

# Assessment of European breeding programmes from different sustainability aspects

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Financial support from the  
6<sup>th</sup> EU Framework Programme

**[www.q-porkchains.org](http://www.q-porkchains.org)**

**"Sustainable development** is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

*Brundtland et al, 1987*

**Economic, environmental (or ecological)  
and societal sustainability**

# Definition of sustainable production

"Sustainable production is creating goods by using processes and systems that are non-polluting, that conserve energy and natural resources in economically viable, safe and healthy ways for employees, communities, and consumers and which are socially and creatively rewarding for all stakeholders for the short- and long-term future"

*Glavič & Lukman, 2007*

**Q-PorkChains**, an EU-project in the 6<sup>th</sup> framework

The aim is to develop European high quality pork products in sustainable production systems

[www.q-porkchains.org](http://www.q-porkchains.org)



## Aspects of sustainable production

- Biodiversity & Genetics
- Societal conformity
- Economic sustainability
- Animal health
- Meat quality
- Animal welfare
- Environmental impact
- Meat safety
- Human work conditions



# Sustainability aspects related to pig breeding

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Aspect	Influence on breeding
Genetics - Biodiversity	Minimised inbreeding within breed and maximised total genetic variation
Societal conformity	Stake holders' acceptance of breeding goal, methods and products
Economic sustainability	Production, reproduction and health traits
Animal health	Disease resistance, piglet vitality, longevity, leg problems etc
Meat quality	Drip loss, colour, IMF, taste etc, and boar taint
Animal welfare	Traits related to 5 freedoms, e.g. aggression, fear, pain, hunger
Environmental impact	Via production (e.g. feed efficiency), health traits and reproduction (e.g. drug emission)
Meat safety	Via health traits (microbes)
Human work conditions	Via behaviour, health traits and economy (i.e. productivity)

# Checklist for sustainable breeding schemes

*Woolliams et al (2005)*

1. Is the market and product well defined?
2. Is the breeding goal well defined?
3. Is sensitivity to external factors addressed?
4. Are sufficient economic, technical (including R&D) and human resources available?
5. Can livestock resources and selection strategies secure a sufficiently large effective population size to keep change of inbreeding under 1 % per generation?

# Checklist for sustainable breeding schemes

*Woolliams et al (2005)*

6. Is recording sufficient?
7. Are expected effects of selection predicted?
8. Is genetic progress monitored and evaluated?
9. Are time horizon and milestones defined?
10. Is the profitability of the breeding scheme evaluated?
11. Is the local breed characterised?



# Assessment of breeding programme for dairy cattle - a master student project

- Study Woolliams' checklist and literature
- Prepare questions
- Visit breeding organisation, interviews, reading documents
- Describe breeding structure
- Assess the sustainability of the breeding programme
- Strength - Weaknesses - Opportunities - Threats
- Discuss with a researcher in animal ethics
- Present conclusions and recommendations to the breeding organisation

# Assessment of breeding programme for dairy cattle – results from the students' assessment

## Strengths

- Healthy and reproductive cows
- Comprehensive data base
- Farmers' opinions are considered
- Well educated staff

## Opportunities

- Increasing international demand
- Cooperation with Norway
- Herd book open to similar breeds

## Weaknesses

- No strategy for climate impact
- Small on global market
- Not considering GxE (export)
- Small staff group - vulnerable

## Threats

- Less milk than Holstein
- Public rejection of ET
- Herd book open to  $\leq 12.5\%$  Holstein

# Assessment of breeding programme for dairy cattle – students' recommendations

- Warmer climate leads to increasing demand for healthy and reproductive cows. Discuss Nordic market versus export. How to handle GxE?
- Consider including meat production in the genetic evaluation. Is combined milk-meat production more sustainable?

