TEXAS TECH UNIVERSITY™

Bedding and boarding while transporting pigs to slaughter-choosing the right amount

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Overview and Background

- Total number of pigs transported each year: over 100 million
- Rate of DOA: 0.17%
- Rate of NA: > 0.2%
- Pigs with negative welfare problems during transport to market: over 40,000 per year

Overview and Background

Issues:

- Welfare issue
- Public concern
- Economic impact for both farm and plant

So, a major issue

$$$$$$

Overview and Background

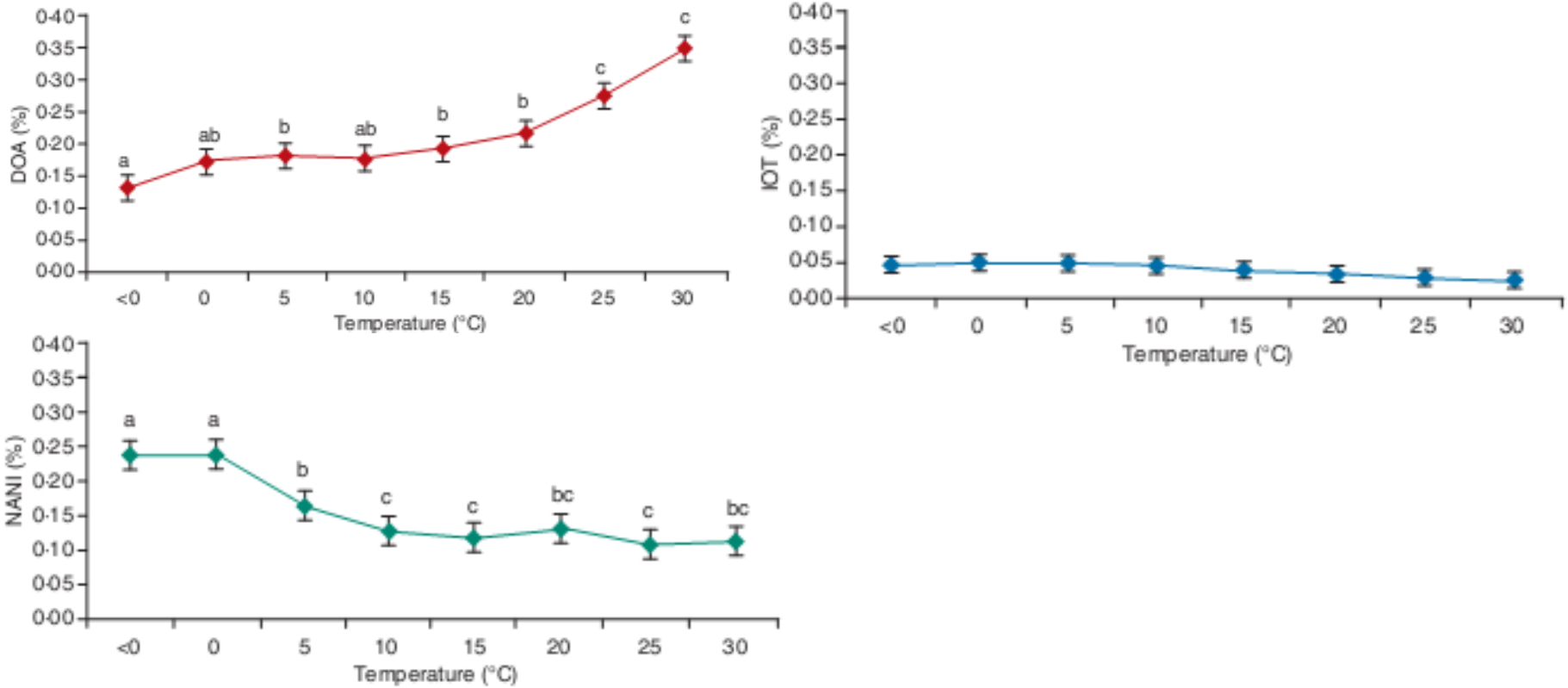
•At temperatures 0 to 5 C, less NANI pigs with dry bedding as compared to no bedding

