Management Practices and Pork Quality

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Areas Discussed

- What is “Management”?
- What is “Pork Quality”?
- Link between “Management” and “Quality”
- Transport losses

Management?

"The organization and control of the way something operates"

Includes all aspects from "conception to consumption"

Focus of this presentation:

"Pre-harvest animal handling"

Pre-harvest Pig Handling

- Narrow definition
  - How pigs are moved at the farm and at the plant
- Broader definition
  - Involves all factors that can affect the animal from leaving the farm pen to arriving at the point of harvest

Pork Quality?

- Quality is complex
  - Multi-faceted and multi-factorial
- Components
  - Compositional
  - Nutritional
  - Technological
  - Toxicological
  - Sensorial
  - Hygienic

Link between Pre-harvest Pig Handling in Pork Quality

- The process of “handling” of pigs between the farm and the point of harvest results in “stress” on the animal and increased activity

- “Stress” and activity change:
  - Muscle metabolism both pre- and post-harvest
  - Muscle energy levels
  - Muscle temperature

- Postmortem, result in changes in:
  - Muscle pH and temperature
  - Muscle color and water-holding capacity

Stress and Pork Quality

- Key issues are the intensity and timing of pre-slaughter stress

- Short-term “acute” stress
  - Close to harvest
  - Influences the incidence of PSE via rate of post-mortem glycolysis and muscle temperature

- Longer term “chronic” stress
  - 24 hours pre-harvest
  - Influences the incidence of DFD via muscle glycogen levels at harvest

Losses During Transport: Definitions

Losses up to the scale in the slaughter plant

Dead on Arrival

Non-ambulatory

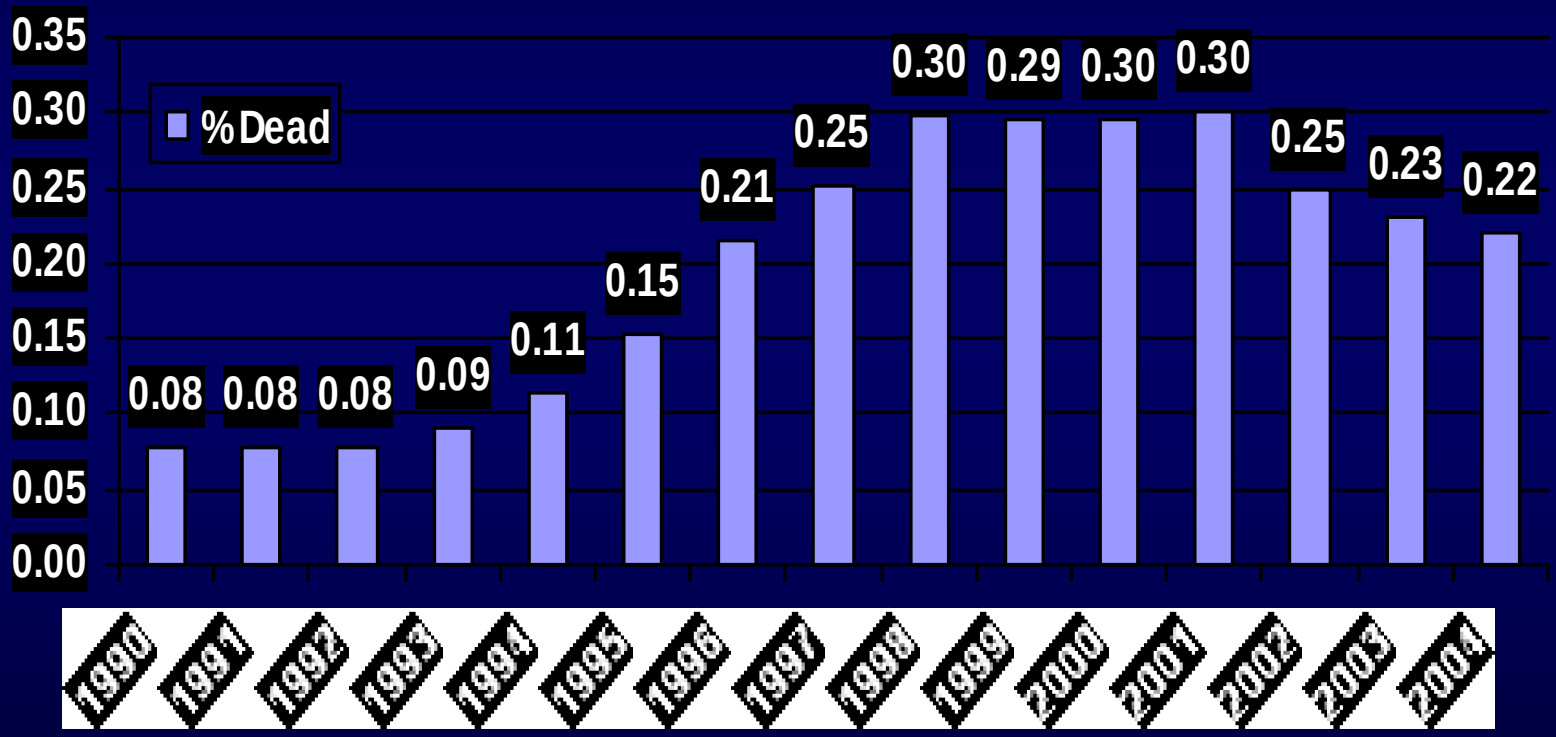
INJURED (NAI)

NON-INJURED (NANI)

Slows, Subjects, Suspects, Downers

FATIGUED

Incidence of Dead Pigs Arriving at US Packing Plants (1990-2004)



