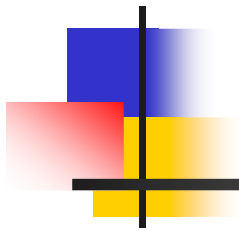


Dairy cow welfare: Solutions for current problems



John Webster
Emeritus Professor, University of
Bristol, UK



What is animal welfare?

- **What is it to them?**
 - What is meant by welfare, wellbeing, sentience, stress, suffering?
- **What is it to us?**
 - Ethics of animal welfare
- **What should we do about it?**
 - Awareness, education, promotion



Right thought and right action



- *"The end of a man is an action, not a thought, though it were the noblest"*
-Thomas Carlyle (1795-1881)



Animal Welfare: Right Action

- To acknowledge and understand sentience in animals
- to breed and manage farm animals that can sustain fitness and avoid suffering throughout their productive lives
- to establish an effective system of welfare assurance for farm animals
- to increase public demand for real improvements in farm animal welfare



“Well-being”

‘Fit and happy’

- sustained physical and mental health
 - absence of disease
 - absence of suffering (e.g.pain, fear, exhaustion)
- feeling good (‘happy’)
 - comfort, companionship, security



Animal Sentience

- **'Feelings that matter'**
 - Perception of environmental stimuli
 - Interpretation: emotion & cognition
 - Motivation:
 - a measure of how much it matters
 - Measured response
 - Assess effectiveness of outcome
 - Modify mood and understanding in light of experience



Stress and suffering

- Suffering occurs when an animal cannot cope (or has difficulty in coping) with unpleasant feelings:
 - because the sensations are too intense, too complex or too prolonged
 - e.g. hypothermia in lambs, metabolic exhaustion in dairy cows
 - because it is unable to respond in a way that will effectively improve how it feels
 - e.g. sows in stalls, hens in barren cages



Animal Sentience

Why does it matter to us?

- Suffering and pleasure are defined by the capacity to feel, not the capacity to think
 - chimpanzee = horse = rat
- Sentient animals learn by experience as they attempt to cope with life. If they fail, they suffer
 - suffering is a learnt experience



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Improving welfare

- Legislation
 - slow, sets minimal standards only
- Redirection of subsidy
 - directed to environmental protection and animal welfare
- Voluntary animal welfare-based QA schemes
 - to improve consumer awareness, trust and demand for ethical products



"Slipping the political leash"

The Power of the People

- Laying Hens
 - Brambell to EU legislation -50 years
 - Freedom Food free-range eggs >40% in 10 years
- Organic farming
- Bioethics on public display
 - Ethical restaurants (coffee, beef)
 - McDonald's!