•But overall, percentage of DOA and IOT pigs was less in dry bedding trailer as compared to no bedding, but percentage of NANI pigs was higher as compared to no or wet bedding. (Sutherland et al, 2009)

Measure	Number of trailer loads	DOA	IOT	NANI	N&D
Bedding					
Dry	9220	0·167[c] (0·011)	0·038[c] (0·003)	0·255[d] (0·009)	0·460 (0·016)
None	3359	0·204[d] (0·016)	0·066[d] (0·005)	0·162[b] (0·014)	0·432 (0·023)
Wet	3711	0·177[cd] (0·019)	0·052[d] (0·006)	0·207[c] (0·017)	0·436 (0·028)

DOA: dead on arrival, IOT: injured in trailer, NANI: down on trailer or before weighing (non ambulatory, non injured), N&D: total dead

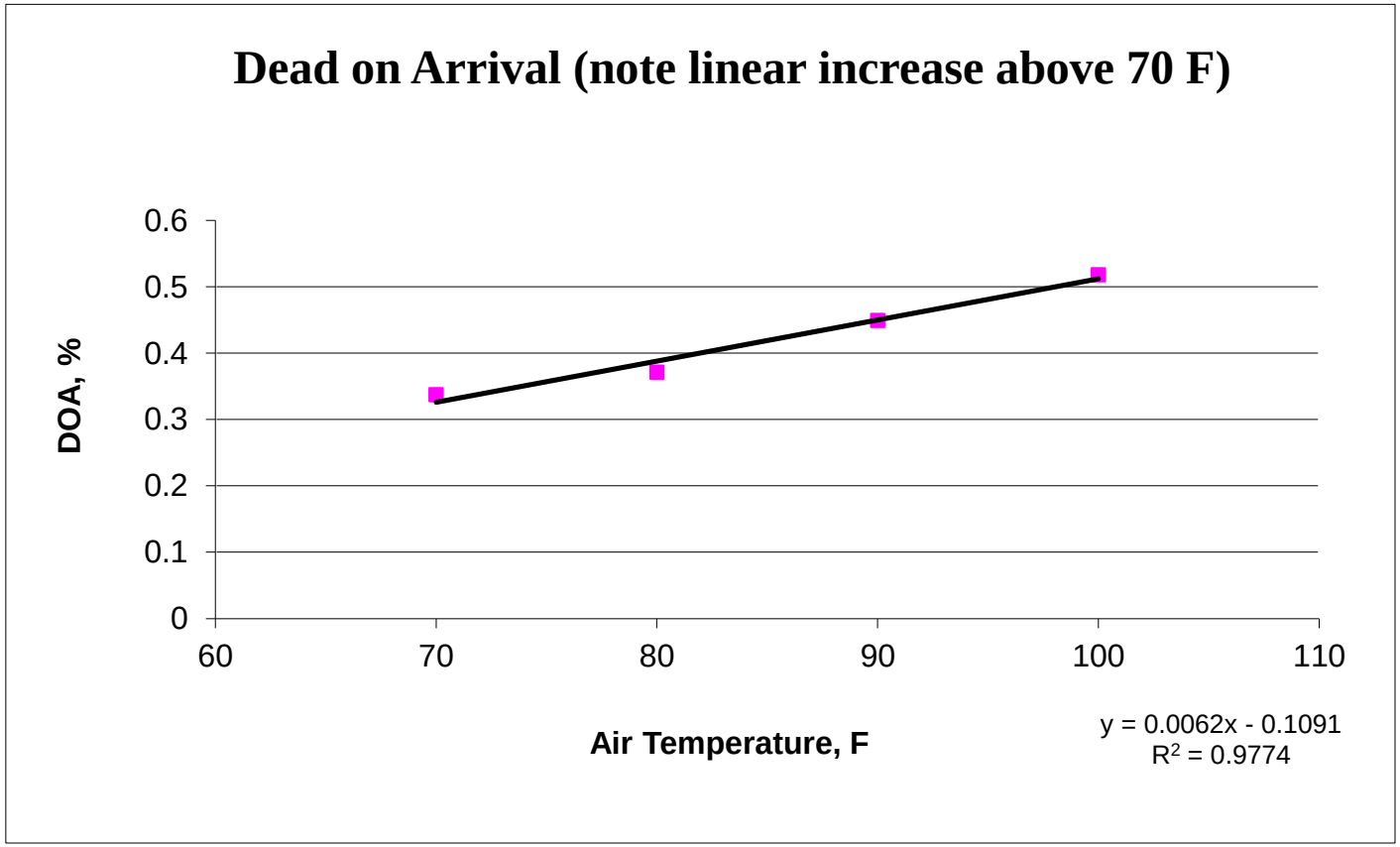
Overview and Background



Field data indicate that the rate of non-ambulatory, non-injured pigs increases in **cold weather,** but DOA rate increases with outside temperature (Sutherland, 2009).

Background

Field data indicate that the rate of DOA pigs increases in **warm weather** (Sutherland, 2009).



How to reduce losses??

- Selection of right breed
- Proper handling techniques