Gamborg and Sandøe (2005):

“ There is no single, correct definition of sustainability in animal production. The breeding sector needs to adapt the concept of sustainability to its and its stakeholders' specific needs. These needs differ between different production systems and therefore sustainable breeding can only be defined within a given production system in a given environment. “

# Inventory of 12 different pig production systems in Europe

4 conventional

2 local, small scale, niche product

3 high meat quality

1 animal friendly

2 environmental and animal friendly



# Breeding organisations

Seven 'conventional' breeding organisations

- cooperative or private
- more or less international
- rather small, big or very big

Two 'local breed-organisations'

## Material & methods

Questionnaire to 9 organisations,  
based on checklist by Woolliams et al (2005)

Data collection sheet to each visited farmer,  
10 herds per system

Qualitative rather than quantitative assessment,  
worked with words rather than figures

**Note:** No real facts on e.g. increase in inbreeding,  
only breeding organisation's description of how  
it is handled

## Biodiversity & Genetics aspect

4 dimensions in the sustainability assessment

1. Breeding goal and external factors
2. Recording and selection
3. Genetic variation
4. Management of breeding programme

Each dimension equally important for sustainability



## Scale used within dimension

bad effect on sustainability	0
no or little effect	1
good effect	2
very good	3

Same scale (0-3) in all dimensions

## Example: Recording and selection

- Recording agreement breeding goal 2
- Instructions for recording 3
- Estimation gain, side effects 2
- Evaluation of profitability 1

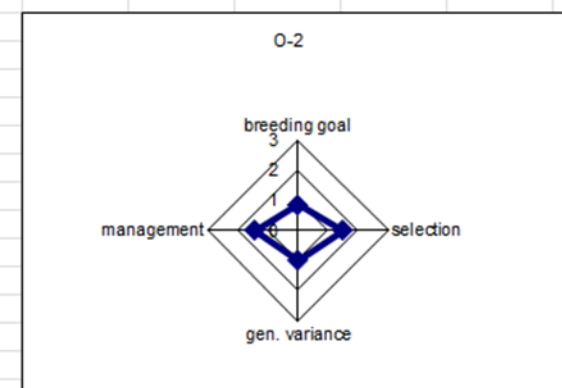
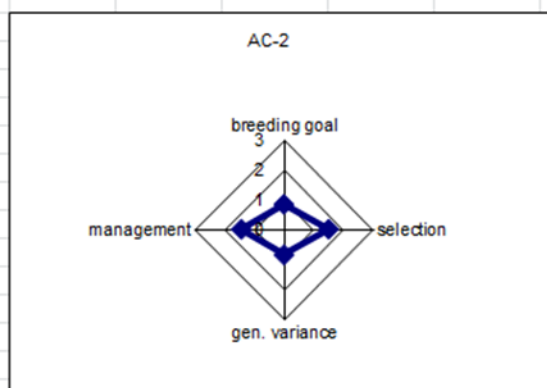
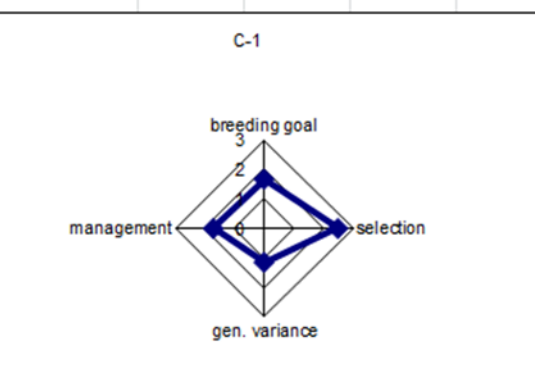
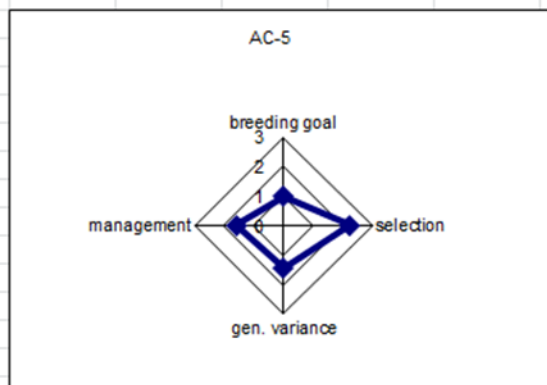
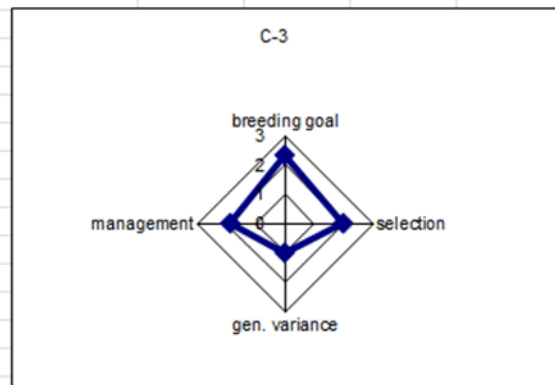
*Dimension score*