European welfare labelling schemes



UK



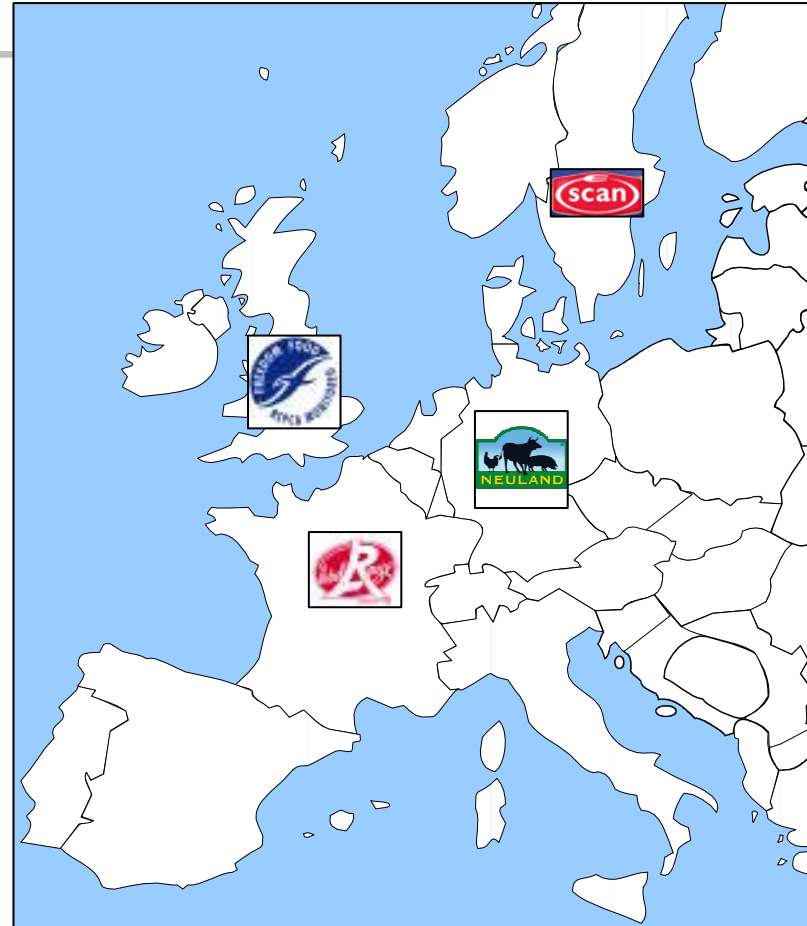
France



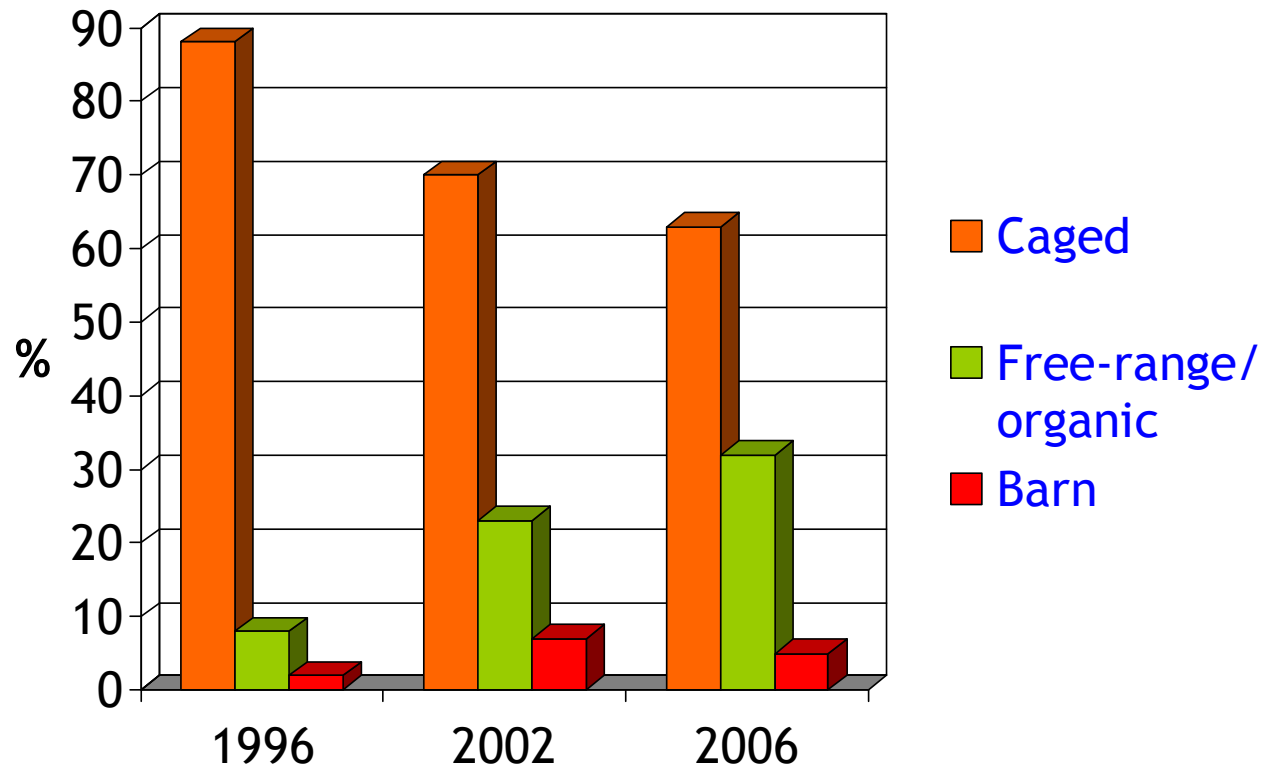
Germany



Sweden

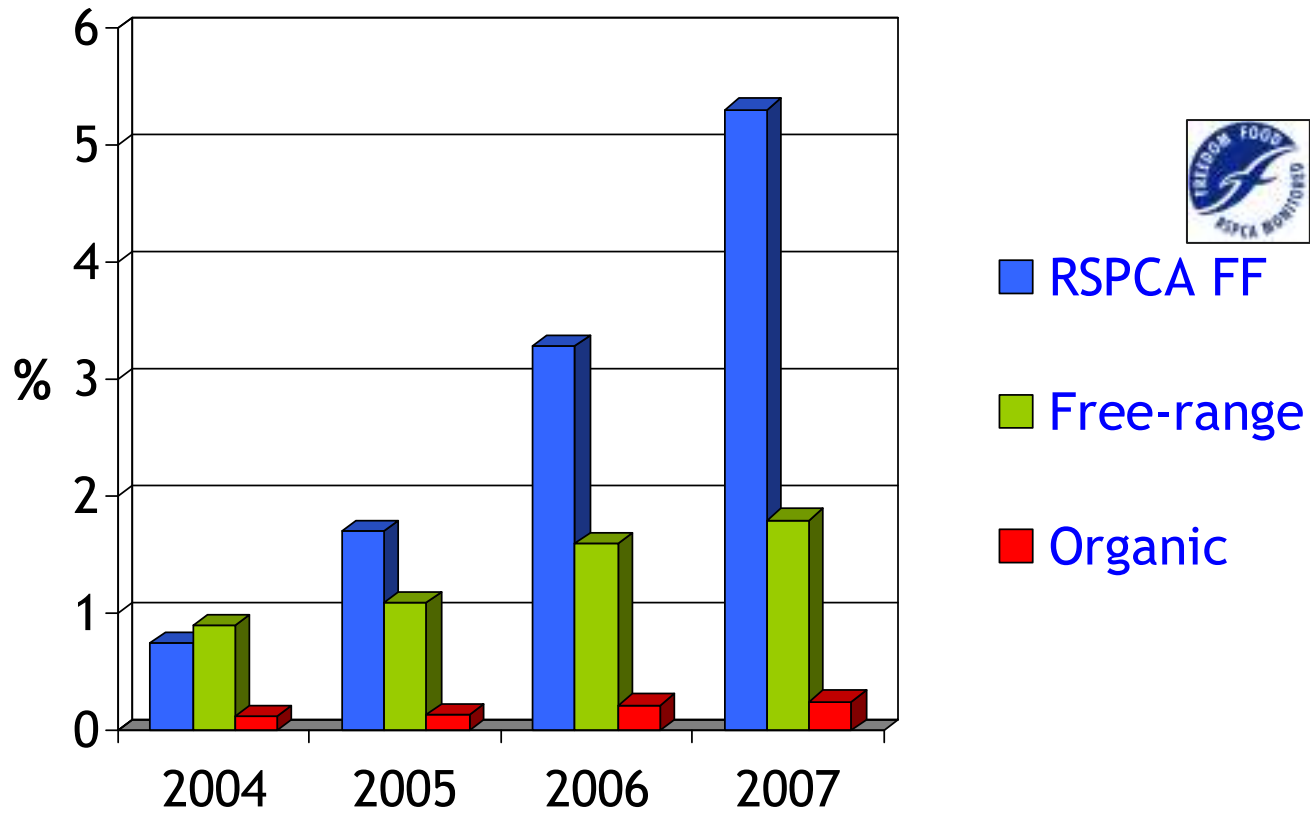


UK egg production trends



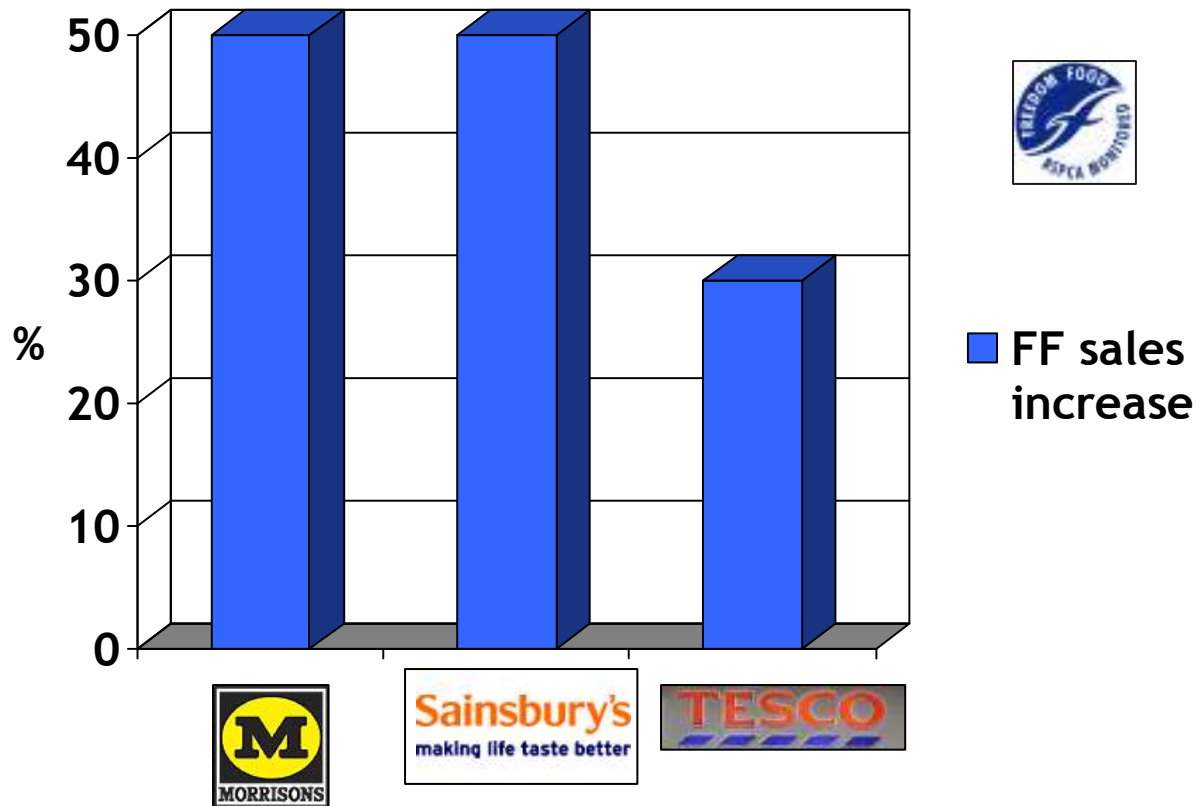
UK chicken production trends

Market share



UK chicken production trends:2008

Case study: 2008 chicken campaign via television, supermarket results





The Ethical Matrix: Laying hens

	Barren cage	Enriched cage	Free range
Hens	Unacceptable	Meets most hen needs	Acceptable (with care)
Consumers	Cheap & wholesome	Unacceptable to welfarists	Popular choice
Producers	Commodity, no added value	No added value?	Added value Pride

Free Range Eggs & Milk



Eggs >50% Market

Milk products

“am I bothered?”





Dairy cow welfare priorities

- As seen by the cow
 - Less pain
 - (lameness, mastitis)
 - More comfort
 - (beds, floors)
 - Less work
 - (digestion & metabolism)
 - Less malaise
 - (metabolic disorders)
- As seen by the people
 - “A life worth living”
 - Cows
 - Green fields
 - Longevity
 - No cripples
 - Male Calves
 - No white veal
 - No exports
 - No slaughter at birth



“Beyond Calf Exports” (CIWF/RSPCA)

- Strategies to improve welfare and minimise wastage of male dairy calves
 - Sexed semen +++
 - Improving muscularity of dairy breeds -?
 - Improve longevity of dairy cows
 - Baby bull beef (cereal prices?)
 - Forage-fed baby steer beef
 - Rose veal
- Unlikely ? but already part of overall dairy farm quality assurance plan for suppliers to Waitrose and Tesco.



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'Robustness': targets

- Calve at 2y.o., 520kg.
- Minimise non-productive period (2 mo.)
- Fertility >70% take to 1st service
- Replacement rate <20%/year
- Involuntary culling <10%/year
- Minimise suffering



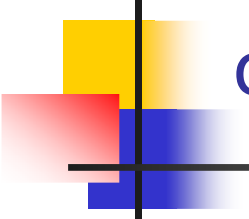
Possible welfare problems for the Dairy Cow

- Hunger, malnutrition or metabolic disease
 - improper feeding for phenotype
- Chronic discomfort
 - cubicle design, loss of condition
- Pain from mastitis or lameness
- Increased susceptibility to infection
- Psychological disturbance (e.g. bullying)
- Metabolic or physical exhaustion



Failures of Provision

- Inadequate nutrition for phenotype
 - infertility, metabolic disorders
- Inadequate environment for phenotype
 - mastitis, lameness
- Phenotype 'unfit for purpose'
 - premature culling



'Unfit for purpose' Phenotypic and genotypic correlations with increasing yield.

