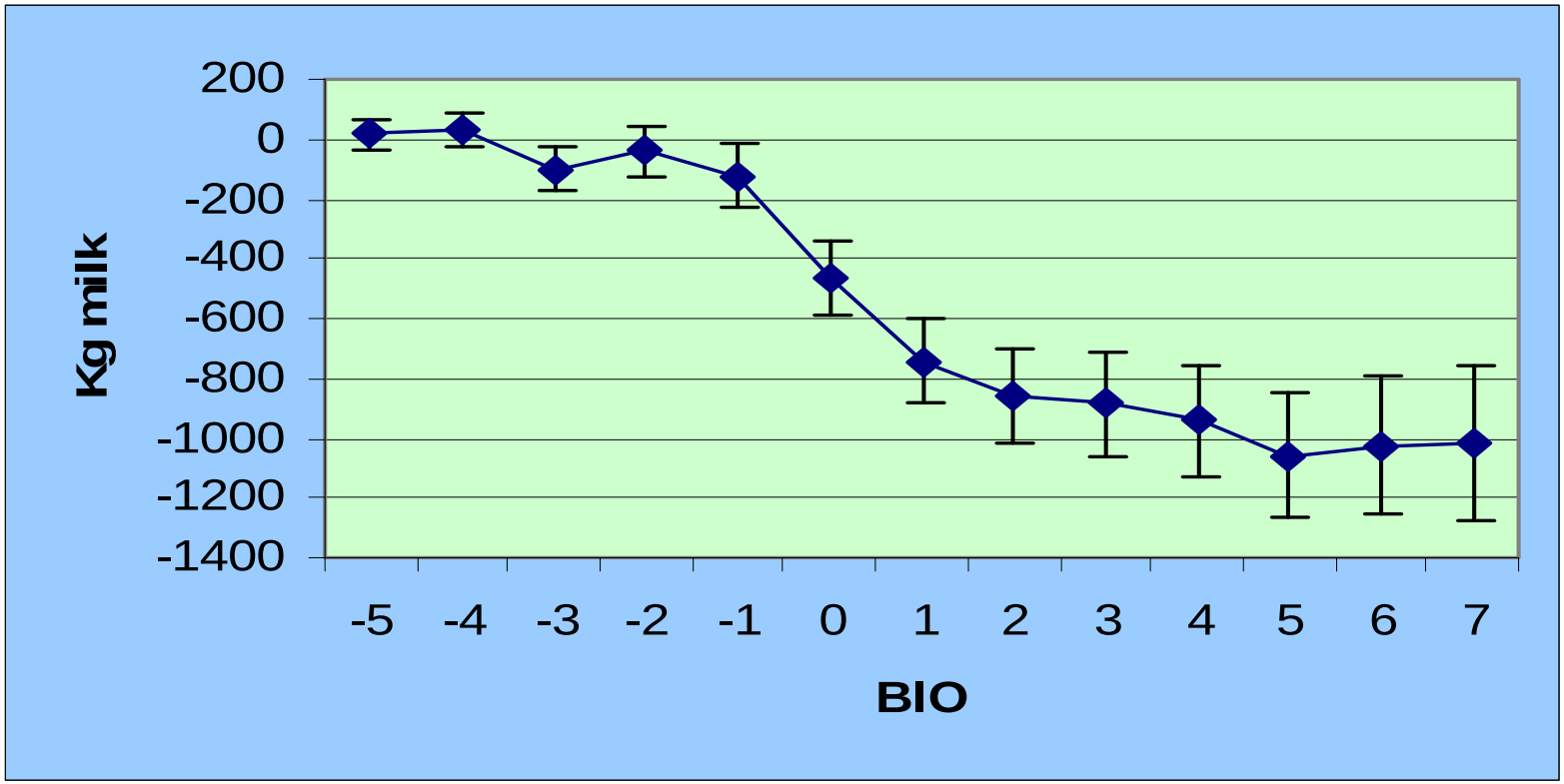
Genetic effect of conversion:



$$Yijkl = mu + H_i + YS_j + ß_0 * AFC_{ijkl} + ß_1 * (AFC_{ijkl})^2 +$$

$$ß_3 * DO_{ijkl} + ß_4 * (DO_{ijkl})^2 + BIO_k + Animal_l + e_{ijkl}$$

Effect on cows:

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Effect on cows:

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Effect on cows:

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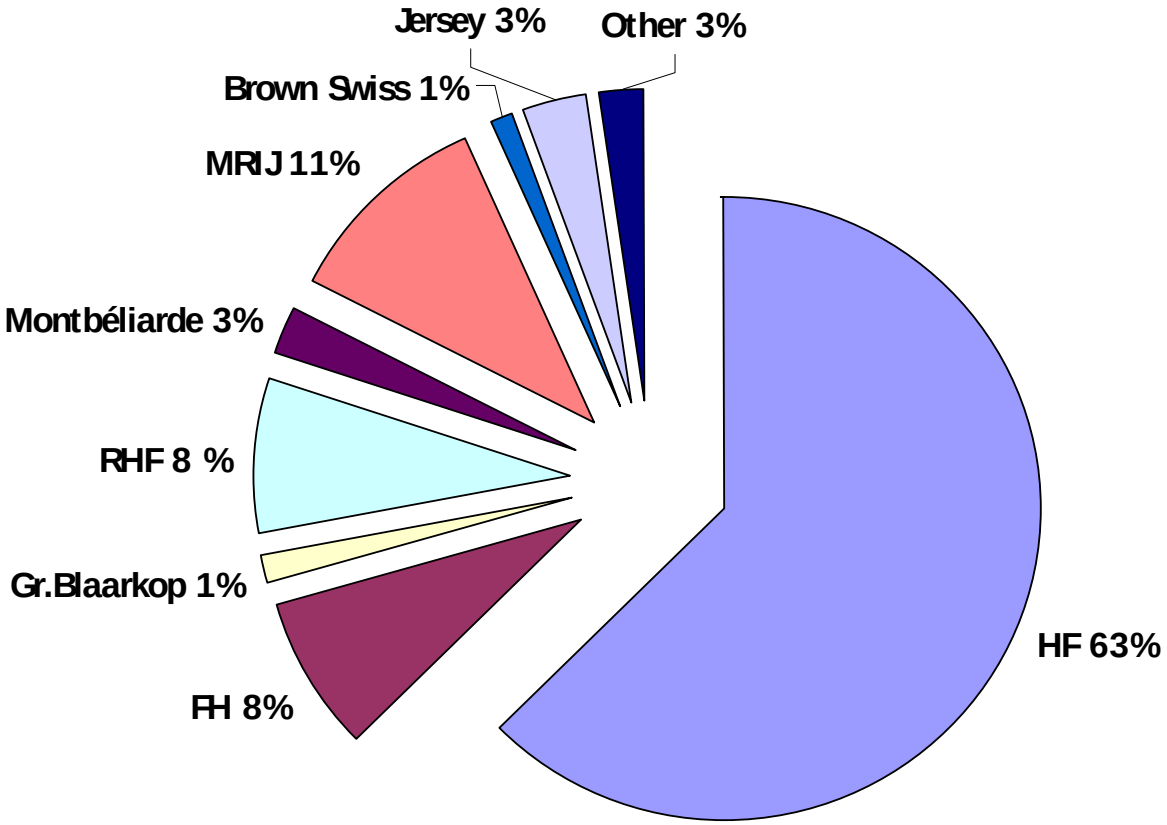
Breeds in the Netherlands 1999



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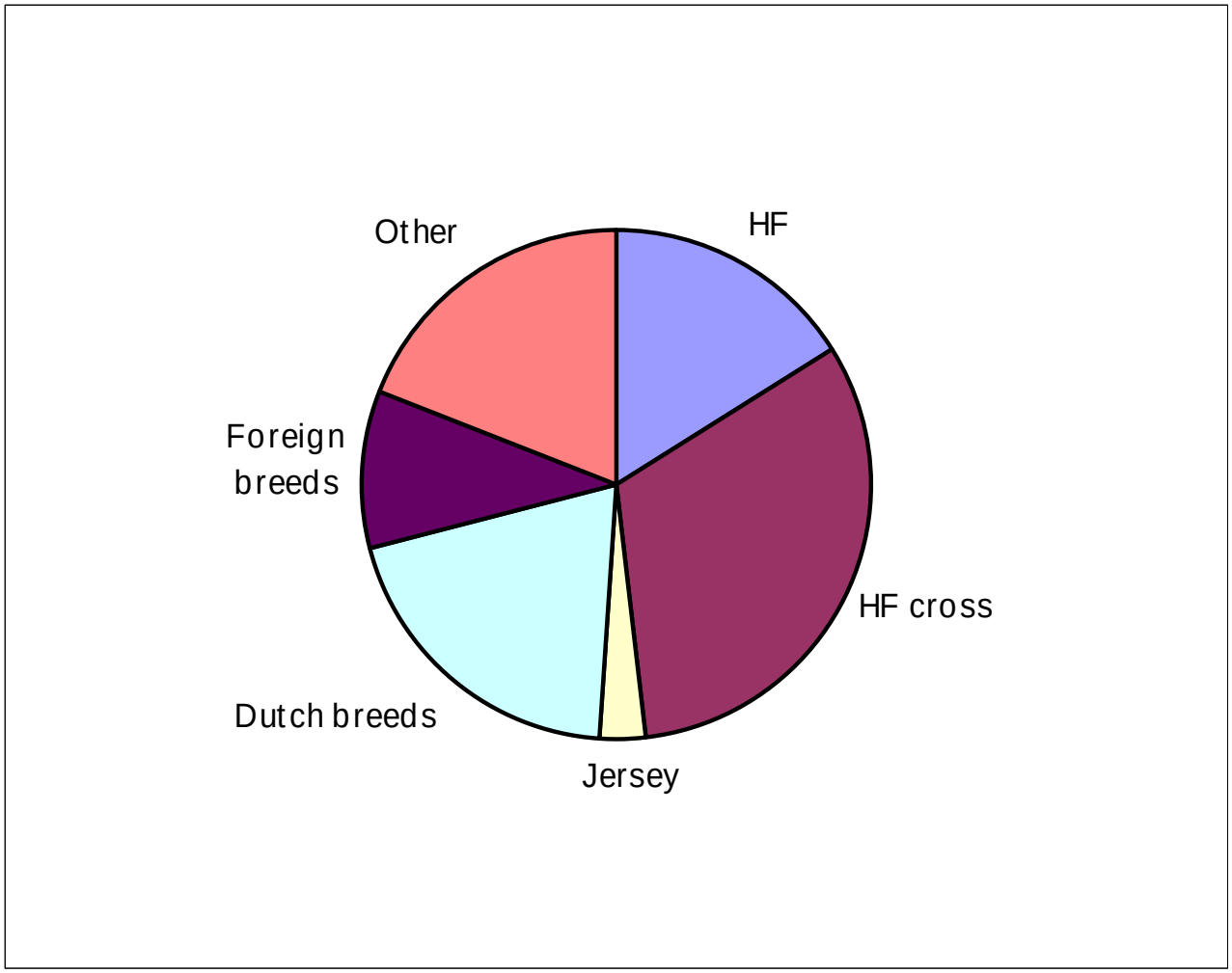
Breeds aimed for in 2005