$$8/4 = 2$$

V17

fx

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		C-3	AC-5	T-2	C-1	AC-2	O-2	C-2	AC-3	T-1	C-4	AC-4	AC-1
2	breeding goal	2,333333	1	1,666667	1,666667	0,833333	0,833333	2,166667	2,5	1,5	2,833333	1,5	1,5
3	selection	2	2,25	0,666667	2,5	1,5	1,5	2,5	2,75	0,75	2,5	1,75	1,75
4	gen. variance	1	1,428571	2	1,142857	0,857143	1	1,285714	2	1,857143	1,714286	1,714286	1,833333
5	management	1,857143	1,571429	0,571429	1,714286	1,428571	1,428571	2,285714	2,428571	1	2,428571	1,714286	1,714286



## Breeding goal and external factors

- Definition of market and relation to breeding goal
- Definition of 'sustainable breeding'
- Sensitivity to external factors
- Breeding goal's agreement with prod. system
- Breeding goal's agreement with farmers' demands
- Foresight of threats to the production system

# Example of notes for Breeding goal and external factors

Breeding goal and external factors	C 1	C 4
Know their producers	Yes	Yes
Ideas about future of the system	Vague	Clear
Analysis of marketing needs	Limited & seldom	Monitors regularly
Definition of sustainable breeding	Narrow, only economy	Broad, well formulated
Genetic back up	Many nucleus herds	Nucleus herds in different areas + frozen semen
...		

## Recording and selection

- Recorded traits in agreement with breeding goal
- Clear instructions for recording
- Estimation of breeding values, genetic gain and negative side effects
- Evaluation of profitability