	Phenotype	Genotype
Calving interval	+0.20	+0.39
Mastitis	-0.01	+0.26
Lameness	+0.04	+0.17



Consequences of inadequate nutrition for phenotype

- **SHORT TERM**
 - metabolic hunger for nutrients to support lactation
 - digestive disorders from rumen overload
 - no time to meet all behavioural needs (e.g. eating v. resting)
- **LONG TERM**
 - infertility
 - loss of condition
 - exhaustion



Towards the more Robust Cow Lifetime Net Merit (USDA)

- Milk fat and protein 62%
- Somatic cell score -9%
- Udder conformation 7%
- Productive life 14%
- Feet and legs 4%
- Body size -4%

Solutions: Cows fit for purpose



The commodity producer
Best in a barn?

The 'Added value' producer

- Organic
- Complementary (grass)
- b casein A2??





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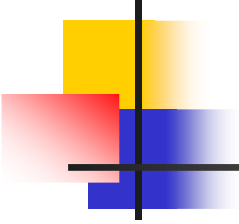


Welfare Quality:

Part 1. Action for farm animals

- Promotion of animal wellbeing (“fit and happy”) through:
 - Evidence of good husbandry
 - Monitoring of welfare
 - Effective action to address welfare problems (?)
 - Review of actions (?)
 - Rewards for good husbandry (?)

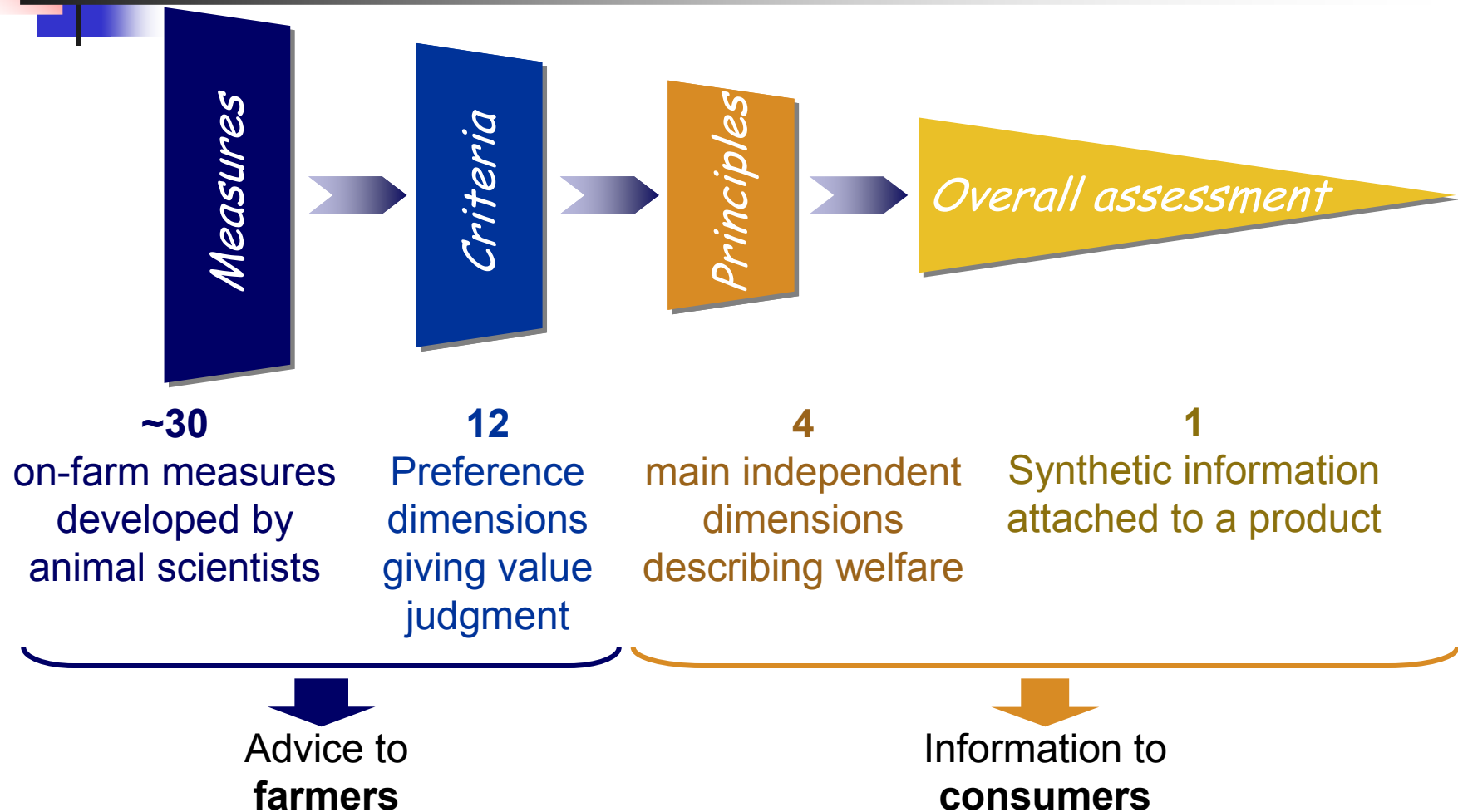
Welfare Quality: 12 welfare criteria



Welfare principles	Welfare criteria
Good feeding	Absence of prolonged hunger
	Absence of prolonged thirst
Good housing	Comfort around resting
	Thermal comfort
	Ease of movement
Good health	Absence of injuries
	Absence of disease
	Absence of pain induced by management procedures
Appropriate behaviour ³	Expression of social behaviours
	Expression of other behaviours
	Good human-animal relationship
	Absence of general fear

Welfare Quality:

Progressive evaluation structure





Welfare Quality:

Part 2. Promotion of public demand

- Promotion of high-welfare food as part of “added value”
 - Labelling
- Evidence –based quality assurance
 - Unclassified – basal – good – excellent (!)
 - Stars



Dairy Cow Welfare: Quality Control

- Farmers are responsible for husbandry provisions
- 'Welfare Assurance' requires independent, animal-based monitoring of welfare outcomes
 - quantifiable, repeatable & robust
 - should integrate consequences of past husbandry
 - Should prioritise an action plan to promote good welfare and address specific problems



GOOD HUSBANDRY

- provision of appropriate resources
- skilled and sympathetic stockmanship
- clear records of planning, actions and effects



Monitoring: dairy cows

Freedom Food v. NDFAS

- Nutrition
 - condition, digestion
- Fertility
- Mastitis
- Lameness
- External appearance
- Behaviour
 - resting, social

Results Profile of 53 Dairy Farms



Dr H Whay

© Bristol University

Measure **Source of Information** **Unit of Measure**

Score Categories
(20% in each banding)

Est. - Estimated by farmer, Obs.-Observed during visit, Rec.-Farm records

			A		B		C		D		E	
Health & Production												
<i>Nutrition</i>												
Annual Ave. milk yield	Est.	Litres	10500	8300	8200	7789	7652	7118	7000	6500	6313	4275
Thin cows (BCS <2)	Obs.	%	0	5.6	6.3	11.1	13.3	21.4	21.7	31.3	33.3	61.1
Fat cows (BCS >3.5)	Obs.	%	0	0	0	0	0	0	1.4	5	5.1	27.6
Bloated rumen ¹	Obs.	%	0	0	2.6	6.5	6.7	16.7	17.5	24.1	25	46.7
Hollow rumen ¹	Obs.	%	0	6.3	7.4	13.8	14.3	20	20.8	31.3	32.1	82.4
Milk fever cases	Est.	/100 cows/year	0	0	0	0	0	0	1.1	1.1	1.3	30.6
Other disease ²	Est.	/100 cows/year	0	2.7	3.0	4.4	4.7	6.9	7.3	9.5	10.3	19.1
<i>Reproduction</i>												
Conception rate to 1 st Service	Est.	%	80	68	66	60	59	56	55	49	47	28
Assisted calving cases	Est.	/100 cows/year	0	0	0	0	0.9	1.1	1.1	4.8	4.9	40
<i>Mastitis</i>												
Mastitis cases	Rec.	/100 cows/year	0	9	11.5	20.7	21.3	34.5	40.8	46.2	46.8	120
Mastitis cases	Est.	/100 cows/year	2.8	13.3	14.8	18.9	20	32.7	33.0	46.7	46.8	89.1
<i>Lameness</i>												
No. of lame cows	Obs.	%	0	13.6	13.8	18	19.5	23.5	23.6	29.6	29.8	50
Lameness cases	Rec.	/100 cows/year	0	0	0	0	2.2	4.1	4.3	11.0	11.5	42.3
Lameness cases	Est.	/100 cows/year	3.2	8.7	9.2	14.7	14.9	20.7	21.3	34.8	34.9	54.4
Claw overgrowth ³	Obs.	%	0	11.8	12.5	25	26.7	34.4	35	46.2	46.4	76.5
Poor claw conformation ⁴	Obs.	%	0	0	0	0	3.3	7.1	7.4	16.7	17.9	37.5
<i>Non-specific Illness / Mortality</i>												
Dull / Obviously sick	Obs.	%	0	0	0	0	2.2	3.3	3.6	6.3	6.7	20
Sudden death / casualty	Est.	/100 cows/year	0	1.0	1.1	1.7	1.8	2.8	3.1	4.1	4.3	15.6

