IMPROVING PROTEIN EFFICIENCY OF LIVESTOCK

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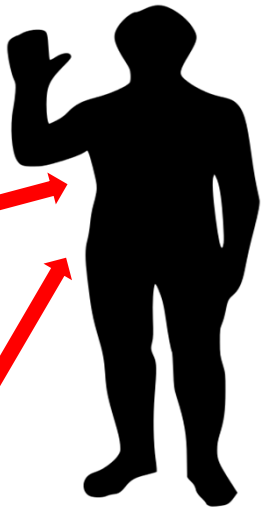
ACKNOWLEDGEMENT

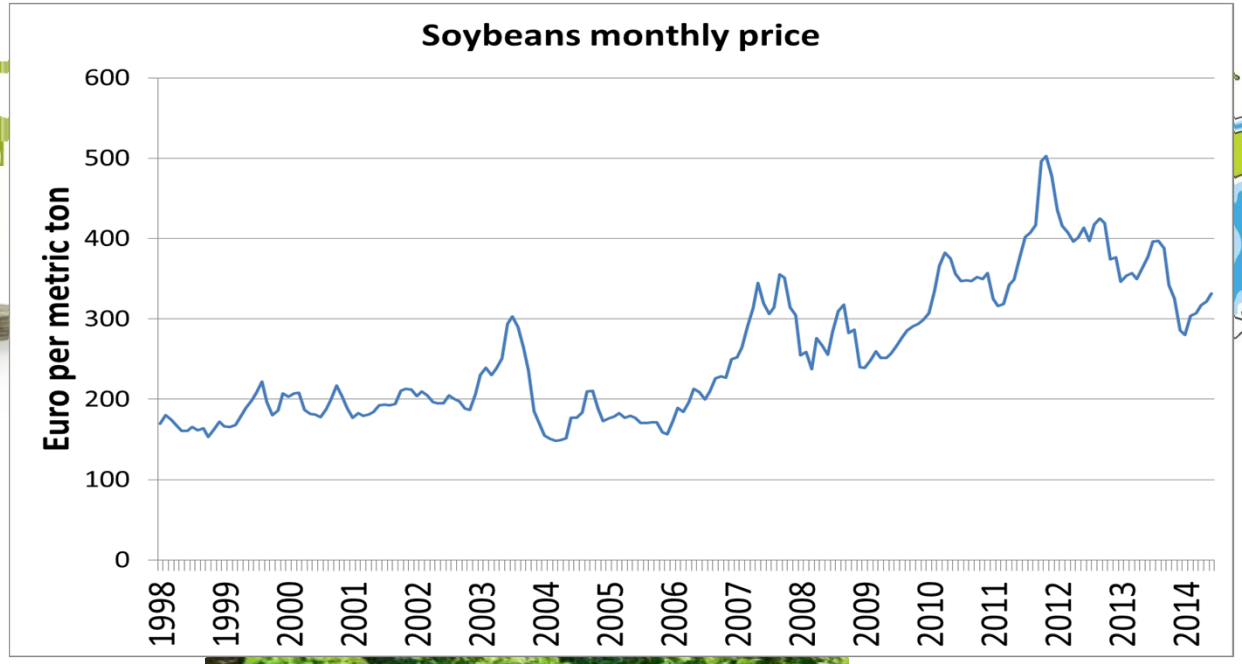
- Breed4Food theme 4: Resource Efficiency

- Project team



PROTEINS





Alternative protein sources?

Livestock more efficient?

AIM

- To identify new traits related to protein efficiency of livestock
- Using
  - Desk study to investigate possibilities to breed for improved protein efficiency

DEFINITION PROTEIN EFFICIENCY

- $Corr.protein\ efficiency = \frac{animal\ protein\ output\ (kg)}{human\ edible\ protein\ input\ (kg)} \times 100\%$
- Corrected for human-edible proteins

Feed	Human-edible proportion (%)
Grazed pasture, silage and hay	0
Cereal and pulse grains	80
Cereal by-products	20
Soybean meal	80
Other oilseed meals	20
Other by-products	20
Mineral vitamin premix	0