- Following a proper guideline and method
- Modifications in existing facilities

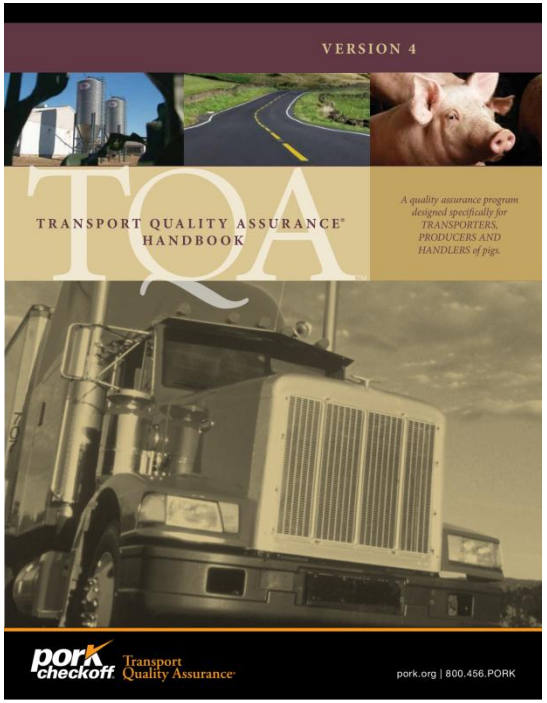
Ultimate??

The ultimate research goal is to develop industry recommendations for internal trailer environment management protocols that will optimize internal trailer temperature, maintain pig comfort and core body temperature and minimize transport losses.

TQA Program

According to TQA Handbook, in driver code of ethics,

- Transporter must have access to clean bedding approved by the packer, and must be used during transport.
- Provide extra bedding (wood shavings, wheat straw, corn stubble) during winter



TQA Program

TQA recommendations:

Truck Set – Up Procedures During Temperature Extremes			
Air Temp (°F)	Bedding	Side-Slats	
<10	Heavy	90% Closed	10% Open*
10-20	Medium	75% Closed	25% Open*
20-40	Medium	50% Closed	50% Open
40-50	Light	25% Closed	75% Open
> 50	Light†	0% Closed	100% Open

* Minimum openings are needed for ventilation even in the coldest weather.
† Consider using sand or wetting bedding if it is not too humid and trucks are moving.