External Appearance

*Cow Cleanliness & Coat Condition*⁵

Dirty hind limbs	Obs.	%	65	85	90	96.4	96.7	100	100	100	100	100	100
Dirty udder	Obs.	%	0	8.3	10	17.7	17.9	23.8	24.1	33.3	35.9	70	
Dirty flanks	Obs.	%	0	0	2.5	6.9	8.3	11.8	14.3	25	25.6	77.8	
Dull coat	Obs.	%	0	0	2.5	5.6	6.7	7.4	7.7	12.5	16.7	36.6	
Thick hairy coat	Obs.	%	0	5	5.9	10.3	11.1	16.7	18.2	23.3	25	76.9	
Hair loss	Obs.	%	0	0	4.2	7.1	7.7	13.8	14.8	30.8	32.6	88.2	
<i>Injuries from the Environment</i>													
Hock hair loss	Obs.	%	0	7.7	10	21.9	22.2	45.5	47.1	71.4	74.1	91.7	
Swollen hock	Obs.	%	0	10.7	11.1	28.3	29.4	36.1	37.5	68.2	70	96.7	
Ulcerated hock	Obs.	%	0	0	2.8	3.7	4.8	11.8	12.5	25	28.6	50	
Non-hock injuries	Obs.	%	6.3	42.9	45.8	58.6	59.3	65.6	66.7	79.2	80	100	

Behaviour

*Approachability*⁶

Maximum flight distance	Obs.	meters	1.5	2.5	3.0	3.0	3.5	4.0	4.5	4.5	5	7
Average flight distance	Obs.	meters	0.6	1.1	1.2	1.5	1.5	1.65	1.7	1.9	2.1	3.4

Lying Behaviour

Cow idling ⁷	Obs.	%	0.0	2.6	2.8	3.7	4.7	5.1	5.6	8.3	8.5	25
Rising restriction ⁸	Obs.	%	0	10	12.5	20	30	30	33.3	40	50	77.8

- 1 Bloated / Hollow Rumen - Proportion of cows with noticeable signs of rumen distention or low rumen fill
- 2 Other Disease - Including hypomag., ketosis, etc. but not mastitis, lameness and milk fever
- 3 Claw Overgrowth - Proportion of cows with long toes / excessive heel depth / imbalance between claws
- 4 Claw Conformation - Proportion of cows with any abnormalities of conformation such as corkscrew claws / flexor tendon extension
- 5 Cow Cleanliness / Coat Condition / Injuries - Proportion of cows with signs of each condition
- 6 Approachability / Flight Distance - Average & maximum distance at which 10 cows retreat from observer
- 7 Cow Idling - Proportion of cows observed performing no activity (not eating, drinking, ruminating, walking or lying)
- 8 Rising Restriction - Proportion of group showing serious / severe rising restriction (difficulty rising, hitting fittings & 'dog sitting')

Example : % requiring action - intervention level

Thin cows (% with BCS<2)

Best 20% Worst 20%

0 5.6 6.3 11.1 13.3 21.4 21.7 31.3 33.3 61.1

Mastitis cases

Best 20% Worst 20%

2.8 13.3 14.8 18.9 20 32.7 33.0 46.7 46.8 89.1

Lame cows (%)

Best 20% Worst 20%

0 14 14 18 20 23.5 24 29.6 29.8 50

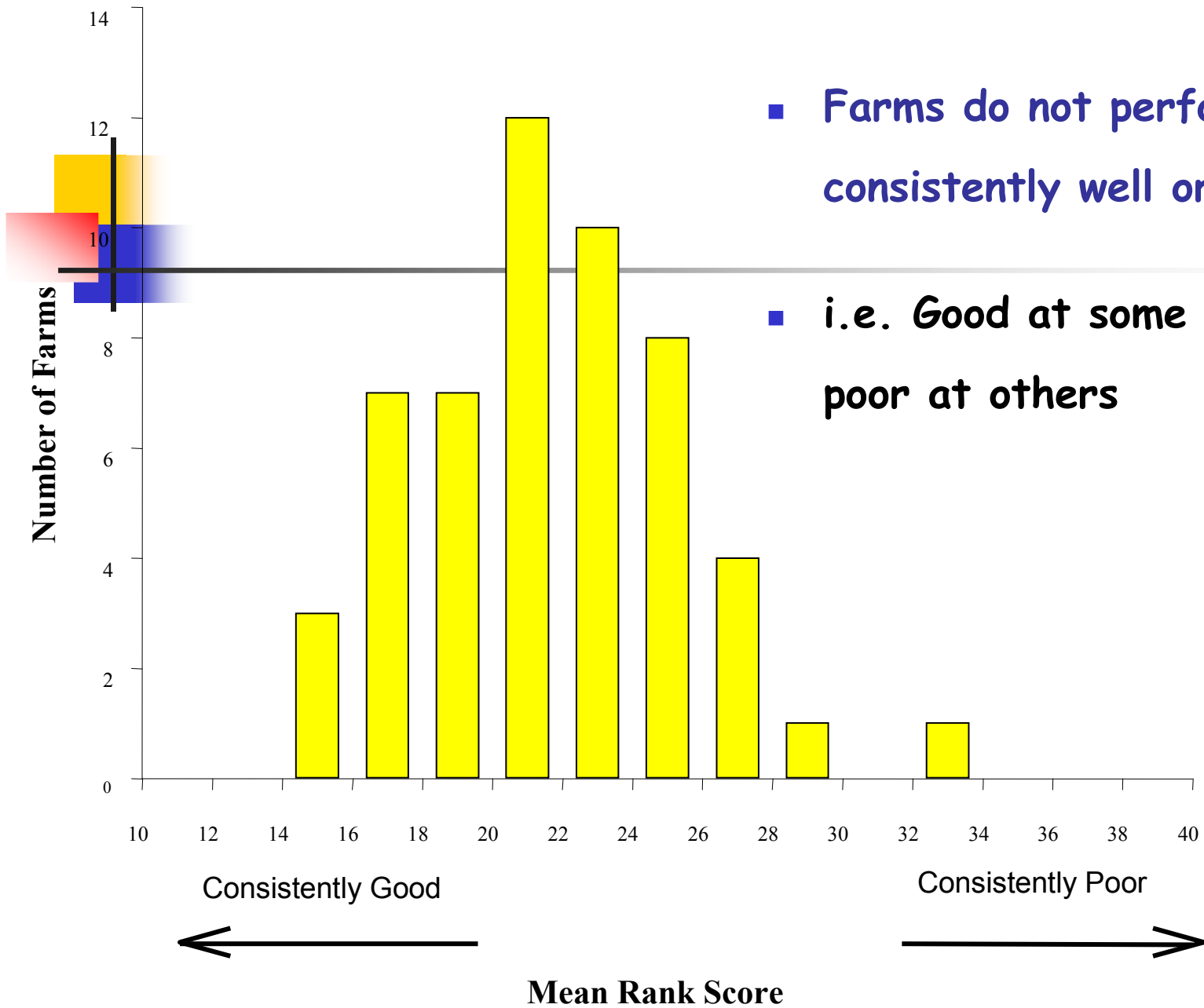
Swollen hock (%)

Best 20% Worst 20%

0 10.7 11.1 28.3 29.4 36.1 37.5 68.2 70 96.7

■ Farms do not perform consistently well or badly

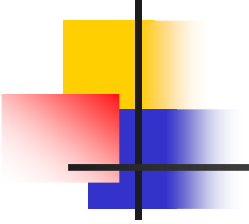
■ i.e. Good at some aspects , poor at others





Lameness in U.K. Dairy Cows (1990-2000)

	Mean	Range
Annual incidence, %	55	11-170
Overall prevalence, %	21	2-54
of which (approx.)	1990	2000
Solar ulcer	24%	21%
White line disease	19%	16%
Digital dermatitis	6%	14%
Foul-of-the-foot	4%	3%
General laminitis	2%	1%



Scientific digression: the aetiopathogenesis of 'Claw horn disruption'