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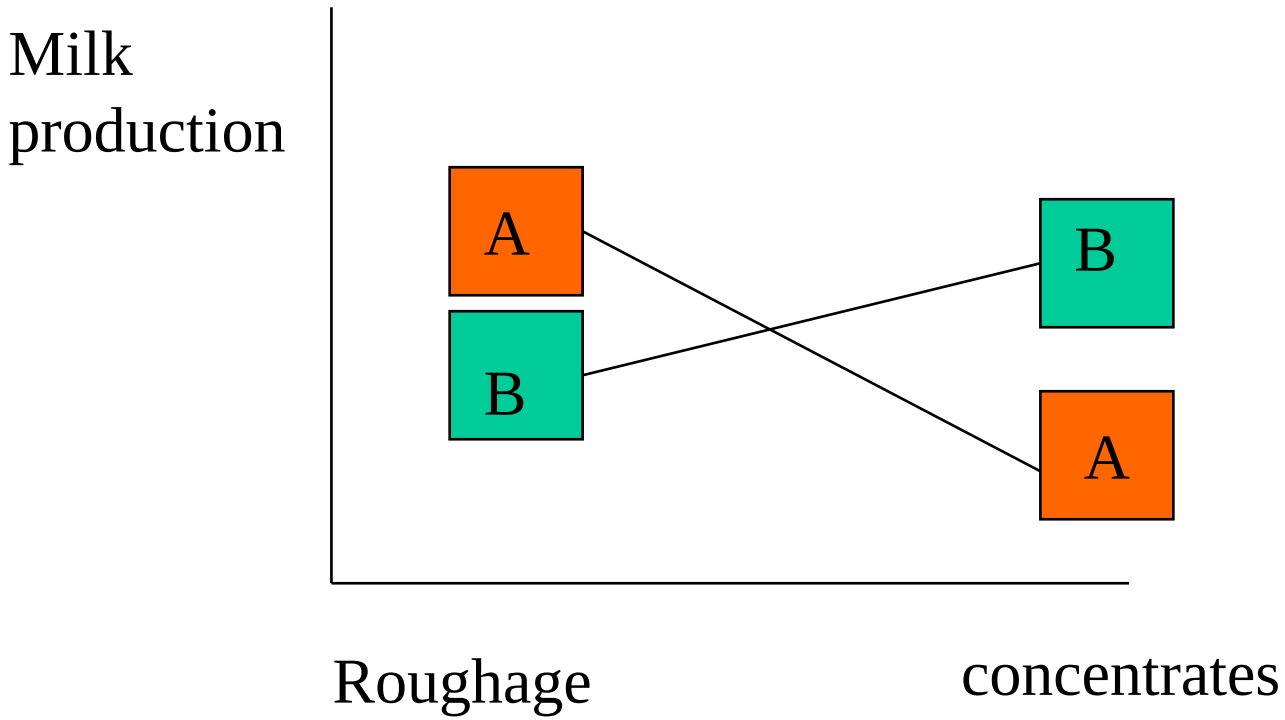
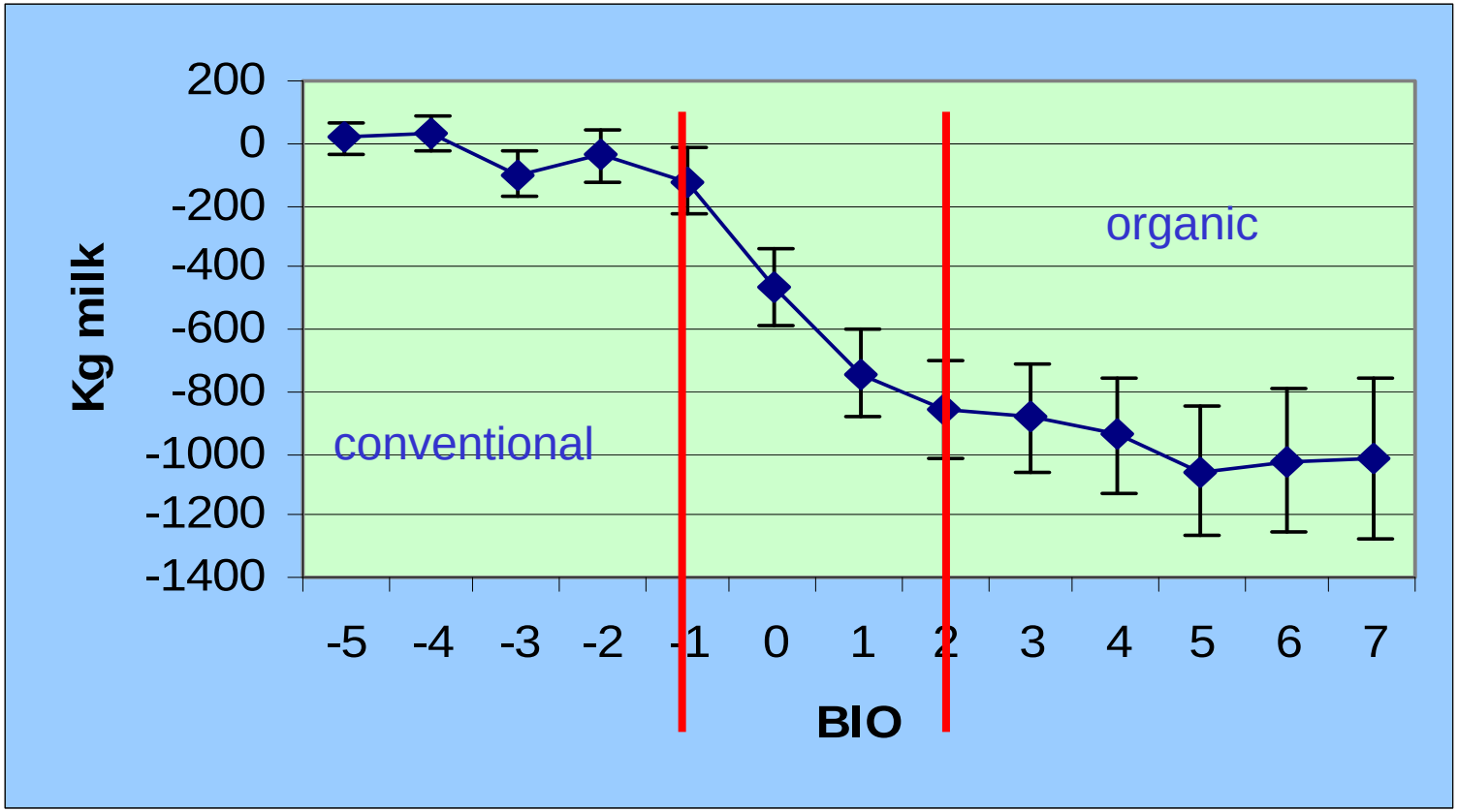
Genotype-environment interaction
G x E