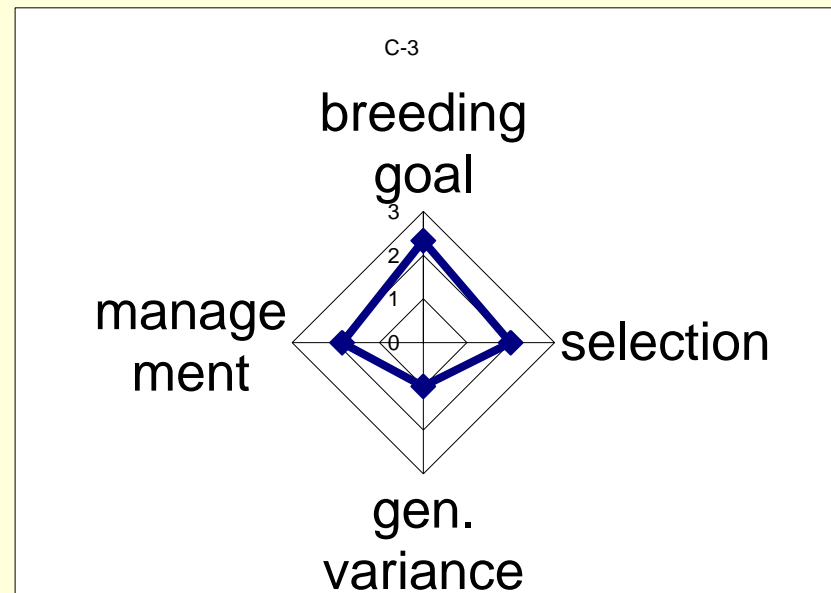
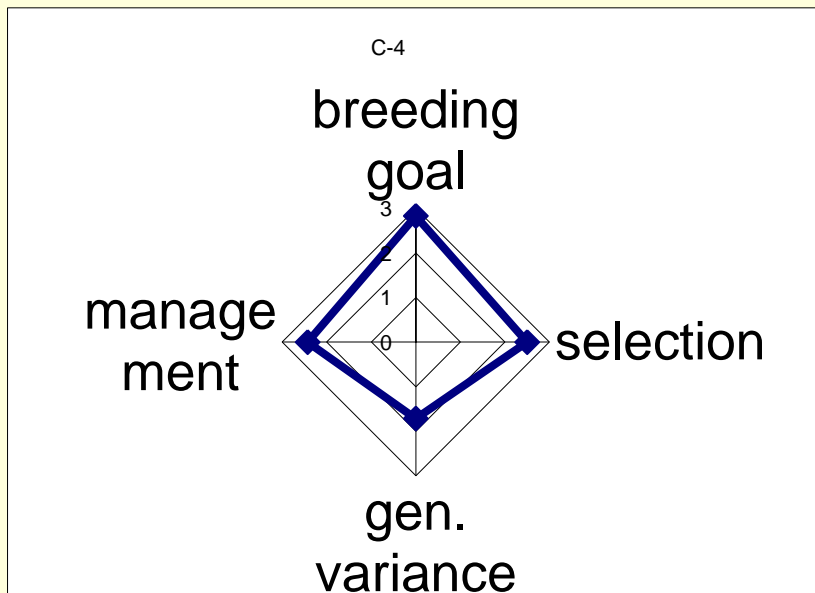
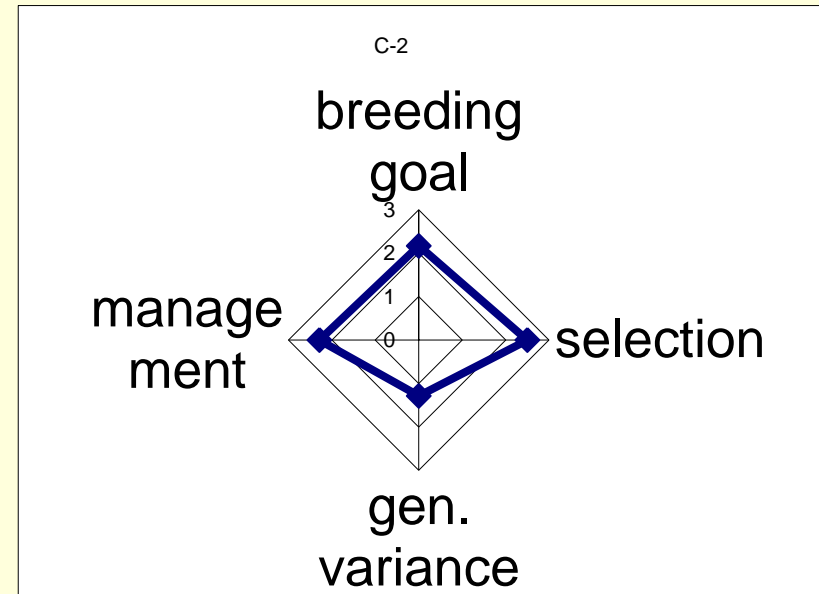
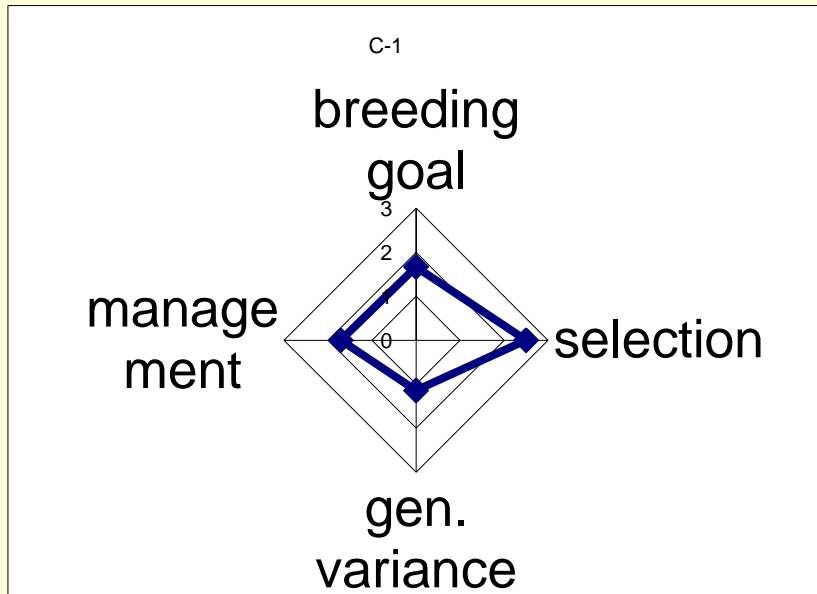
## Genetic variation

