



BREEDING FOR ENHANCED WELFARE IN MONOGASTRIC PRODUCTION SYSTEMS

Sandra Edwards

Future Drivers of Production Systems

1. Economic pressures

- **Increased output per animal**
 - Prolificacy, growth rate
- **Reduced variable costs**
 - Increased feed efficiency
- **Reduced fixed costs**
 - Economies of scale, reduced labour input

Future Drivers of Production Systems

2. Consumer and societal demands

- **Safety and quality of product**
 - Zoonoses
 - Healthy eating
 - Organoleptic quality
- **Acceptability of production method**
 - Environmental impact
 - Animal welfare

The Consequences for Welfare

1. Economic pressures

- **High production genotypes**
 - Skeletal problems
 - Cardiovascular problems
 - Immunological problems
- **Low human input systems**
 - Supervision problems
 - Intervention problems

The Consequences for Welfare

2. Societal pressures

- **Legislative protection**
 - System changes and constraints
- **Diversification and Extensification**
 - Environmental challenges
 - Social challenges

Legislative system changes

● Pigs

– Directive 2001/88/EC

Bans gestation stalls from 2013

Review of farrowing crates

Review of castration and tail docking



Legislative system changes

● Poultry



– Directive 1999/74/EC

Bans conventional layer cages from 2012

Bans beak trimming unless national derogation

– Directive 2007/43/EC

Limits stocking density for meat chickens

Introduces welfare outcome assessment

Review of genetic problems



Welfare & The Five Freedoms

General stakeholder agreement

- Freedom from pain, injury and disease
- Freedom from hunger and thirst

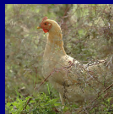
Agreement in principle but not in details

- Freedom from thermal and physical discomfort
- Freedom from fear and distress

Significant disagreement in principles and detail

- Freedom to express normal behaviour

Welfare Perspectives



Natural living
(integrity)

Biological function

Affective state
(QoL)

High production genotypes

- Selection for growth rate, leanness, prolificacy
- Consequences for pathology may be different in more extensive systems



- OCD and leg weakness in pigs ($h^2 = 0.2-0.6$)

Bone strength in layers ($h^2 = 0.4$)

56 QTLs for 12 phenotypic skeletal integrity traits in poultry

Longevity of sow ($h^2 = 0.05-0.25$)

(Re-) Balanced selection indices - production & functional traits
- short & long term performance

Selection for lifetime production

Low Human Input Systems

- Selection for self sufficiency
 - health
 - breeding reliability
- Genetic resistance or resilience to disease
 - Reduced antibiotics, overcoming antibiotic resistance



~200 diseases with single gene cause
Genetic traits of acquired and innate immunity

Identification of SNPs for specific diseases
Correlates of selection for traits of immunity

Preparing for System Constraints

- Social aggression in less restrictive systems
 - Larger group sizes
 - Less stable groups



Aggression in poultry, pigs ($h^2 = 0.2-0.4$)
Breeding for "good citizenship"



Practical application - simple indicator traits
- selective breeding on group effects

Preparing for System Constraints

- Neonatal survival in less restrictive systems
 - vigour / viability of neonate
 - maternal characteristics of mother
 - Behavioural
 - Morphological



Neonatal survival of piglet ($h^2=0.04-0.2$)
direct and maternal effects differentiated – interactions

Identification of SNPs and underlying mechanisms

More Extensive Systems

- Selection for robustness
- climatic extremes, nutritional variation
 - parasite resistance



- Genetic variation for thermoregulation shown in sows
- GxE interaction for ambient temperature in poultry
- Repeatability of A. galli FEC in chickens



- Specialists or generalists?

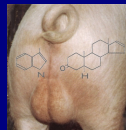
Genetic analyses for environmental sensitivity
- reaction norm approach
Genetic strategies to deal with reduced data collection

Abolishing Mutilations

- Selection for reduced vice
- Selection for reduced boar taint



Feather pecking in poultry ($h^2=0-0.5$)
Tail biting in pigs ($h^2=0-0.3$)
Boar taint in pigs ($h^2=0.1-0.5$)



Practical application - simple indicator traits
Correlates of selection strategies

WELFARE QUALITY Criteria for Good Welfare

- Good feeding
- Good housing
- Good health
- Appropriate behaviour



WELFARE QUALITY Audit Scheme Development

- Animal-based measures of welfare
 - Health
 - Lesions
 - Behaviours (emotions?)

Might such measures form future breeding goals ?

Welfare of chicken genetic strains



	Control strain	New strain
Feather pecking score	1.20	0.03
Comb damage	0.90	0.35
Corticosterone	1.2	1.0
Adrenal weight	7.3	6.7

(Ahmed et al., 1985)

Welfare of chicken genetic strains

“under the conditions of this experiment, it can be concluded that the lack of sight....did not interfere with feeding and other maintenance processes.....but it did reduce injury and may have reduced stress and activity level. It is therefore worthwhile to explore further the potential of this mutation in egg-laying strains

How far should genetic approaches go

?

- Correlates of selection for welfare measures ?
- Ethical analysis of breeding goals