FSIS, 1990 –2004, FY Oct-Sept

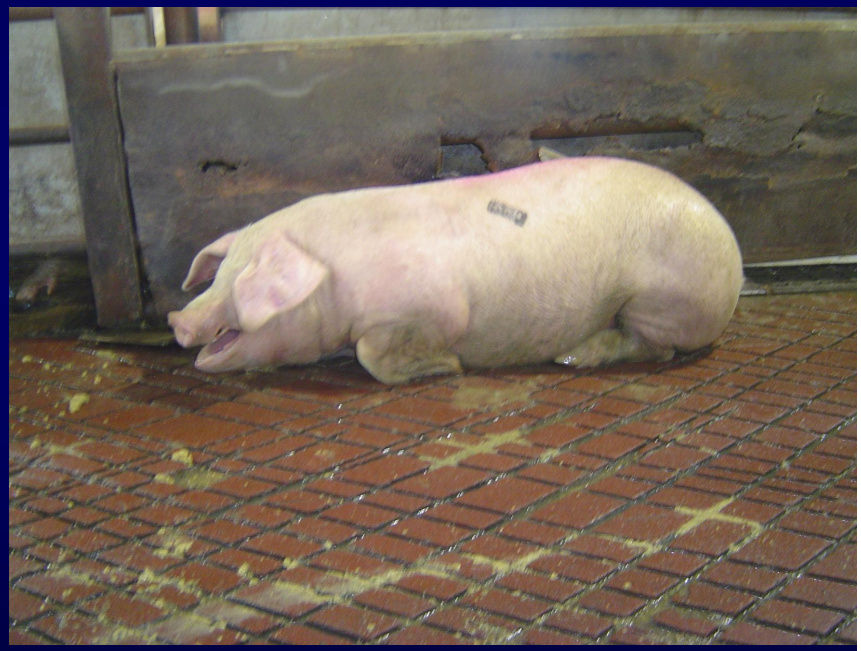
Incidence of Fatigued Pigs at the Plant?

- No national statistics available
- Field studies = ~ 0.2% to 1.0%
- Total transport losses = ~0.5 to 1.3% of pigs transported

Fatigued Pigs - Symptoms

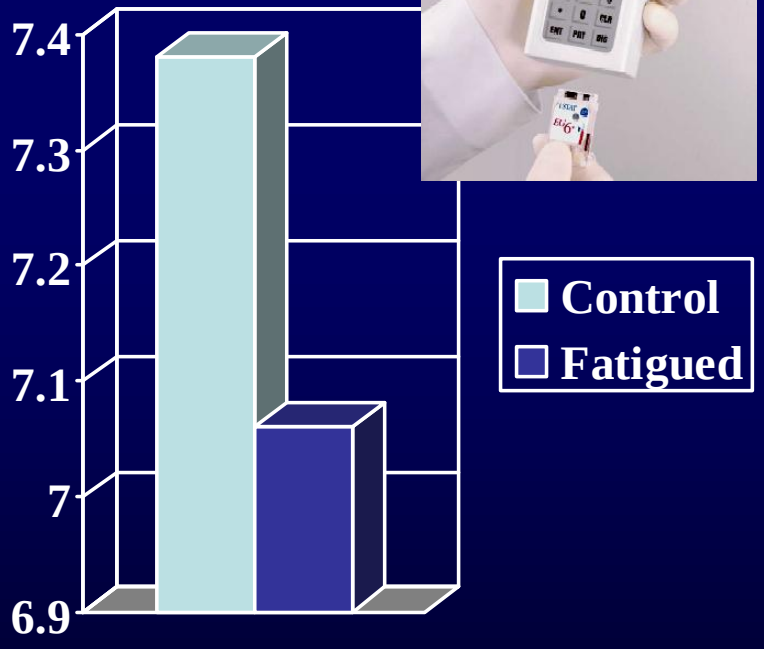
Symptoms characteristic of an extreme stress response

- **Open-mouthed breathing**
- **Skin discoloration**
- **Muscle tremors**
- **Unresponsiveness to stimuli to move**
- **Characteristic vocalization**



Metabolic Changes in Fatigued Pigs

- Metabolic acidosis:
  - Increase in blood lactate
  - Decrease in blood pH
- Elevated body temperature



Anderson et al., 2003

“Accumulation” of Stress

Normal Pig

↓ Stress

Open-Mouth Breathing

Skin Discoloration

Refuses to move

↓ Stress

Abnormal Vocalization

Muscle Tremors

Collapse = Fatigued

↓ Stress

Death

Fatigued Pigs

- Fatigued pigs can occur at any stage from the farm to the point of slaughter
- Most (if not all) pigs will become fatigued if subjected to sufficient stress
- Individual stressors may be additive
- Most fatigued pigs will recover given sufficient time in a “minimum stress” environment

IS THERE A LINK BETWEEN TRANSPORT LOSSES & PORK QUALITY?