Genotype-environment interaction

G x E



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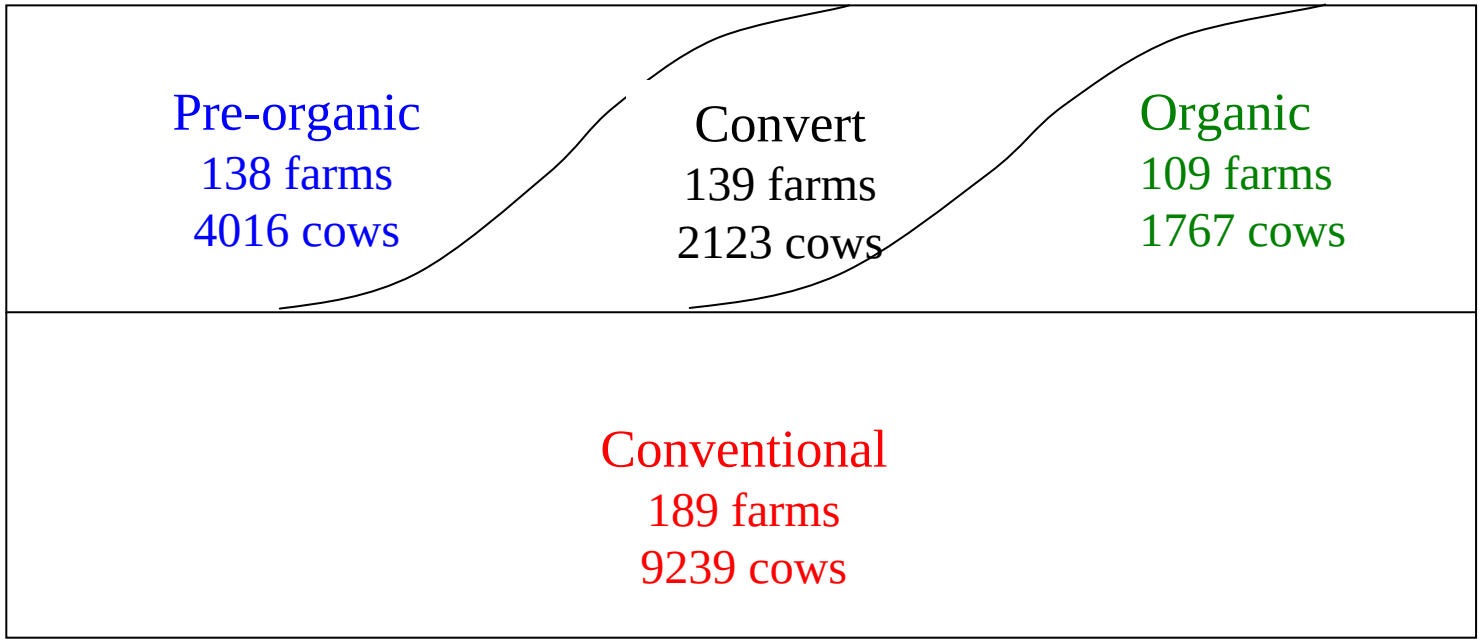

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Mean values for Holsteins per environmental group

	conventional	pre-organic	converting	organic
Kg Milk (sd)	7156 (1203)	6991 (1219)	6622 (1145)	6440 (1158)
% fat (sd)	4.36 (0.46)	4.32 (0.45)	4.31 (0.45)	4.29 (0.46)
% protein (sd)	3.45 (0.19)	3.44 (0.20)	3.37 (0.20)	3.34 (0.19)

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Heritabilities (h^2) per environmental group

	Conventional	Pre-organic	Converting	Organic
Kg milk	0.48	0.39	0.59	0.70
Fat %	0.79	0.83	0.87	0.84
Prot. %	0.72	0.76	0.77	0.68