Sole & White Line haemorrhage

Risk Factors

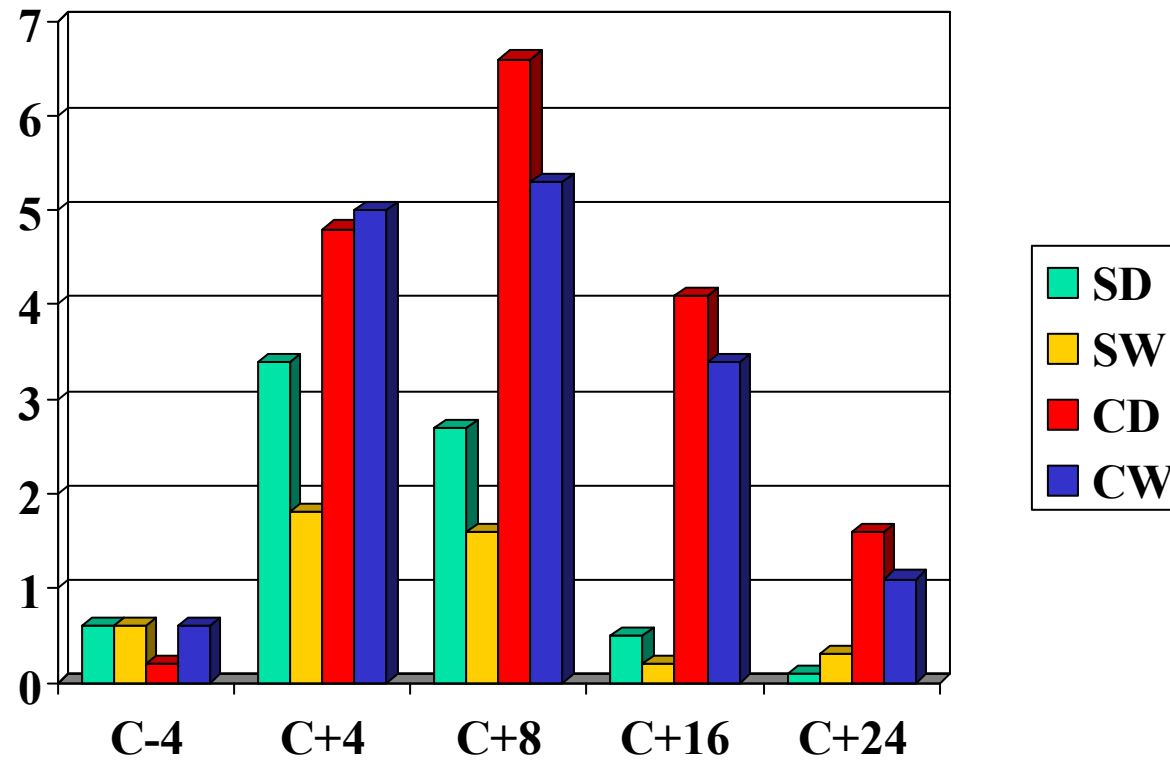
- nature & duration of sole/floor contact
- systemic and indirect effects of feed
- calving & onset of lactation



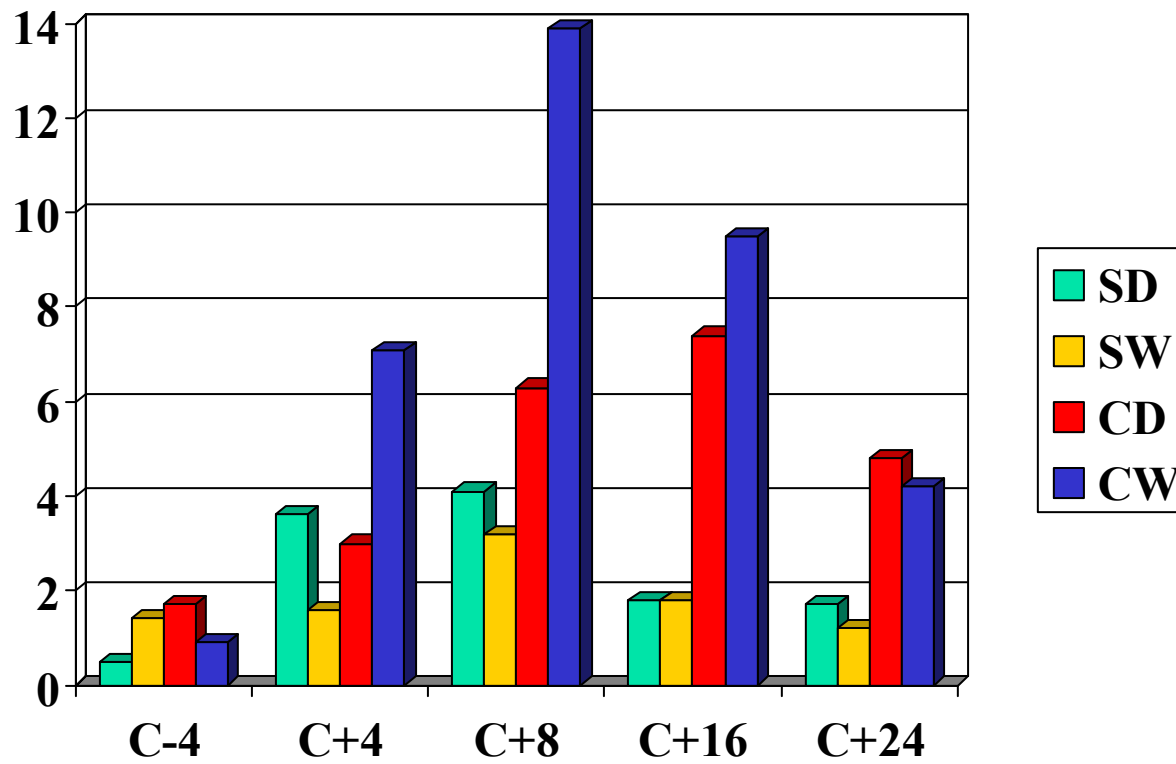
Proposition 1.

- Systemic events associated with calving and the onset of lactation may set in motion the chain of events that lead to CHD; the severity and duration of these lesions being determined by externally imposed conditions of housing and feeding.