Pork Quality of Fatigued Pigs

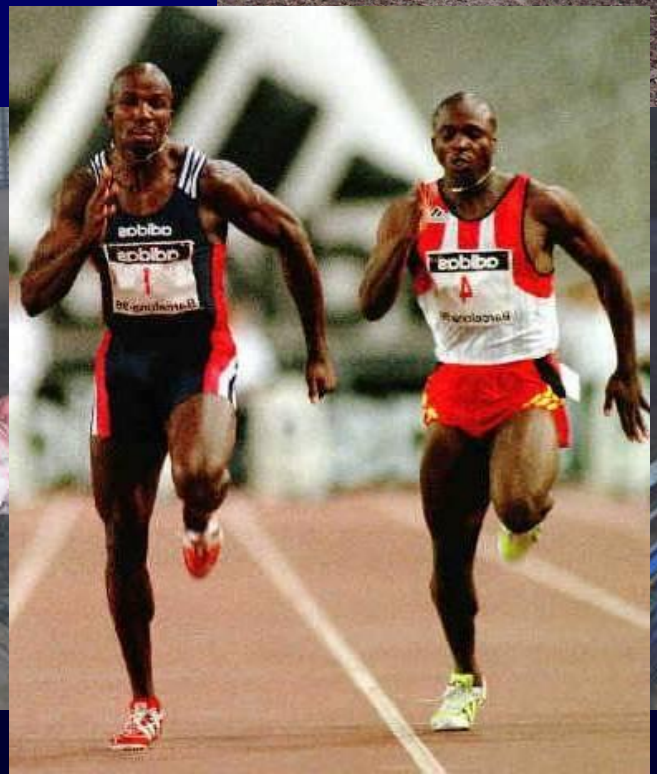
	Plant A	Plant B	Plant C	Plant D	Overall
Ultimate pH	6.20	6.00	5.96	5.90	6.00
Subj. Color[a]	3.8	4.0	3.6	3.7	3.8
Minolta L*	46.1	43.8	46.6	46.3	45.7
Drip loss, %	1.97	1.42	2.37	1.74	1.91

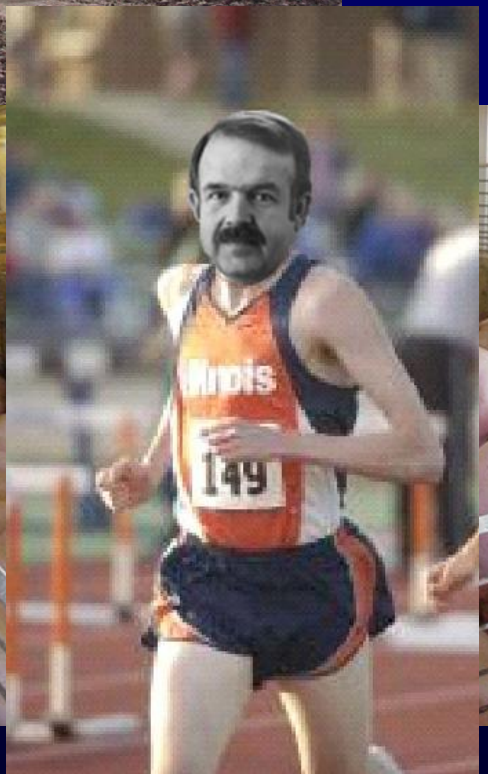
[a]NPPC, 1999 (1-6)

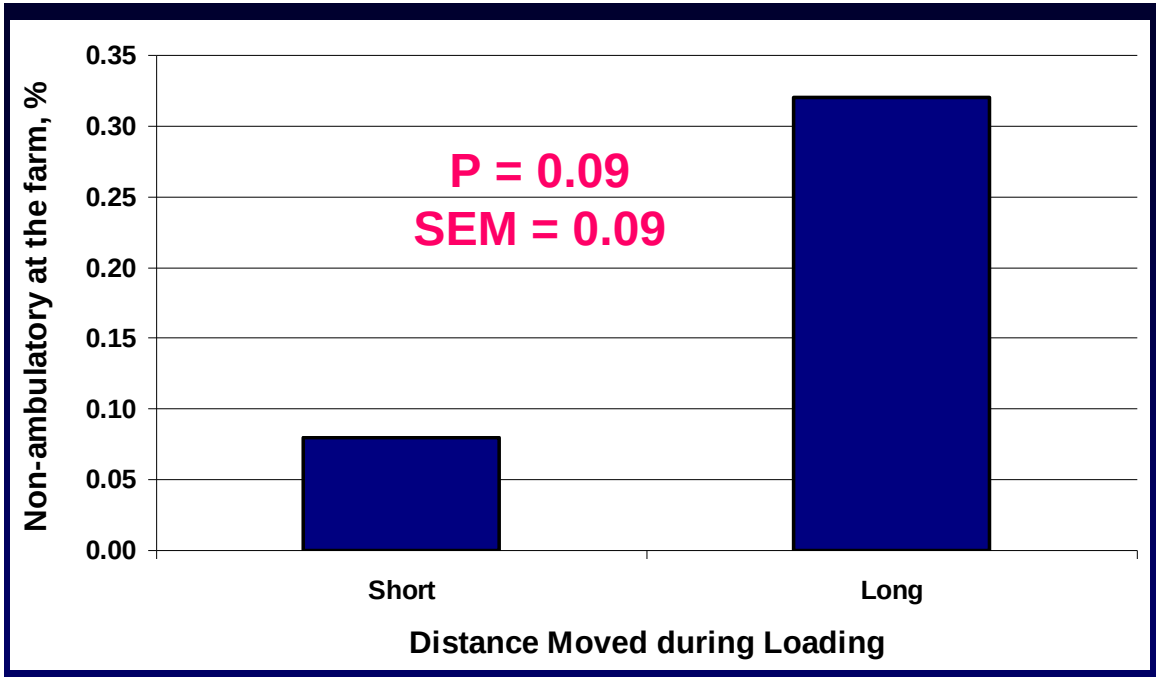
Carr et al., (2005)

Animal Handling Factors at the Farm Associated with Stress/Transport Losses

- Facility design
  - Aisle width
  - Length of building (distance from pen to truck)
  - Ramp height and angle
- Temperature & humidity (season, time of day)
- Handling intensity
- Pre-sorting of pigs prior to loading
- Fasting time