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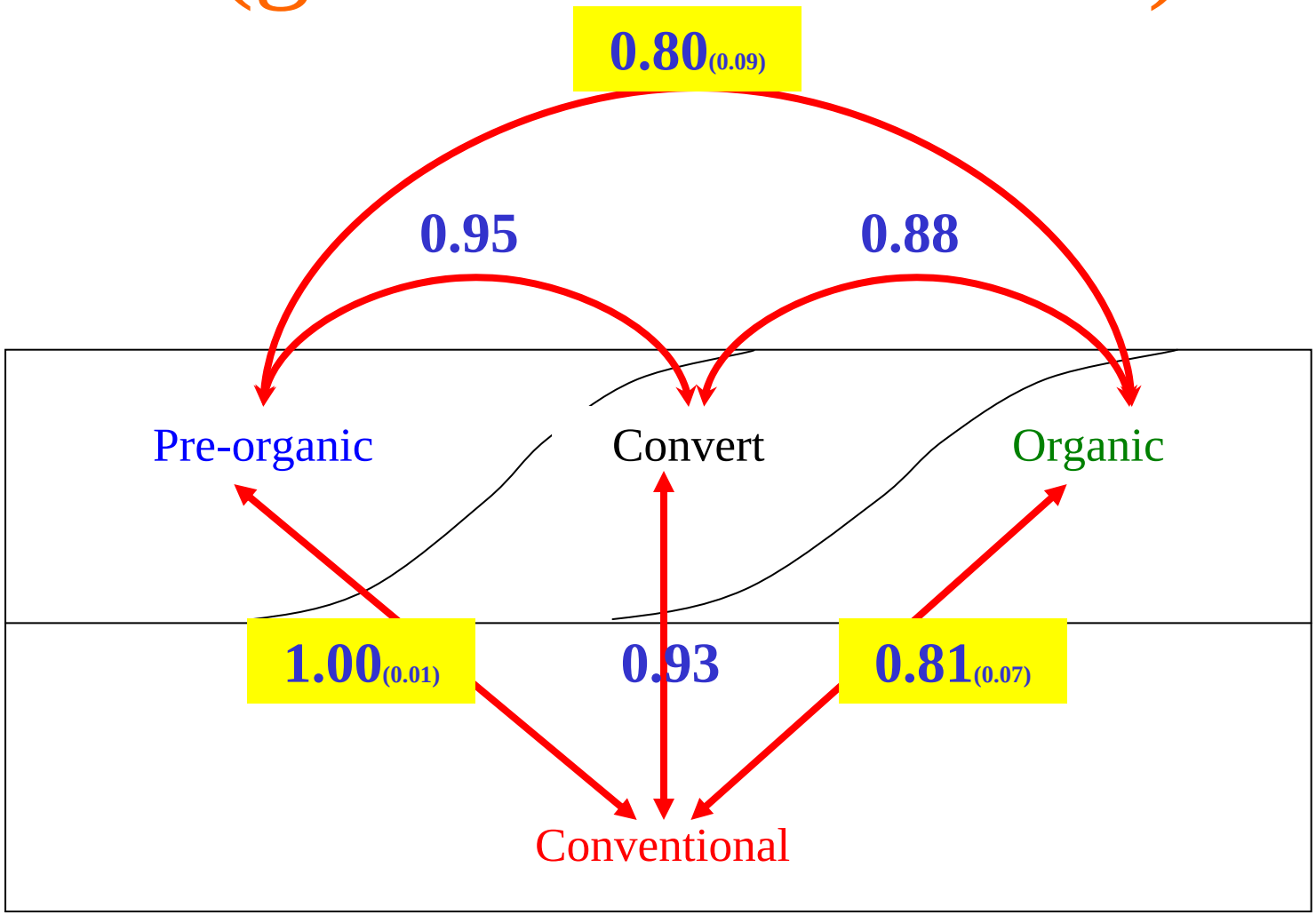
GxE for milk yield (genetic correlations)



Conclusions:

- Important effect of GxE for milk yield, and fat and protein yield.
- What is effect on reproduction and SCC?
- Effect will increase with lower input concentrates

Effect on yield is lower for other (cross)breeds?

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Different farming strategies → different breeding goal?

we compared:

Specialized Milk vs. Multifunctional farming

High input vs. Low Input farming

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Multifunctional vs. Specialized farming

farm descriptives:

59
51 ha
282 tons milk quota
47 milking cows
5892 kg milk/cow
980 kg concentrates/cow
61% cubicals
38% Holstein cows

82
52 ha
367 tons milk quota
56 milking cows
6512 kg milk/cow
1155 kg concentrates/cow
78% cubicals
70% Holstein cows

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Low Input vs. High Input farming

farm descriptives:

48
53 ha
288 tons milk quota
48 milking cows
5811 kg milk/cow
674 kg concentrates/cow
65% cubicals
44% Holstein cows

63
56 ha
365 tons milk quota
55 milking cows
6577 kg milk/cow
1381 kg concentrates/cow
70% cubicals
68% Holstein cows

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Specialized vs. Multifunctional farming and High input vs. Low input farming:

- Overall similar breeding goal!
  - 42 % Multifunctional traits
  - 31% Production traits
  - 27% Conformation traits