PROTEIN EFFICIENCY OF LIVESTOCK

Species	PE (%)[1]	CPE (%)[2]
Pigs	23	38
Broilers	33	48
Laying hens	31	43
Dairy cattle	18	143

[1] PE = Protein efficiency (Wilkinson, 2011), [2] CPE = Corrected protein efficiency (Wilkinson, 2011)
Based on UK ration

AMBITION

- Corrected protein efficiency > 100%
  - To improve protein efficiency
  - To produce animal protein with no or hardly any human edible proteins

IMPROVE PROTEIN EFFICIENCY

PROTEIN SOURCES

Most important

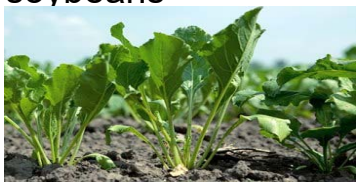
- Alternative protein sources:
  - Perform well in the neighbourhood
  - Cultivation is currently not common
  - Economically feasible
  - Future: still human-inedible

POTENTIAL ALTERNATIVES

Oil seeds: rapeseed, sunflower seed, defatted soybeans

Grain legumes: peas, *vicia faba*, lupines

Forage legumes: Lucerne



Leaf proteins: grass, sugar beet leaves

Aquatic proteins: algae, duckweed

Insects: mealworm, housefly

Van Krimpen et al., 2013

POTENTIAL ALTERNATIVES



Requirement of an animal

- **Digestible amino acids**

Cost price of alternative diet

Leaf proteins: grass, sugar beet leaves

Aquatic proteins: algae, duckweed

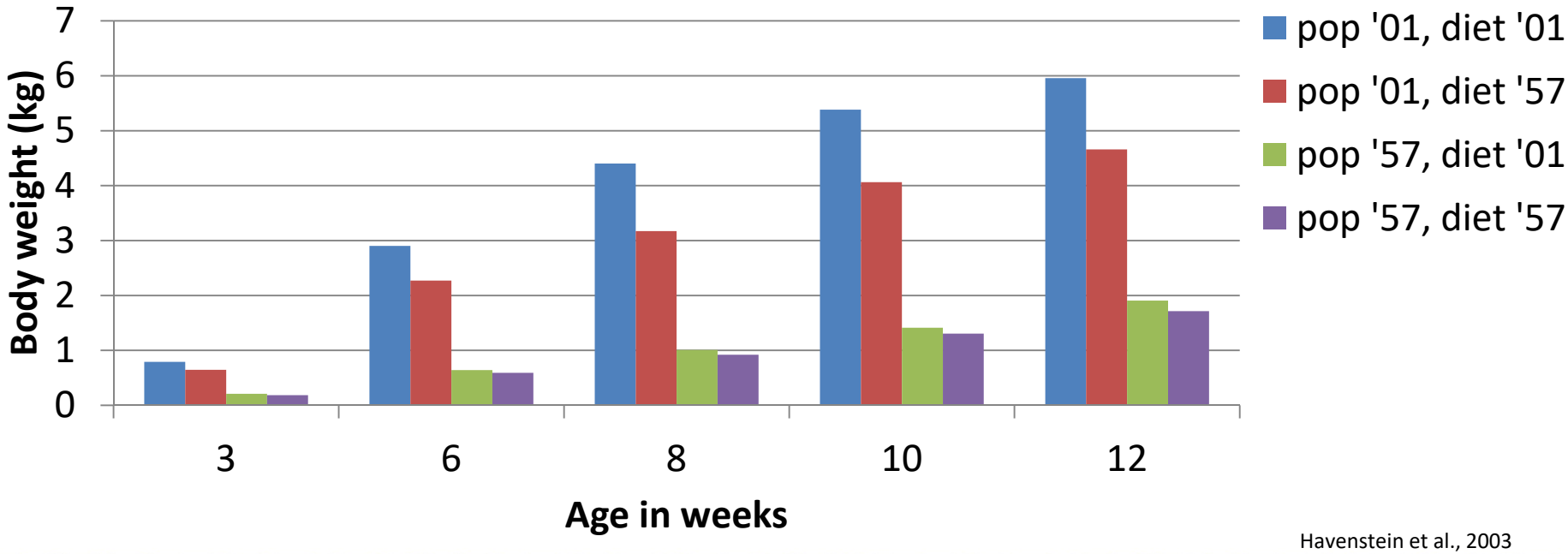
Insects: mealworm, housefly

BREEDING

- So far, focus has been on feed efficiency using feed conversion ratio (FCR)
  - Especially improvement of performance (growth, egg number)
  - Pigs: 20% improvement in feed conversion ratio (‘30-’90)
  - Laying hens: 30% improvement in feed conversion efficiency (‘50-’93)