- Effective population size
- Rules to limit inbreeding
- Use of 'Optimum Contribution Selection'
- Organisation's interest in genetic diversity
- Farmers' interest in genetic diversity
- Uniqueness of breed

## Management of breeding programme

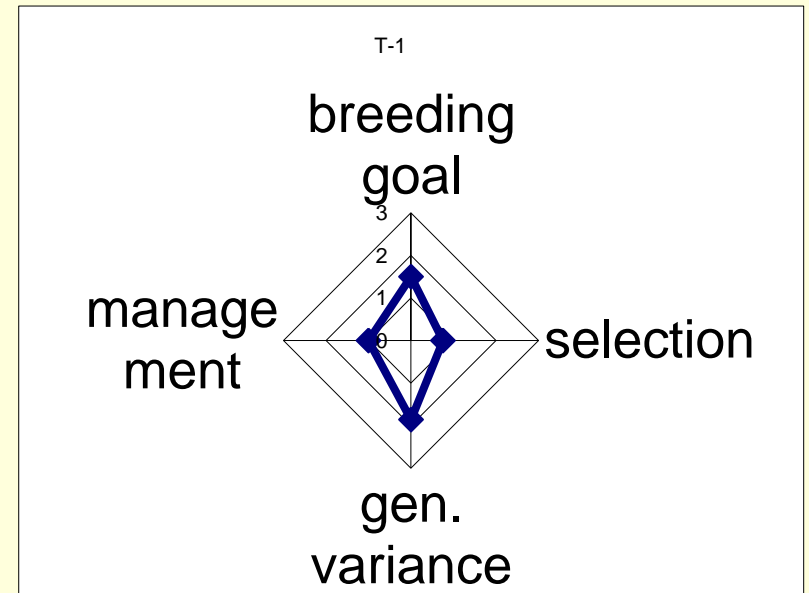
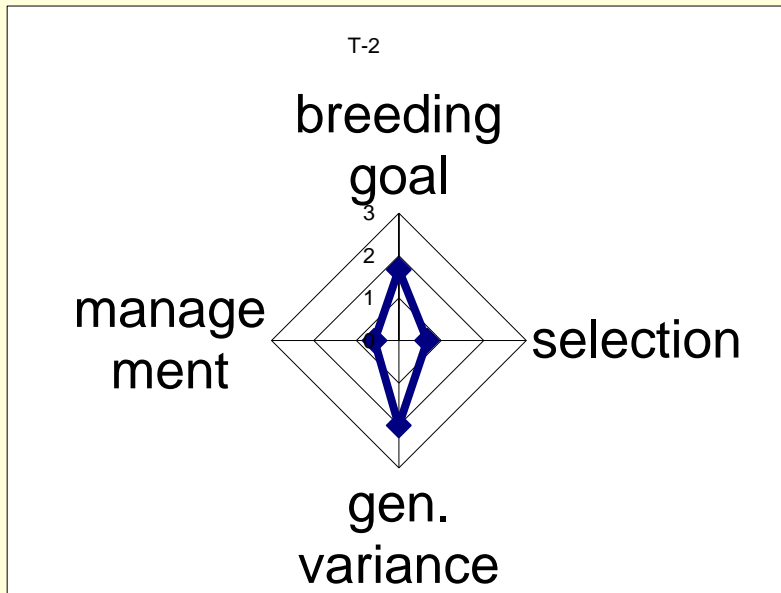
- Economic resources
- Technical resources
- Use of 'latest methods'
- Human resources
- Communication and transparency
- Defined mile stones