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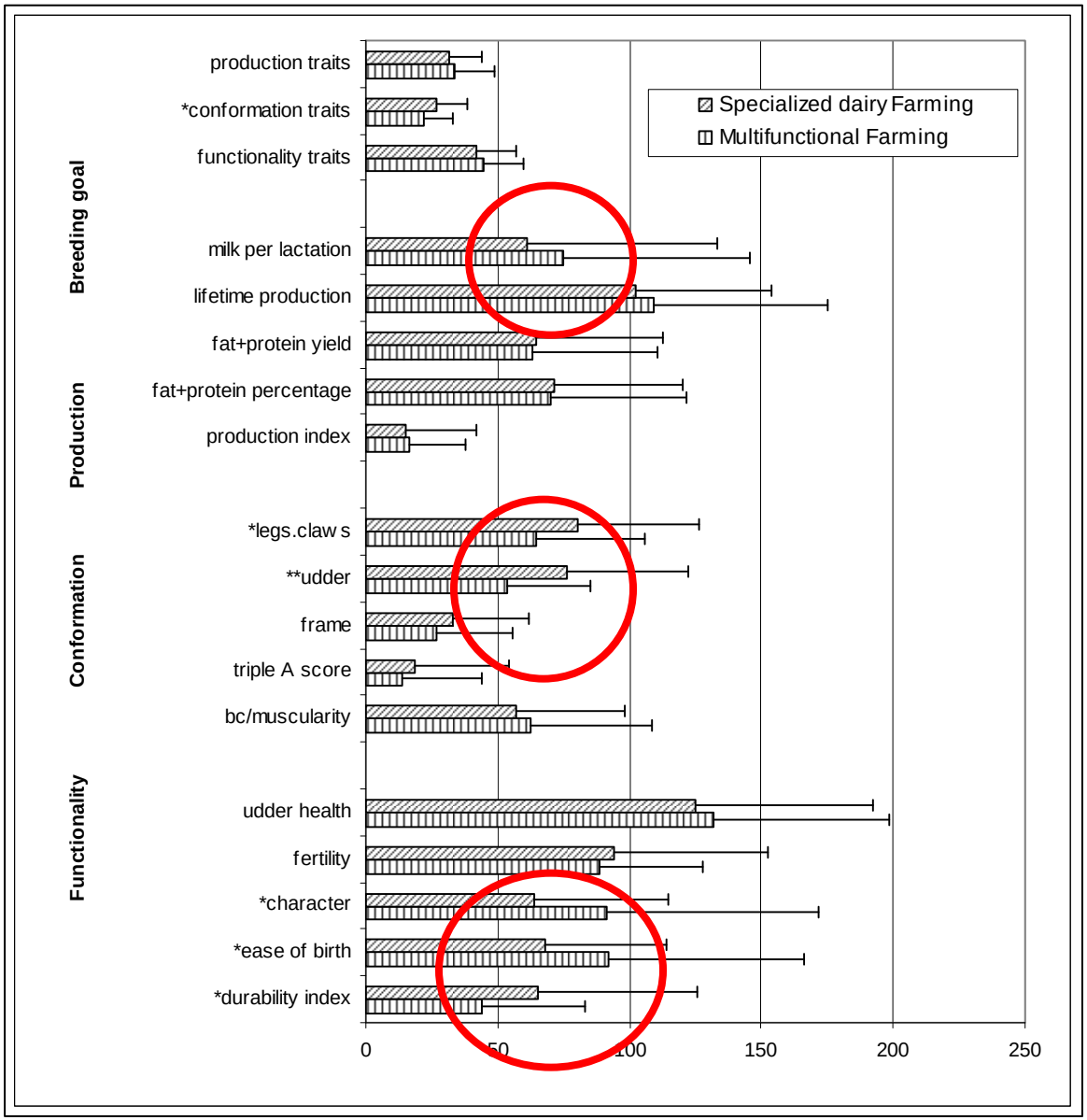
Specialized vs. Multifunctional farming



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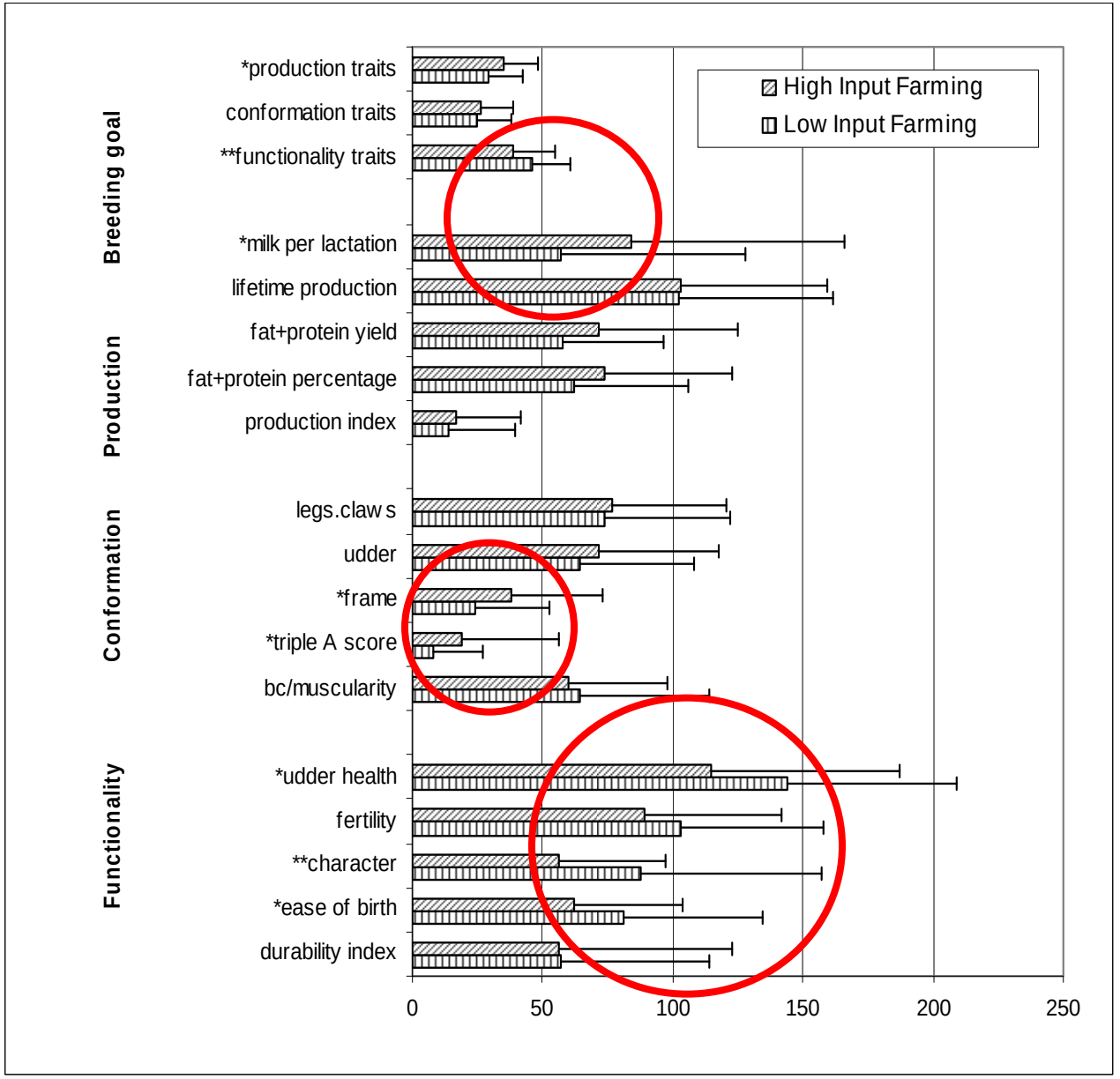
High Input vs. Low Input farming