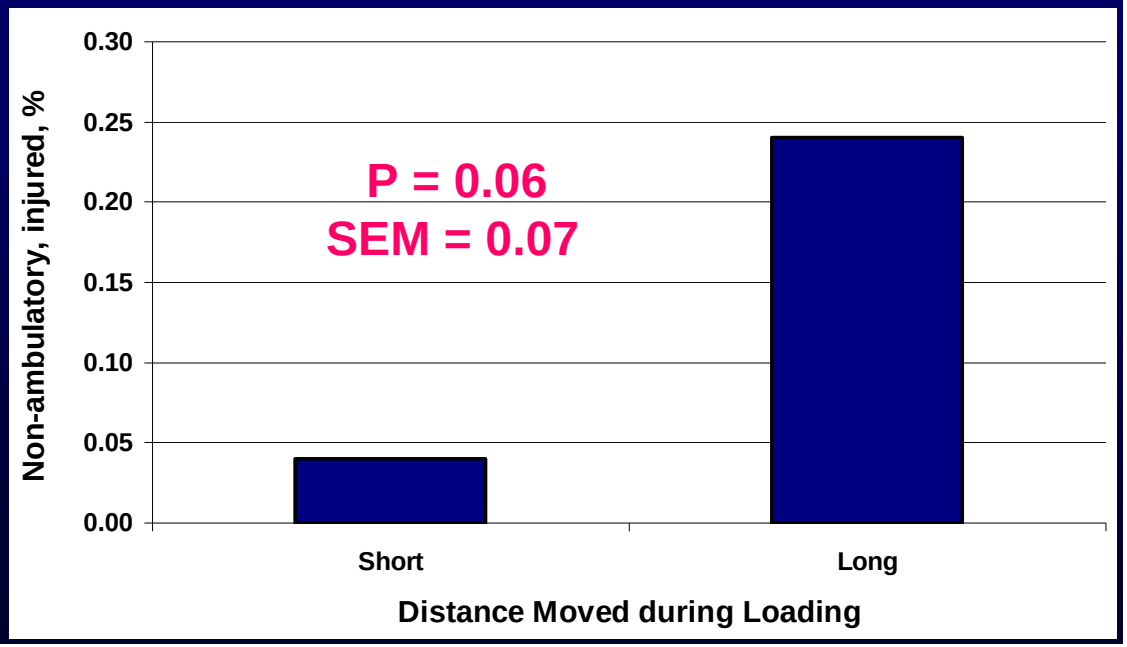


Non-ambulatory pigs at the Farm

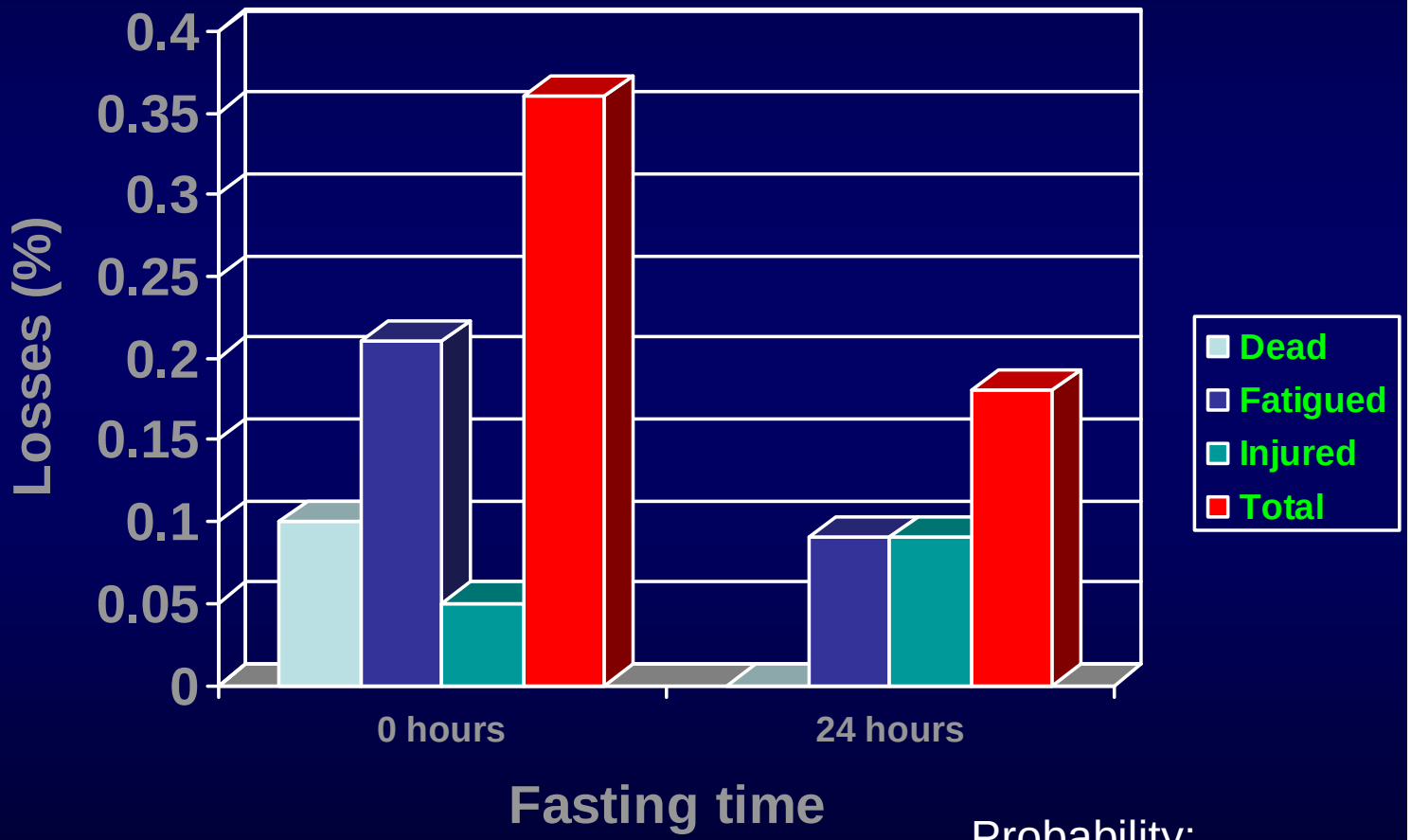
DISTANCE MOVED
SHORT = 0 to 30 meters
LONG = 60 to 90 meters