White line lesions



Solar haemorrhage

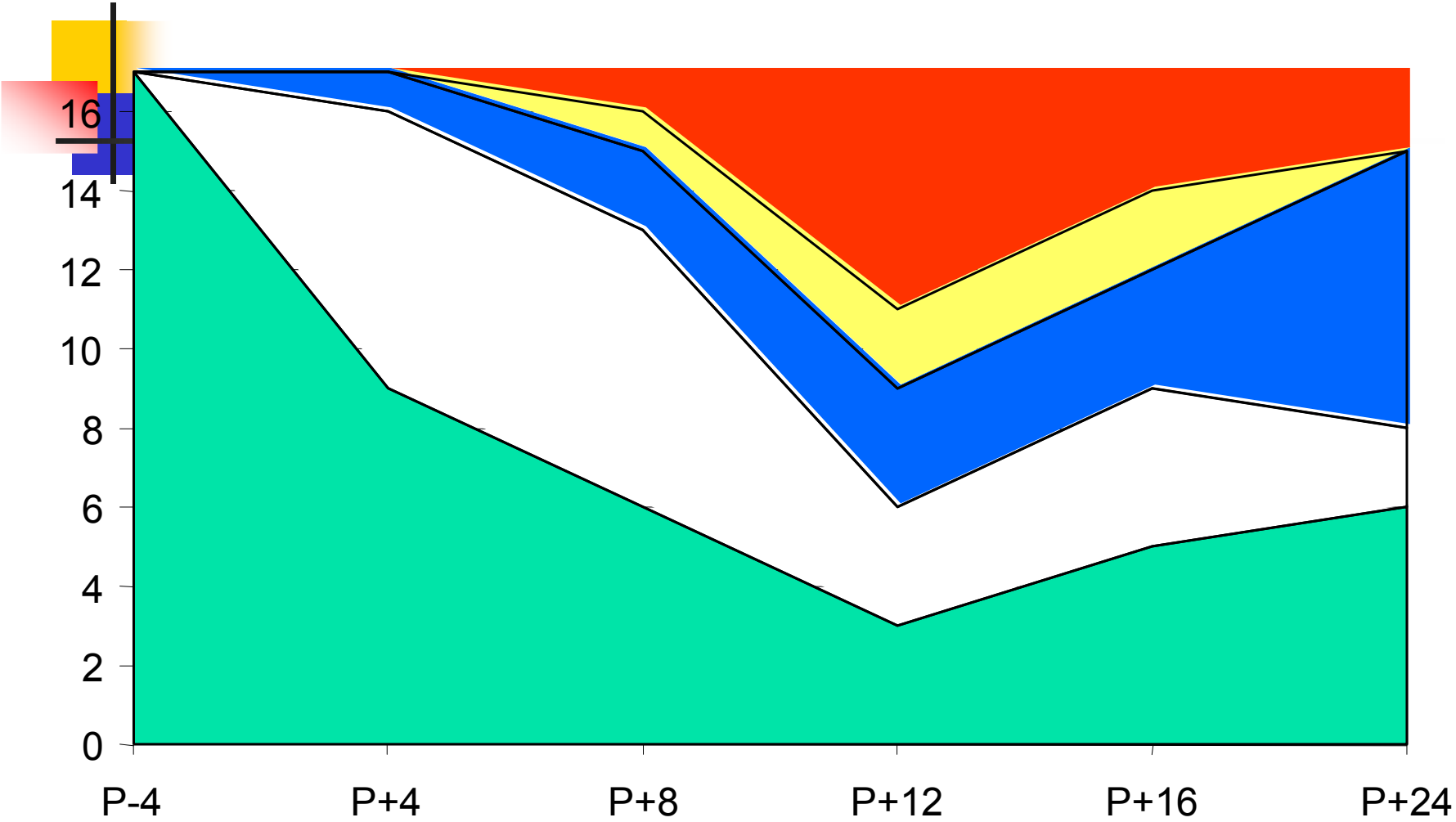




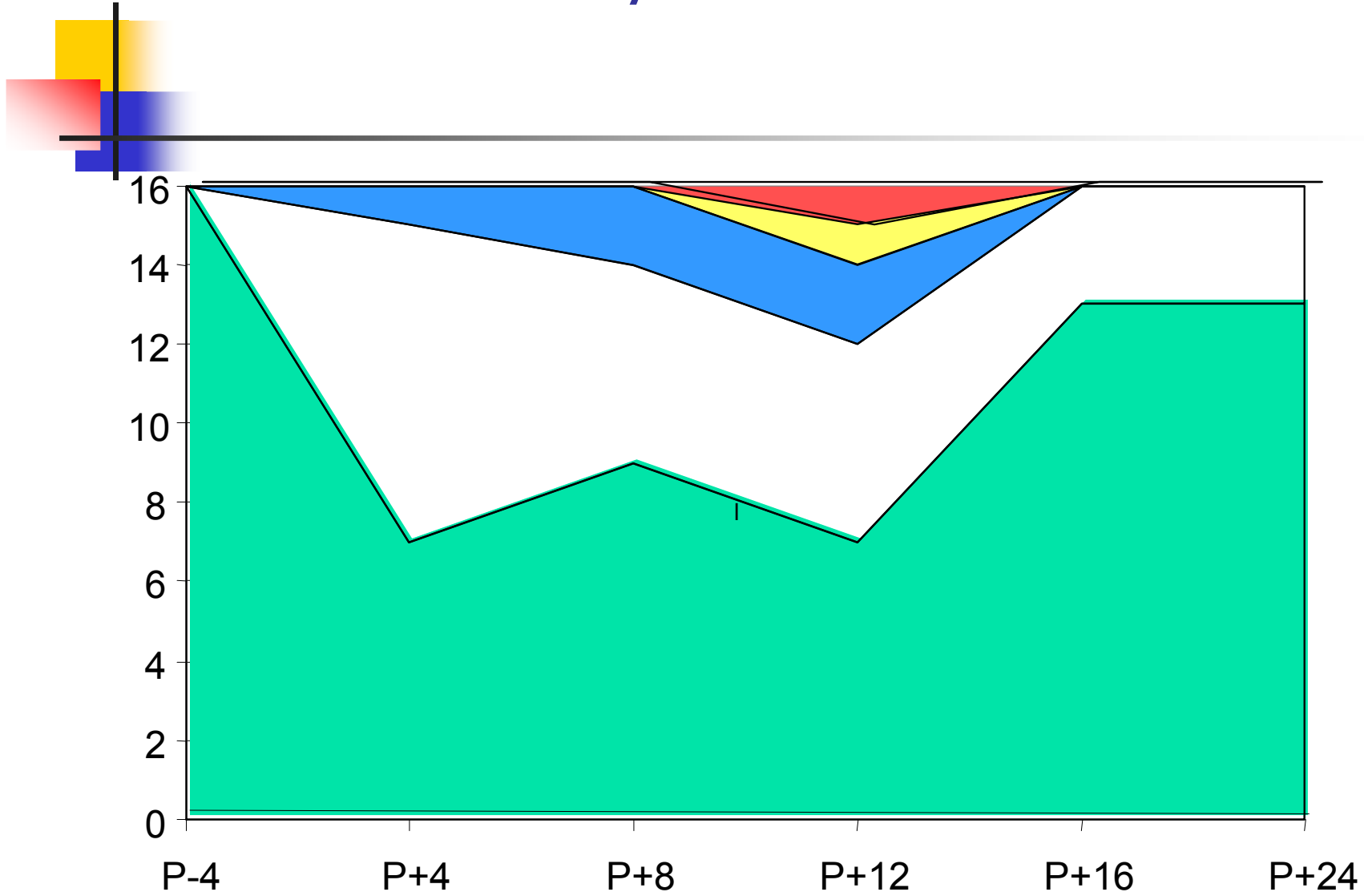
Proposition 2

- If the effects of parturition/lactation are brief, then the consequences could be reduced by postponing housing on cubicles & concrete.

Lameness severity: Cubicles from P-4



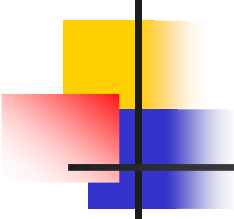
Lameness severity: Straw P-4 to P+8





Proposition 3

- The primary systemic cause of sole and white line lesions is not inflammation in the laminae leading to disruption of claw horn synthesis but a loss of integrity in the support structures which suspend the pedal bone within the hoof.



CHD: Is the early lactation effect due to feeding-induced sub-clinical laminitis?

- True laminitis is rare (in UK)
- Most Euro experiments to induce CHD through concentrate feeding 'unsuccessful'
- Practical nutrition greatly improved (e.g. TMR)