Bedding Study

Objective

• To define the bedding requirements of pigs during transportation in commercial settings during:

- Cold weather
- Mild weather
- Warm weather

Study Design and Sample Size

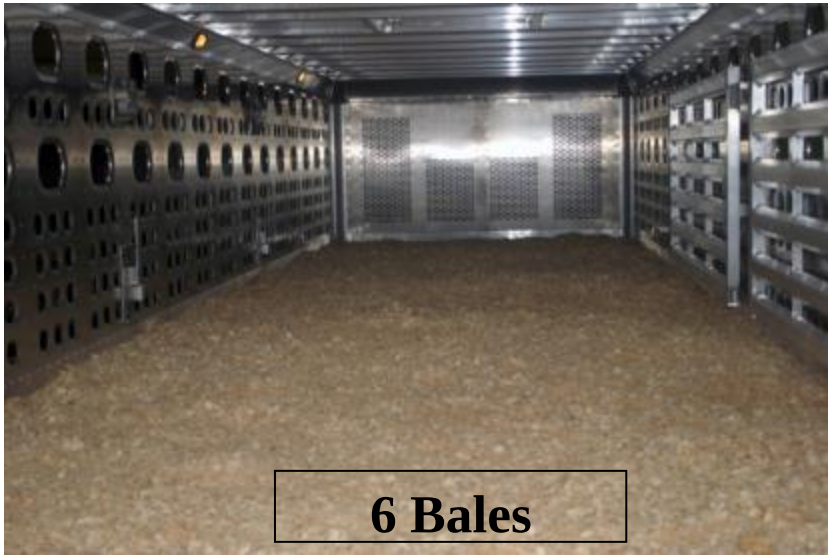
Months	Bedding levels, bales/trailer*	Air Temperature Range
Jan-Feb	6, 12	8 to 68 F -13 to 20 C
March-May	3, 6, 12	28 to 70 F -2 to 21 C
June-July	3, 5, 7, 9	61 to 113 F 16 to 45 C

* 22.7 kg/bale or 50 lb
0.2 m^3/bale or 7 ft^3/bale

Background

Number of bales/deck	mm	inches	Eights of an inch
1	9.5	3/8	3/8
1.5	11.1	3.5/8	3.5/8
3	15.9	5/8	5/8
6	25.4	1	8/8

For a straight deck 53’ X 102” trailer



Study Design and Sample Size

Months	Temperature	Number Trailers	Number pigs
Jan-Feb	Cold	174	28,855
March-May	Mild	345	58,007
June-July	Warm	254	41,824
Total	--	773	128,686

Materials and Methods

At finishing site:

- Random assignment of bedding level
- Information on bedding level, number of loads on that bedding, boarding percentage
- Five sensors collected temperature and humidity in different four compartments and one outside the trailer from start of load to unload
- Handling methods, handling devices, intensity (on a scale of 1 to 5, 1 being the mildest; 5 being aggressive/abusive)

Materials and methods

At finishing site:

- Number of vocalizations, slips/falls, signs of stress
- Management aspects of farms: type of barn, facilities like pen size, aisle, chute, floor type, walls etc., and weather information (temperature, humidity, and wind speed)
- Surface skin temperatures on the pigs flank/side of 10 randomly selected pigs (5 of first 50 and 5 of last 50 pigs loaded into the trailer) in each load using laser thermometer with sensitivity of 0.1˚F

Materials and methods

At plant:

- Air temperature, humidity, surface temperature of 10 pigs (as in finishing site)
- Handling device(s), handling intensity (as in finishing site), vocalizations, slips/falls, time of arrival, waiting and unloading
- Collected bedding samples to determine moisture %
- Record DOA, NA and D & D in each trip

Statistical Analysis

Primary models, by season, effects of:

- Level of bedding
- Air temperature (in 5˚C bins)
- Interaction of bedding and air temperature