Ritter, 2006
109 loads = ~17,000 pigs

Non-ambulatory, injured pigs at the plant



Influence of fasting time on transportation losses



Ritter, 2006
72 loads = ~11,000 pigs

Probability:
Dead = 0.16
Total losses = 0.31

Transport

Transport Factors Associated with Stress/Transport Losses

- Trailer design
- "Environment" on the trailer:
  - Temperature and humidity
  - Air movement
  - Sprinkler cooling
  - Mixing of pigs on the truck
  - Floor space
- Times for:
  - Loading and unloading
  - Transport
  - Waiting at the farm and plant
- Transport distance and driving conditions

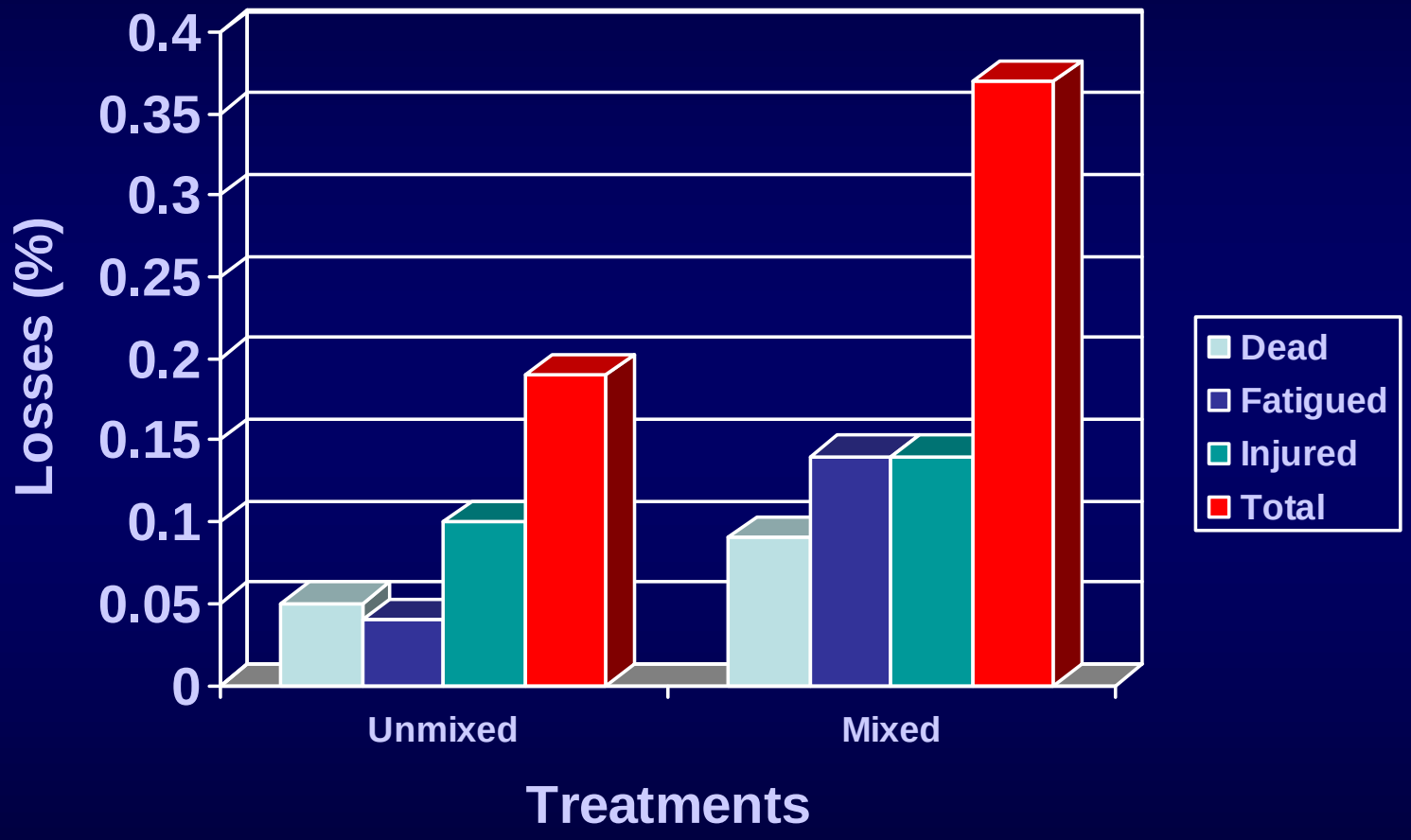
Trailer Design

	Straight	Potbelly	
Unloading time, min	20	36	
Open-mouth breathing after unloading, % of pigs			
Spring	1.3	4.9	**
Summer	2.1	6.2	**
Fall	1.9	2.0	
Winter	0.9	2.7	
Total transport losses, %	0.85	0.96	