# Four conventional pig production systems



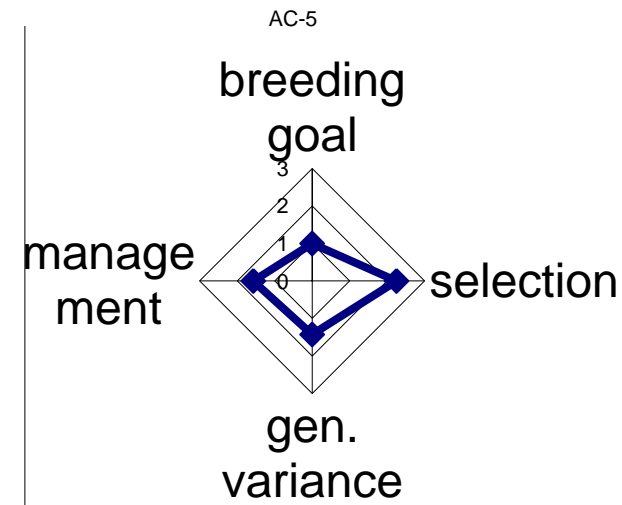
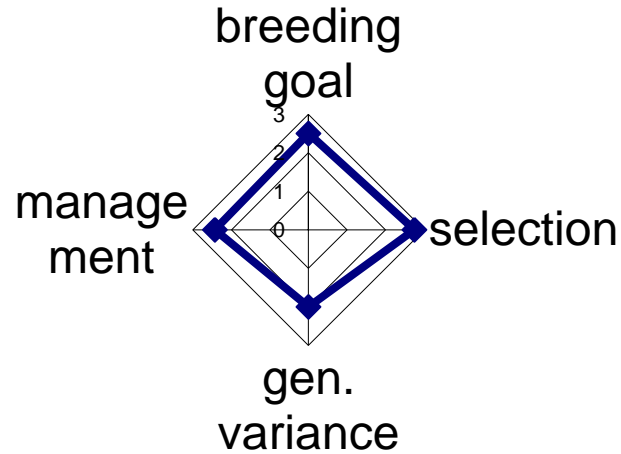
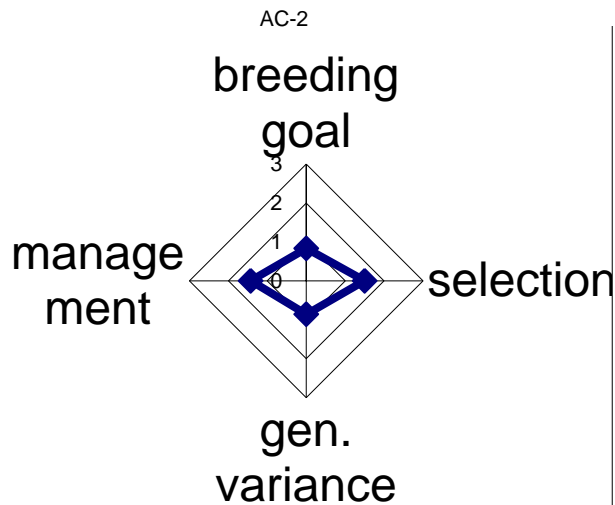