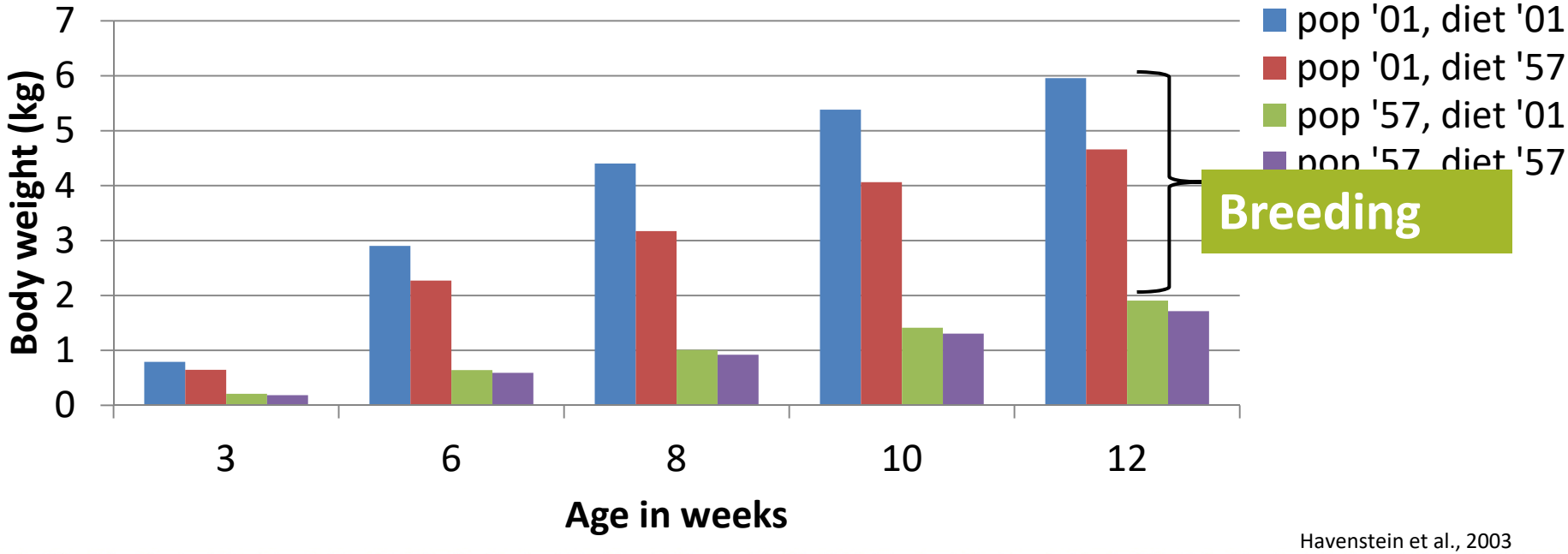
Hill, 2008

GROWTH BROILERS 1957 VS 2001



Havenstein et al., 2003

GROWTH BROILERS 1957 VS 2001



Havenstein et al., 2003

BREEDING FOR PROTEIN EFFICIENCY

- Trait definition
  - Often protein input/output unknown
  - Direct – advanced measurements needed
  - Indirect
    - Feed conversion ratio
    - Manure

INTERACTION NUTRITIONISTS & BREEDERS

Genotype x Nutrition interaction

Digestibility

Partitioning

Precision feeding

Health status

Nutrigenomics

RECOMMENDATIONS

- Use a diet that fits the requirement of the animal
- Breed an animal that can produce on the future diet

Interaction between nutritionists and breeders is important!

TAKE HOME MESSAGE

- Breed an animal that can produce on the future diet!

- Share data
  - Collect individual data
  - Genotype is known

- Future collaboration