Ritter, 2006
109 loads = ~17,000 pigs

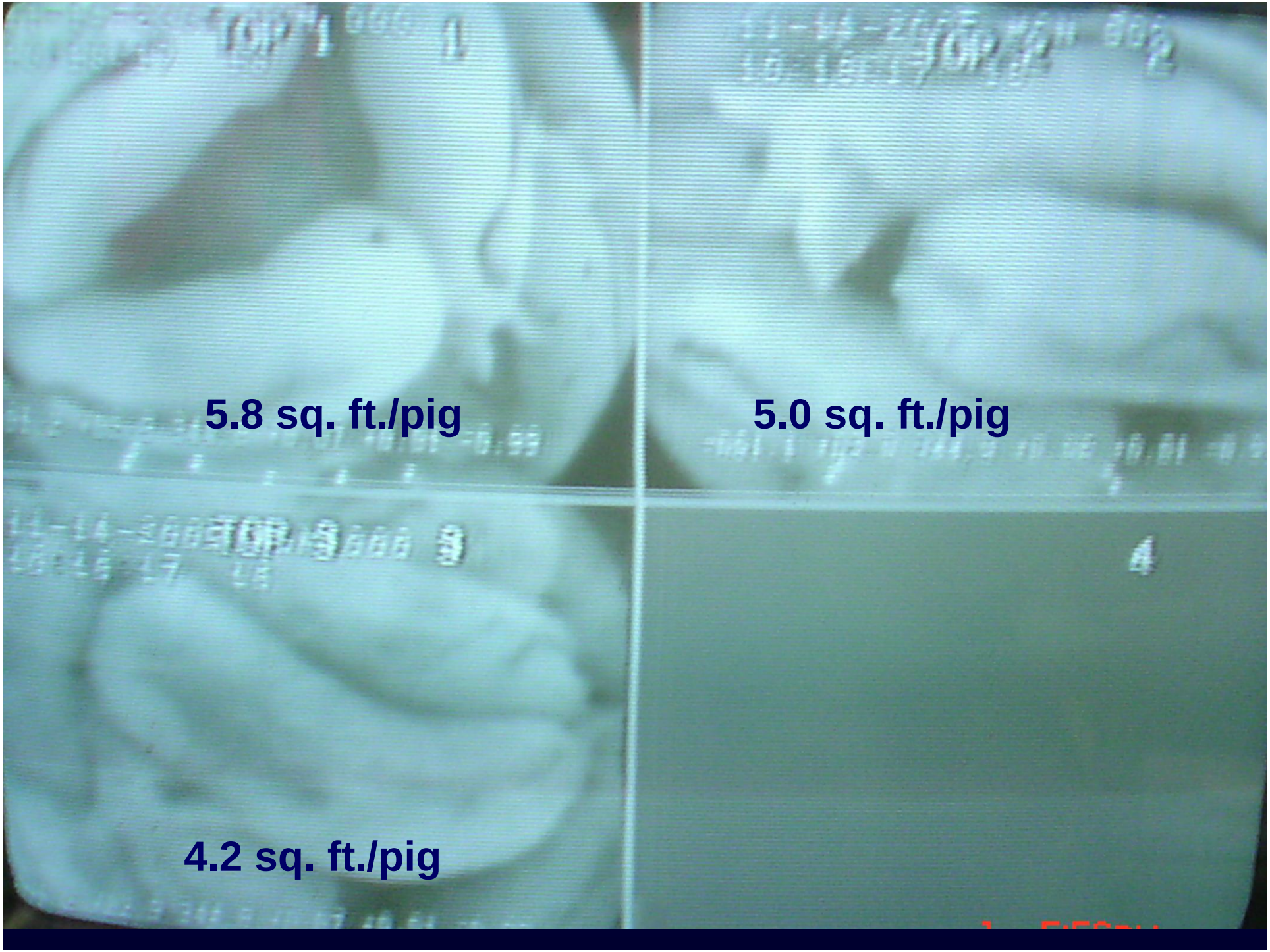
** = P < 0.01

Influence of mixing of pigs from different farm groups on the trailer on transportation losses