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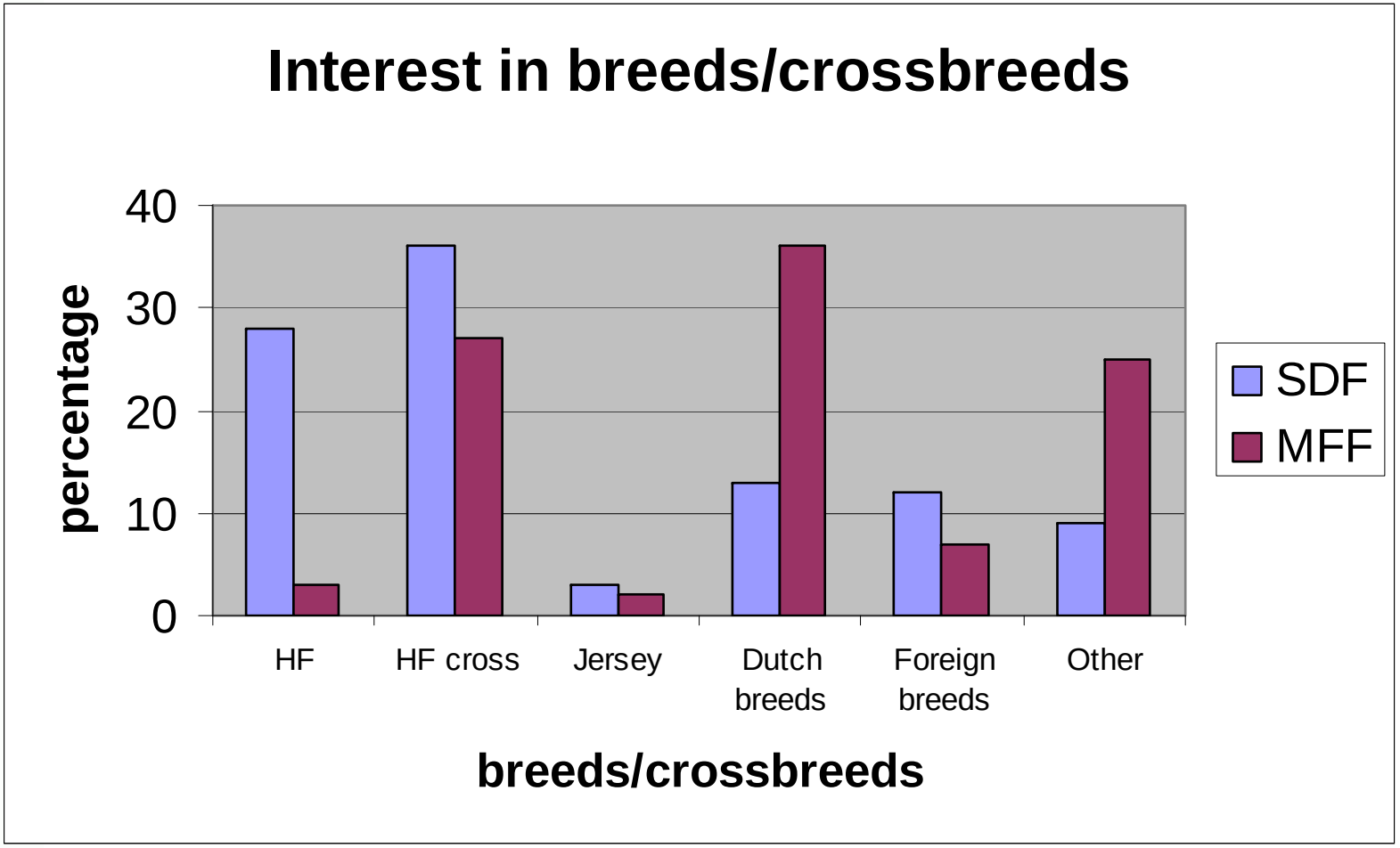
Specialized dairy vs. Multifunctional farming