# Two production systems with traditional breeds

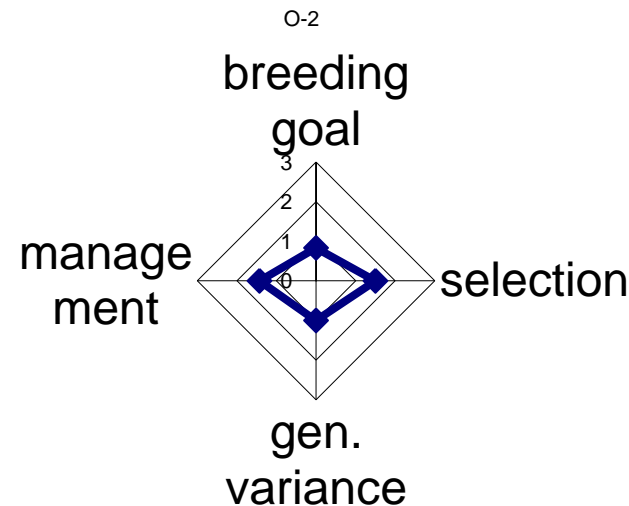
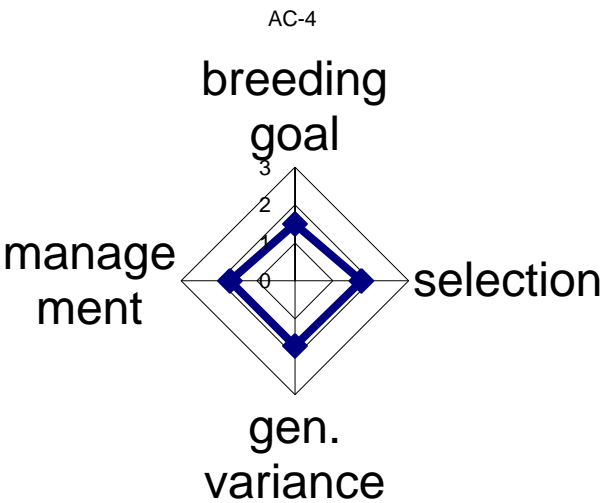


# Six differentiated production systems

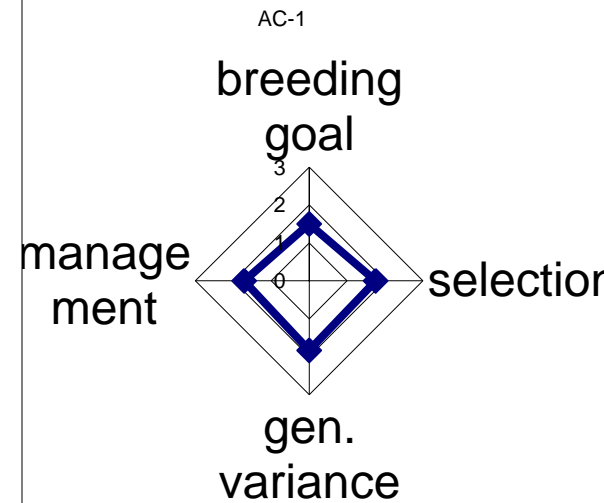
## High meat quality



## Environmental friendly & high welfare



## High welfare



## General reflections

- Sustainability assessments can be done
  - but questioned! Subjective scoring
- The assessment was a useful exercise for the students
- No simple answers - but important to ask, and work with these questions

## More specific reflections

- Animal breeders' have a long term perspective
  - but breeding organisations compete. Today!
- Code of good practice for farm animal breeding
- Breeding goal in relation to production system

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Information about QPorkChains: [www.q-porkchains.org](http://www.q-porkchains.org)

Information about the Master course “Designing Breeding Programmes”: [www.slu.se](http://www.slu.se)