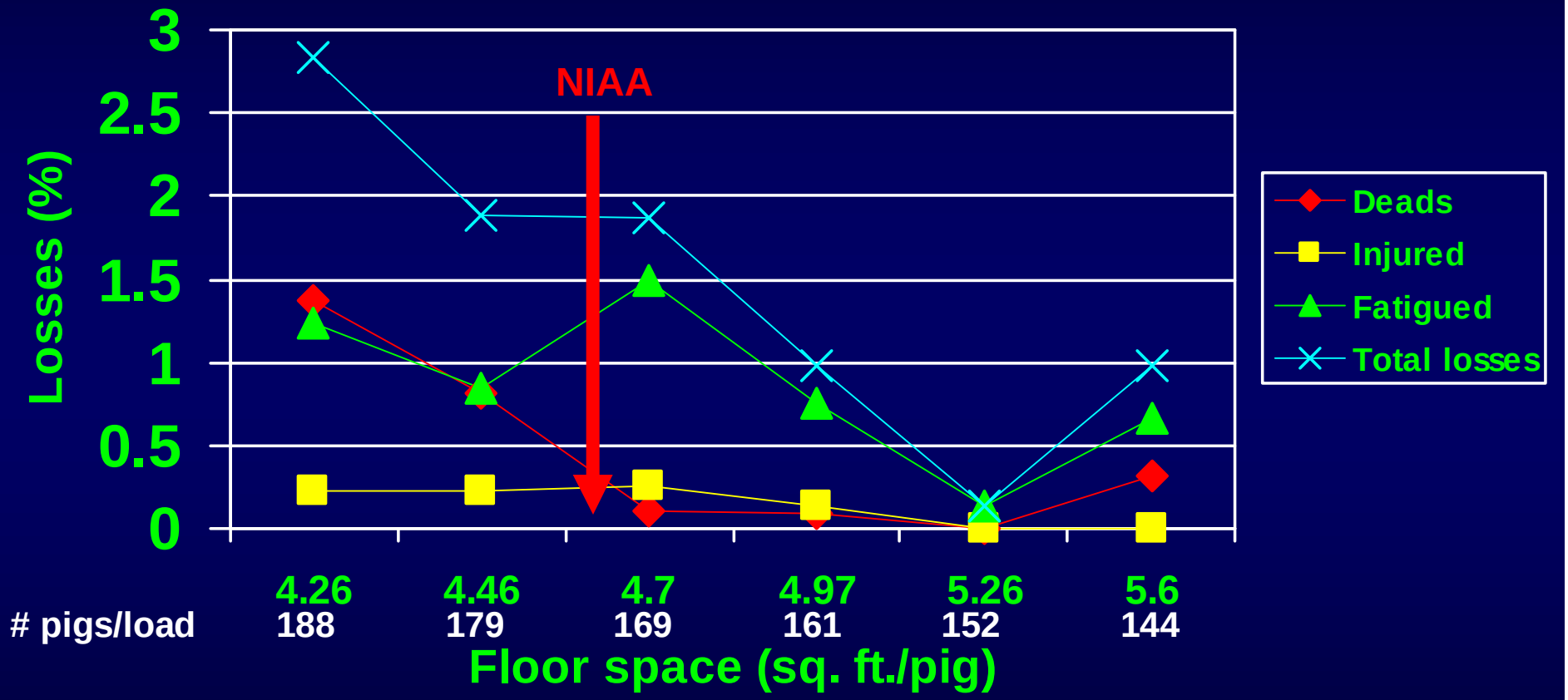


Ritter, 2006
72 loads = ~ 11,000 pigs

Probability:
Fatigued = 0.34
Total losses = 0.34


5.8 sq. ft./pig
5.0 sq. ft./pig
4.2 sq. ft./pig

Influence of floor space on the truck on transport losses



Mean pig weight = 288 lb

NIAA recommendations: 250 lb = 4.26 sq. ft./pig; 300 lb = 4.79 sq. ft./pig

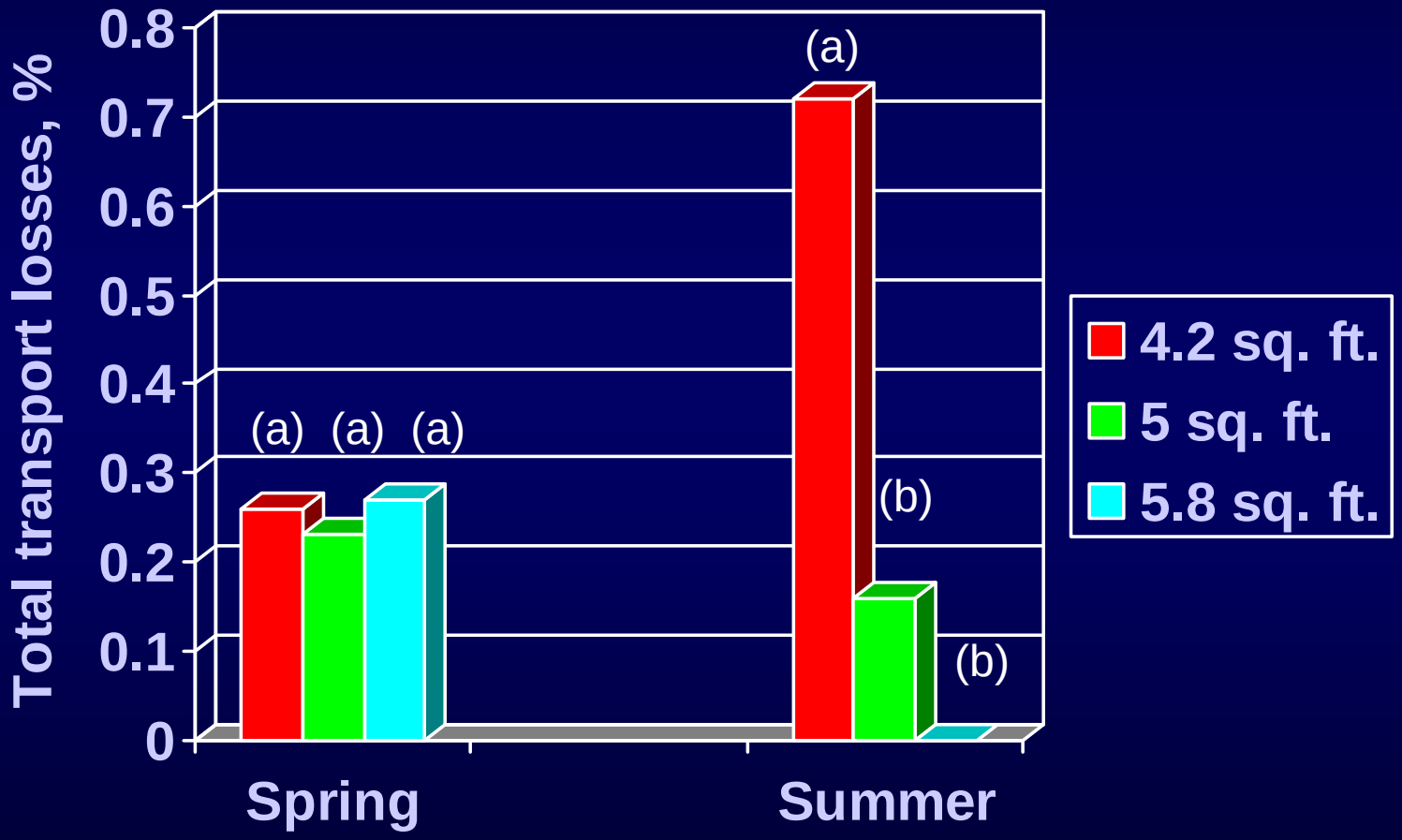
Ritter, 2006

42 loads = ~6,000 pigs

TOP 2

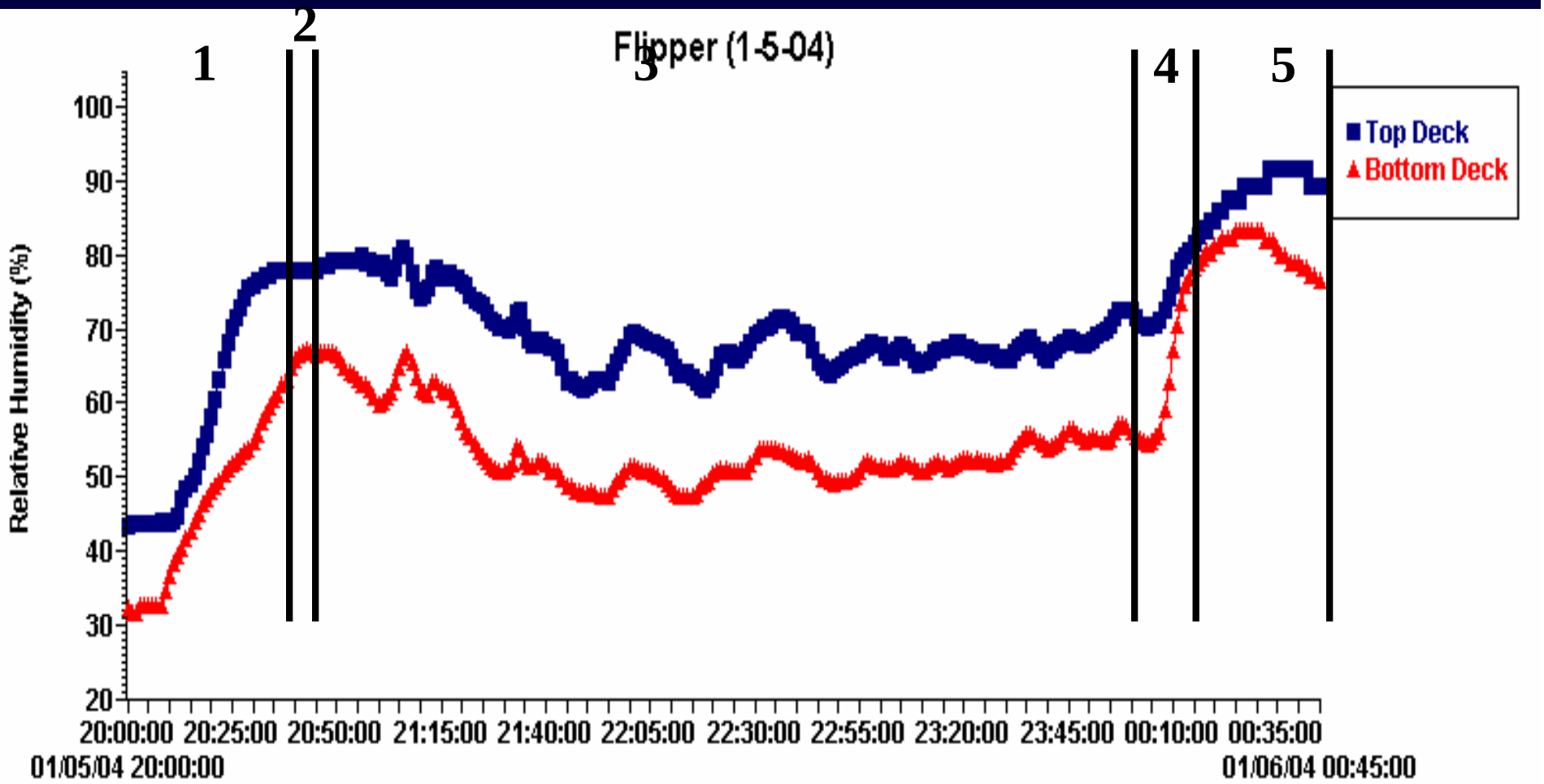
TOP 3000 3
18

Interaction between Floor Space on the Trailer and Season for Transport Losses



Ritter, 2006
72 loads = ~11,000 pigs

Relative humidity changes in the trailer
Winter Load



1: Loading (38 min)
2: Wait at the farm (7 min)
3: Transport (193 min)
4: Wait at Plant (17 min)
5: Unloading (30 min)

Conclusions

- This is not BIOTECHNOLOGY
- Pigs experience a wide range of potential stressors from the farm through to the point of harvest that can influence:
  - transport losses
  - pork color and water-holding capacity
- Our knowledge of the impact of many of these “management factors” is limited

Acknowledgement

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