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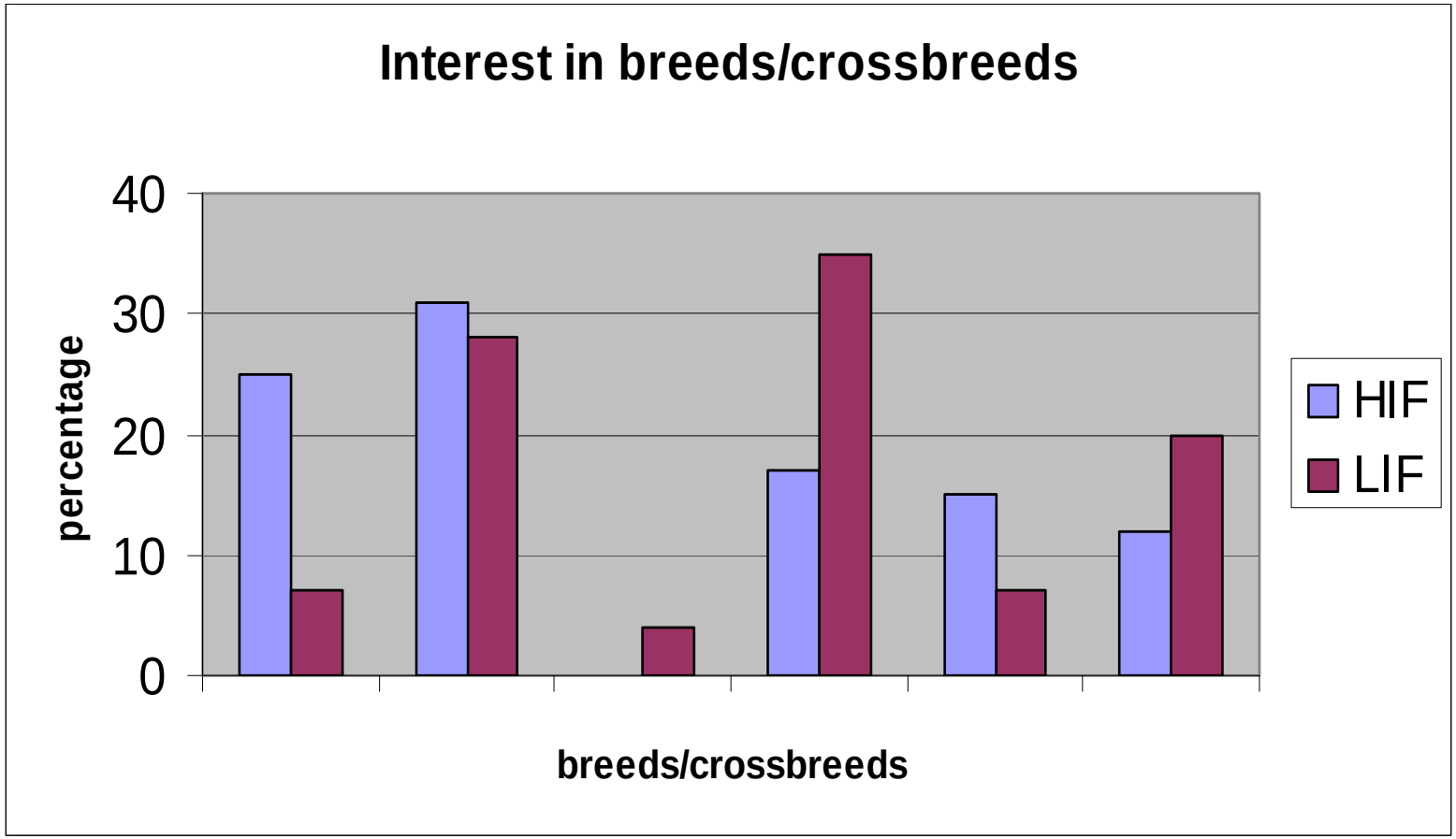
High Input vs. Low Input farming



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Conclusions:

- Different farming strategies in OF
- Overall similar breeding goal independent from strategy
- Farmers try to reach breeding goal by selection of (cross)breeds
- It is “Learning by doing”, while no information is available yet.

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and:

- Holsteins are not done anymore?
- You have to be different as an organic farmer?
- Old native breeds fit to the principles of organic farming?

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and more interest in natural breeding (up to 24 %!)

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Analysing the situation:

- Three possibilities (routes):
  - Adapted conventional breeding
  - Organic breeding programme
  - Natural breeding/on farm breeding

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Analysing the situation:

- Discussion about:
  - Naturality
  - Selecting suitable cow type
  - Demand and supply
  - Sector's public image
  - Ownership / community building
  - Costs and benefits

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Naturality:

- Also AI or back to natural service
- Breeding programmes without ET
- New technologies: Sexing sperm
- Future: Cloning and Cisgenesis in the conventional programmes?
- Introduction of genomics

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Selecting suitable cows:

- Size of the breeding program
- Type of breeding system (‘cold’?)
- Use of AI, genomics, sexed semen
- Breeds/ cross breeds, new breed?

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Numbers of cows:

Country	No. of organic milking cows
The Netherlands	16,182
Belgium	8,297
Germany	85,000
United	214,276
KingdomIreland	850
France	62,140
Italy	58,443
Scandinavia	49,882
Total	495,070

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GxE and reliability:

G x E			No. of daughters required per trait**		
Genetic correlation r	r^2	Reliability r^2_{AI} at conventional reliability 90% (80%) *	Milk $h^2 = 0.35$	SCS $h^2 = 0.10$	CI $h^2 = 0.07$
0.70	0.49	44% (39%)	9 (7)	31(25)	44 (36)
0.80	0.64	58% (51%)	15 (11)	54 (41)	78 (59)
0.90	0.81	73% (65%)	28 (20)	105 (72)	152 (105)
1	1	90% (80%)	94 (42)	351(156)	505 (225)

$$r^2_{AI} = (0.25*n*h^2)/(1+0.25(n-1)h^2$$

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:Demand and supply

- Availability of ET-free bulls
- Difference in breeding goal
- Genetic trend!
- Supply of conventional breeders
- Size of populations/variation

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Sector's public image:

- What do consumers know / think
  - Closed production chain
  - Animal welfare
  - Use of technology
  - Biodiversity
- Consumers getting more involved!

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Ownership-community building:

- Who is going to make the first step
- Organic or conventional
- Knowledge
- New rural-breeding networks for the organic movement?

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Costs and benefits:

- Type of breeding structure
- Size of population
- Genetic progress – important traits

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Conclusion:

- A complex situation
- Process of joined learning and innovation
- New knowledge and spreading it
- Embedding innovations
  - Pilot studies.

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Concluding remarks:

- Better rules needed
- Focus on diversity
- Organic breeding for all farm species

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Now working on:

- Breeding programmes
- Farm based breeding
- European association Eco-AB
- First IFOAM world congress about plant and animal breeding
- Organic breeding of cattle, sheep, goats and laying hens

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thank you for attention.

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