Yet CHD remains unacceptably high

Suspension of the pedal bone

from Lischer 2002

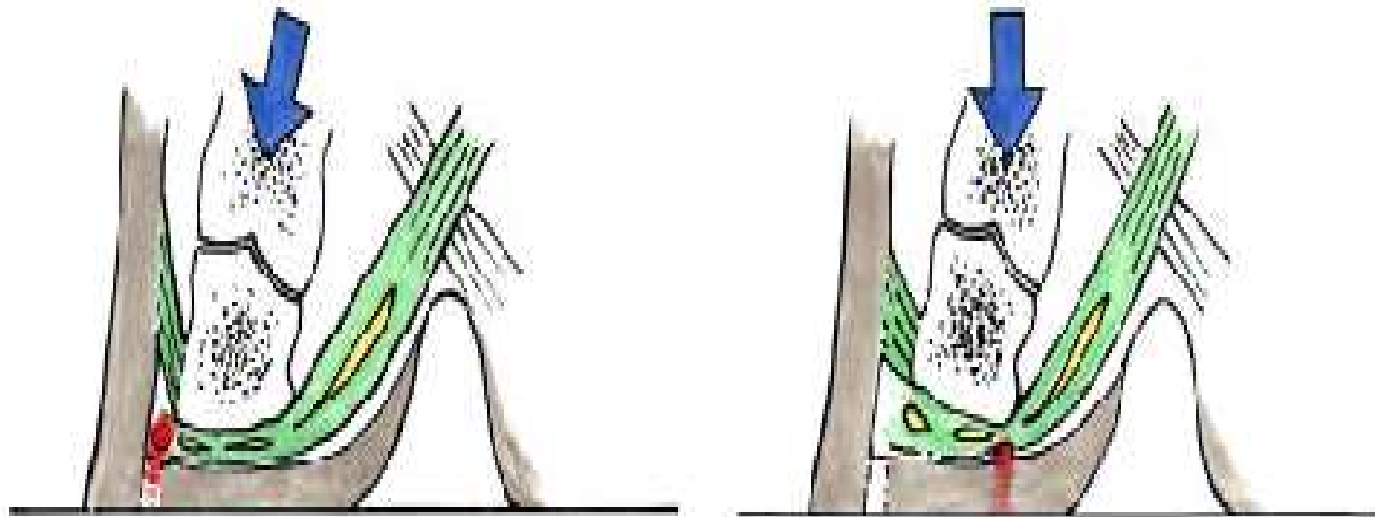


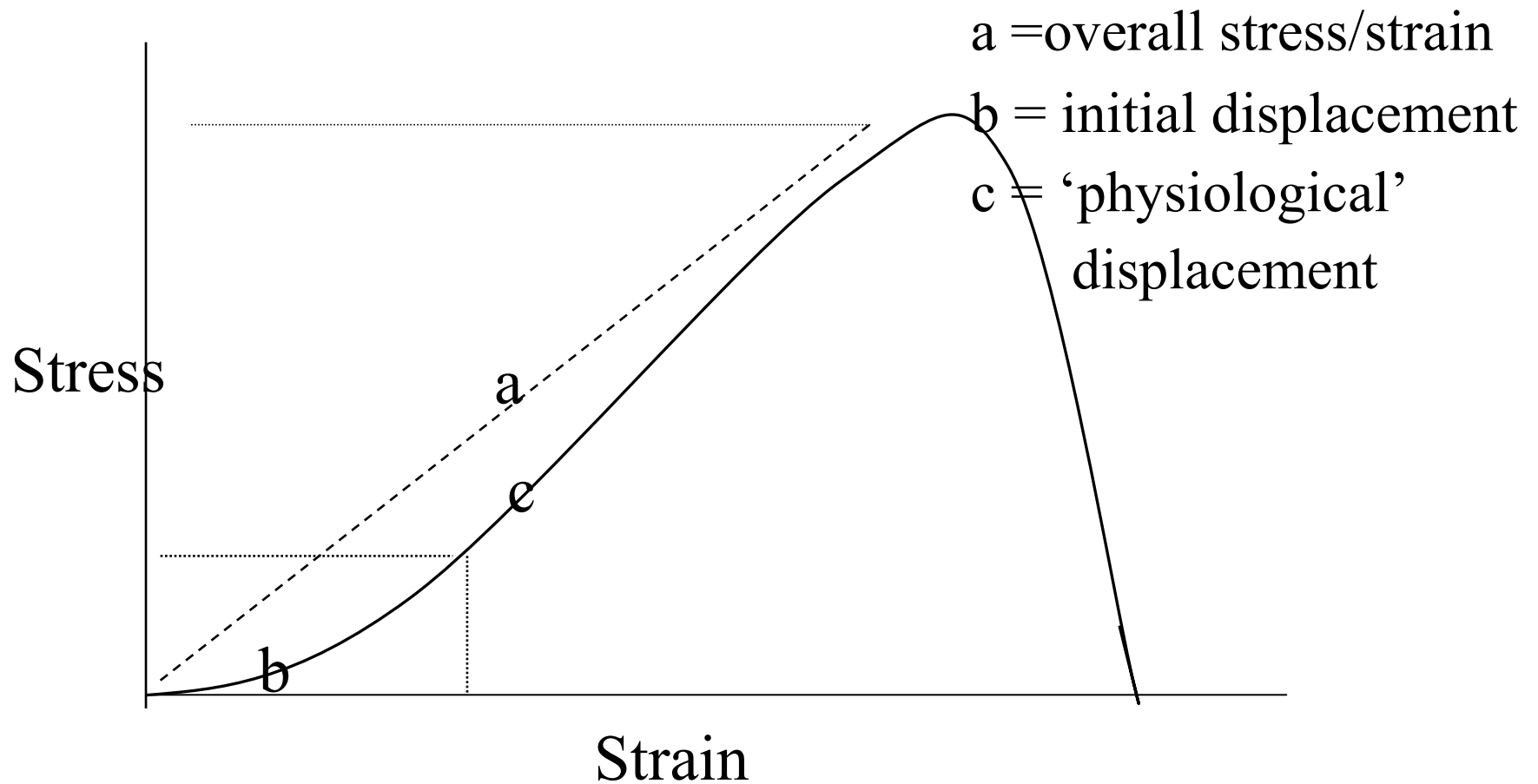
Figure 4: A schematic drawing of the transverse section of the claw at the level of the *tuberculum flexorium* shows how the abaxial side of the third phalanx is suspended by connective tissue



Biomechanics and biochemistry of the support apparatus

- Biomechanics
 - Stress/strain & laxity
- Biochemistry
 - Collagen, elastin
 - Matrix proteinases
 - **MMP2 (maintenance, fibrosis)**
 - **MMP9 (inflammation)**

Stress-strain curve for hoof segments



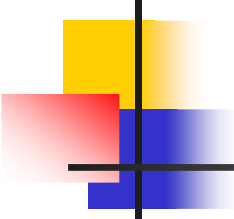


Effects of housing, feeding and parturition on CHD -experimental design

Housing	Feeding	State	Groups
Straw yard	Production (P)	Lactating (L)	YLP (12)
	Production (P)	Maiden (M)	YMP(8)
	Forage (F)	Maiden (M)	YMF(4)
Cubicles	Production (P)	Lactating (L)	CLP (12)
	Production (P)	Maiden (M)	CMP (9)
	Forage (F)	Maiden (M)	CMF (3)

Effects of housing, feeding and lactation on sole lesions and MMPs

Housing	Group	Lesions	ProMMP2	Act MMP2	TIMP2
Straw yard	YLP	12.6	186.7	17.33	37.72
	YMP	3.5	181.1	15.88	39.41
	YMF	3.0	178.1	15.32	33.08
Cubicles	CLP	23.2	334.4	65.67	51.15
	CMP	9.0	263.9	46.22	29.58
	CMF	6.6	202.1	51.70	45.45
Significance	Housing	***	***	***	n.s.
	Diet	n.s.	n.s.	n.s.	n.s.
	Lactation	***	**	**	**



Effects of housing and lactation on biomechanics of the support apparatus

	Resilience (YM)	Laxity	Stress @2MP
Cubicles			
Maiden	15.1	1.34	3.71
Lactating	13.8	1.43	2.93
Straw yard			
Maiden	32.8	0.81	5.81
Lactating	29.0	0.95	4.74
Significance			
House	***	***	***
Lactating	n.s.	*	*



Summary: effects of housing and lactation

- Biomechanics
 - reduced resilience and increased laxity in CH v. SY
 - housing effect exacerbated (slightly) by lactation
- Connective tissues proteinases
 - Maintenance proteinases greater in CH and in lactation
 - No sign of inflammatory proteinases (MMP9)



Lameness control; A HACCP Approach

- Identification of Hazards and identification of critical control points
- Implementation, monitoring and review of actions

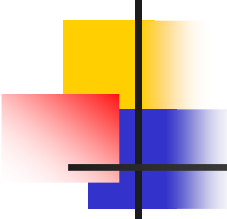


Lameness control: Categorisation of hazards

- Tangible hazards: “on-farm”
 - 80 potential hazards arising from the environment, management or animal condition identified on farm and scored for risk (0-4)
- Proximate hazards: “at-foot”
 - 11 categories of hazard defined on the basis of similar direct actions on the foot.

Categories of proximate hazard:

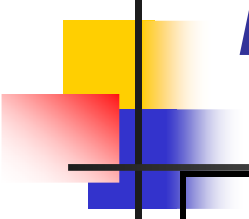
1. Environmental



Proximate hazards	Tangible hazards (examples)
<p>Prolonged standing on concrete</p> <p>Factors that cause claw trauma</p> <p>Slurry/wet conditions underfoot</p> <p>Prolonged standing in slurry</p>	<p>Uncomfortable cubicles, time in collection yard</p> <p>Rough, broken concrete, walkways, hurried herding</p> <p>Slurry remaining after scraping, wet bedding in cubicles</p> <p>Composite of prolonged standing and slurry underfoot.</p>

Categories of proximate hazard: 2.

Managemental



Proximate hazards	Tangible hazards (examples)
Breaches of biosecurity	Open herd, contaminated equipment
Sub-optimal claw shape (SOCC)	Overgrown claws, improper trimming, no trimming policy
Inadequate foot care before calving	DD acquired before calving
Inadequate lameness control	Failures to detect abnormal locomotion, treat feet of lame cows
Inadequate DD detection/control	No foot bathing, inadequate treatment, no records of treatment



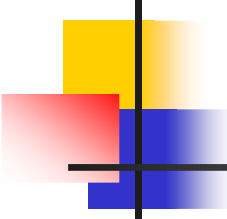
Categories of proximate hazard: **3.** *Animal*

Proximate hazards	Tangible hazards (examples)
Rumen disorders	Poor transition diet, high concentrate feeding in lactation
Heifer phenotype/condition	Poor, variable condition at calving, no selection/culling for conformation

Effects of year^{***}, season (n.s.), year x season (**)
and intervention (n.s.) on unsoundness and severe
lameness

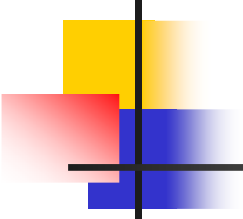
	Winter		Spring		Autumn	
	Y1	Y2	Y1	Y2	Y1	Y2
Rainfall (mm/mo)	52	47	40	60	26	80
Unsound	50.4	54.2	18.3	60.5	31.0	37.8
Intervention	56.0	47.5	27.4	60.7	57.8	57.7
Control						
Severely lame						
Intervention	20.3	15.2	5.9	12.5	9.7	11.6
Control	23.7	16.6	5.7	13.1	17.9	16.8

Ranking of proximate hazards for unsoundness



Proximate hazard	“One-by-one”	“Parsimonious”	
		-SOCC	+SOCC
Standing on concrete	0.504 (0.198)		
Claw trauma	0.469 (0.110)	0.248 (0.114)	
Wet slurry underfoot	0.521 (0.107)	0.347 (0.112)	0.413 (0.105)
Standing in slurry	0.470 (0.101)		
Biosecurity breach	0.255 (0.116)		
SOCC	0.548 (0.099)		0.464 (0.092)
Poor lameness control	0.443 (0.100)	0.310 (0.100)	
Poor DD control	n.s.		
Poor foot care before calving	0.250 (0.100)		
Rumen disorders	0.296 (0.127)		
Heifer phenotype/condition	0.351 (0.116)		

Ranking of proximate hazards for severe lameness



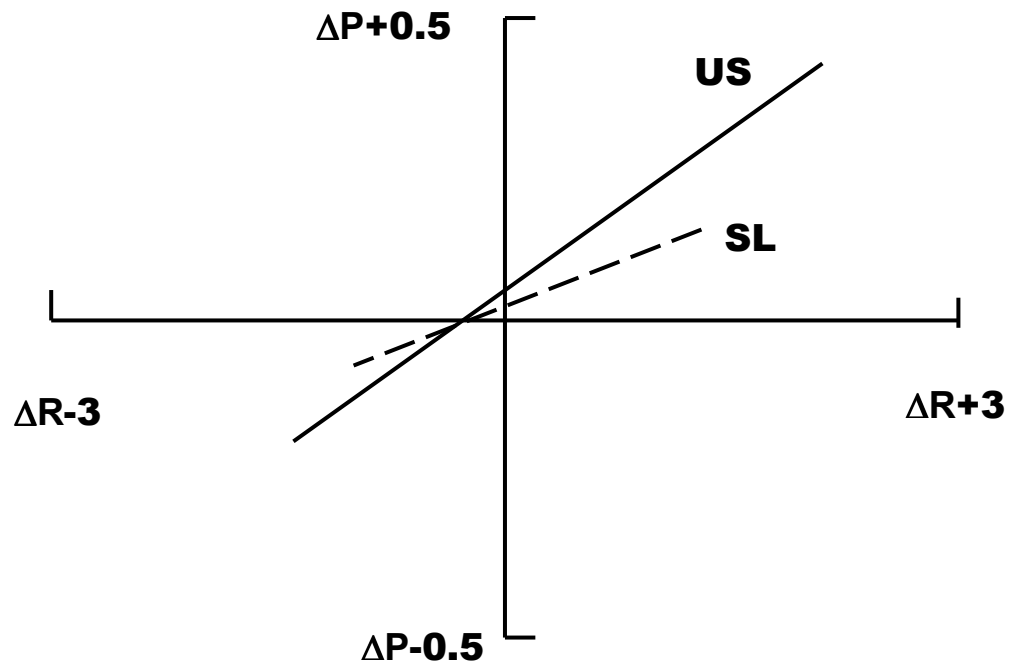
Proximate hazard	“One-by one”	“Parsimonious”	
		-SOCC	+SOCC
Standing on concrete	0.416 (0.134)		
Claw trauma	0.398 (0.135)		
Wet slurry underfoot	0.527 (0.137)	0.275	0.298
Standing in slurry	0.402 (0.127)		
Biosecurity breach	0.466 (0.134)	0.279	
SOCC	0.649 (0.125)		0.428
Poor lameness control	0.591 (0.119)	0.477	0.362
Poor DD control	0.365 (0.126)	0.246	
Poor foot care before calving	0.306 (0.116)		
Rumen disorders	0.325 (0.149)		
Heifer phenotype/condition	0.283 (0.133)		



Calculation of Overall Farm Risk for Unsoundness (US) and Severe Lameness (SL)

- Probability (0-1) of US or SL is the product of:
 - Number of significant hazards
 - Severity of hazards (parameter estimates)
 - Risk score on individual farms for significant hazards.
- For example:
 - $OFR,SL = (0.258 \times 1.5) + (0.428 \times 2.0) + (0.362 \times 2.0)$
 - Slurry SOCC poor control

Effect of changes in OFR on change in probability of US and SL





Proximate hazard (PH) analysis: summary

- Intervention strategy (in this trial) did not succeed, however changes (Y3-Y1) in unsoundness and severe lameness did reflect changes in OFR
- We offer a testable approach for:
 - ranking *generic* severity of hazards
 - Identifying critical control points
 - Scoring *on-farm* risks associated with each PH
 - Calculating overall farm risk (OFR)



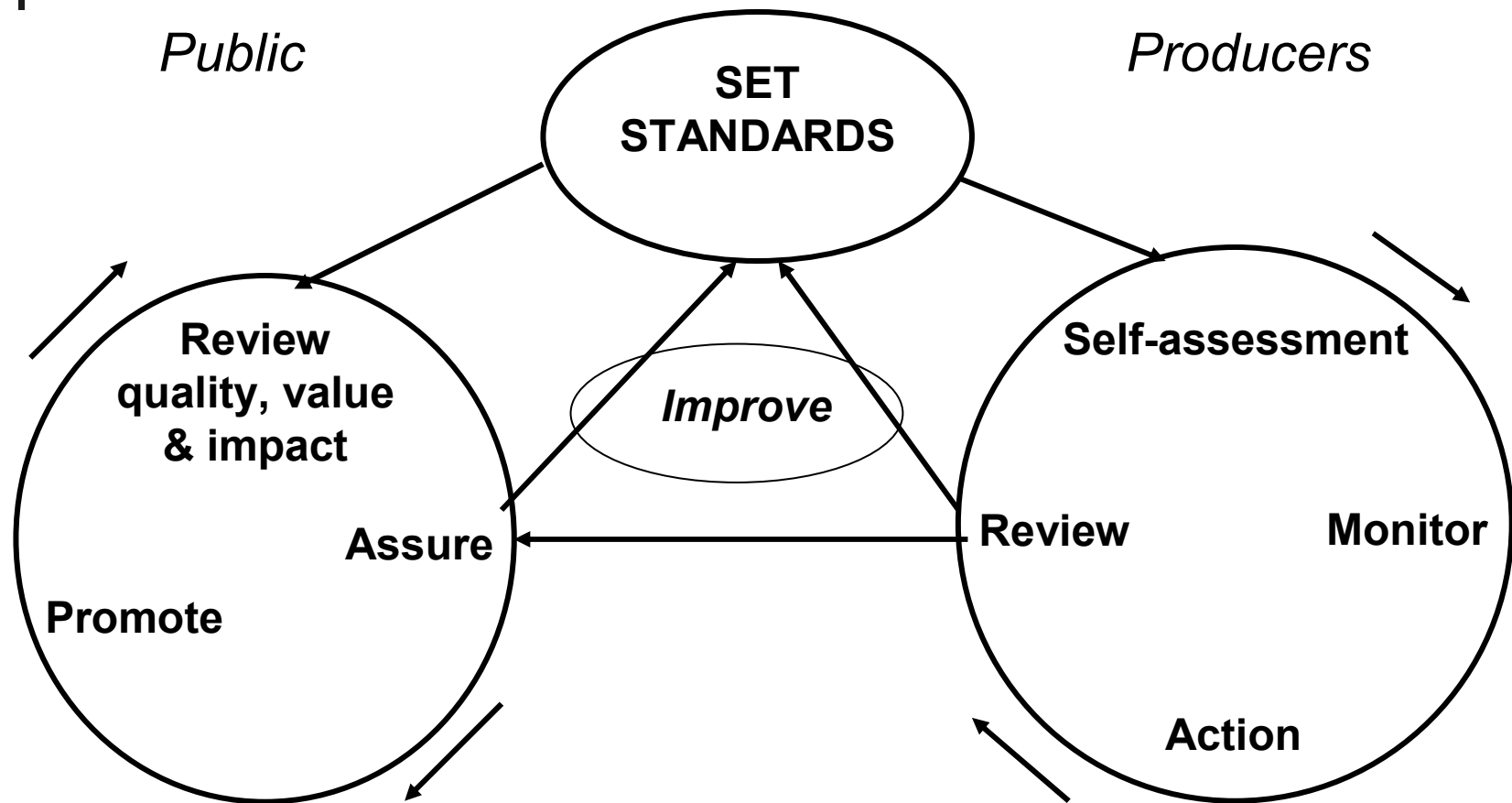
Welfare Quality:

Part 1. Action for farm animals

- Promotion of animal wellbeing (“fit and happy”) through:
 - Evidence of good husbandry
 - Monitoring of welfare
 - Effective action to address welfare problems (?)
 - Review of actions (?)
 - Rewards for good husbandry (?)

The "Virtuous Bicycle"

- a delivery vehicle for improved farm animal welfare





Quality control: The Producer Cycle

- **Self-assessment (of resources)**
 - Saves time, bureaucracy
 - Farmer knows most (if not best)
- **Independent monitoring (of welfare outcomes)**
 - proven robust methods
 - can concentrate on major issues (need not always be exhaustive-saves time)
- **Action plan**
 - Compliance depends on perceived reward to farmer
- **Reassessment**
 - benchmarking provides incentives for improvement
 - Non-compliance results from failure to take effective action



Meat (milk) and right - *“less is more”*

- For the consumer
 - better health, better conscience
- For the animals
 - Better husbandry, health and welfare
- For farmers
 - Better quality of life
- For the living environment
 - Survival!