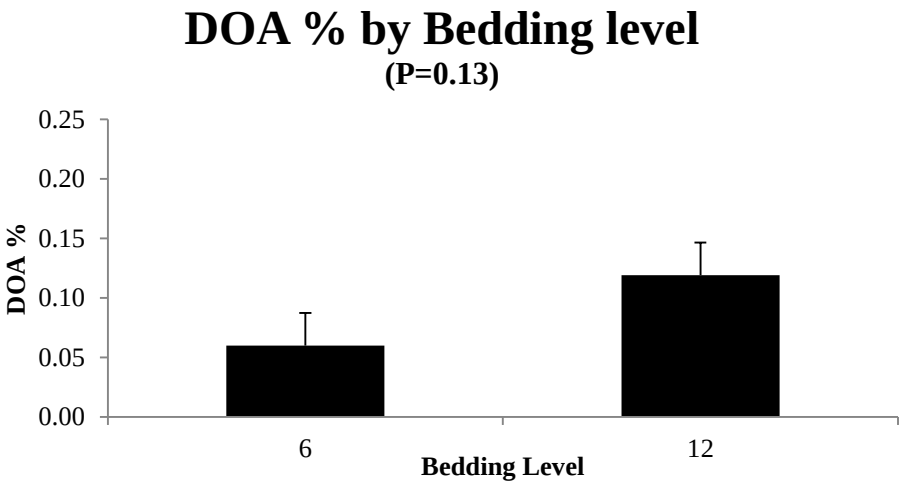
All data entered in Excel and analyzed using SAS (General Linear Model). Regression lines calculated using Excel and SAS.

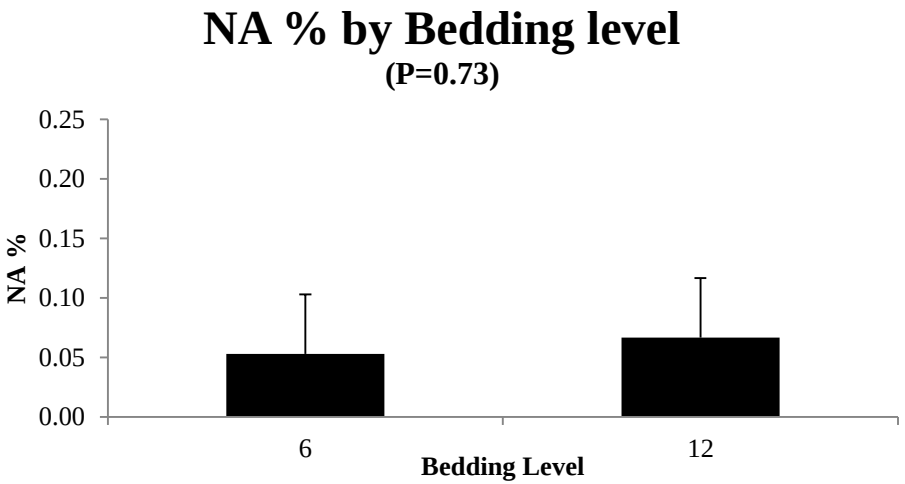
Results

Ranges of conditions during data collection:

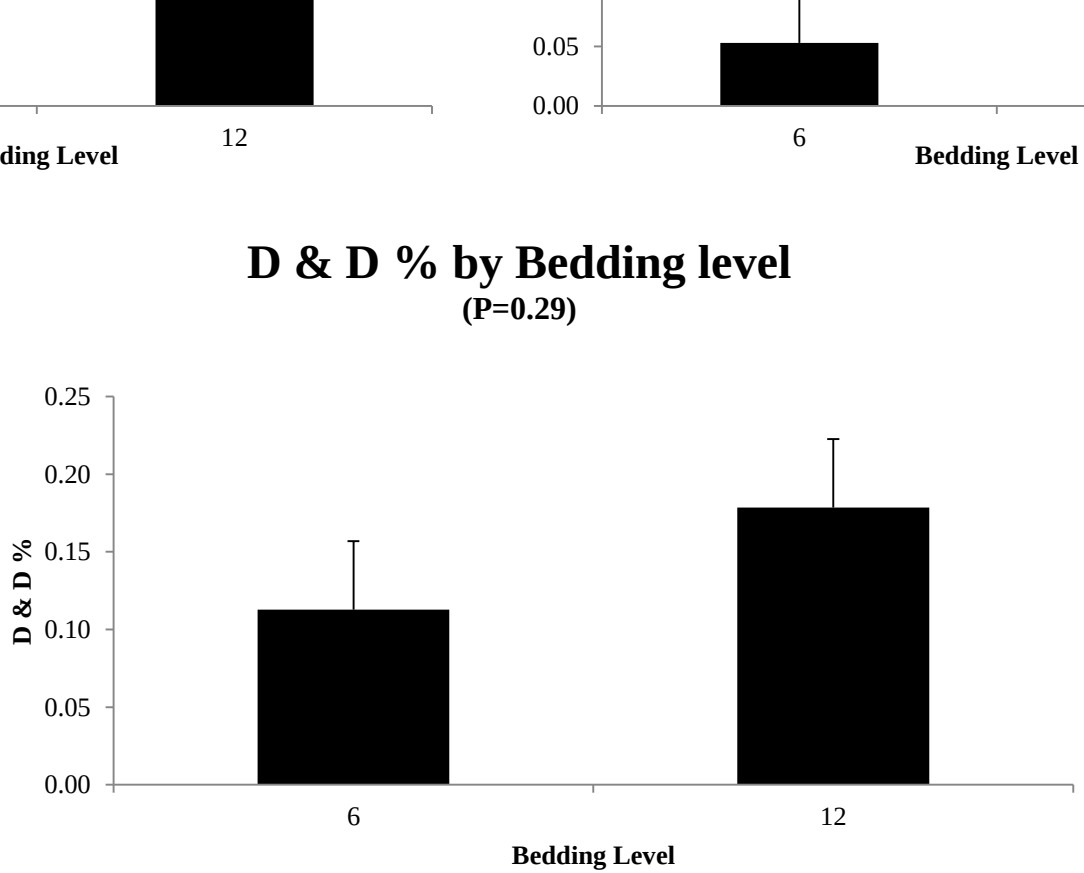
- Load time: 13 to 94 min
- Transit time: 16 to 459 min
- Waiting time at plant: 0 to 198 min
- Total D & D in a trip: 0 to 8
- Handing Intensity ranged: 1-5
- 43/440 (9.8%) loads at finishing sites had a handling intensity of 5 (aggressive, abusive)
- 1/429 (0.23%) observations at plants had a handling intensity of 5

Results – Jan-Feb Bedding Effects

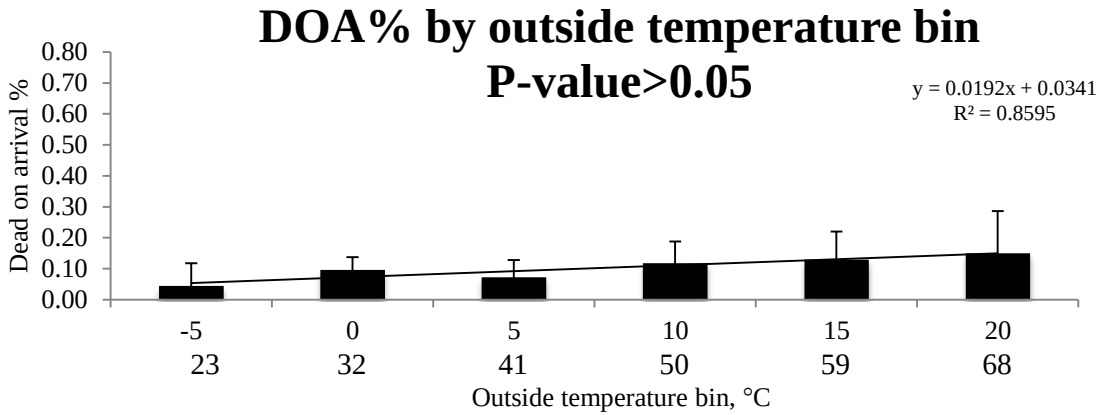




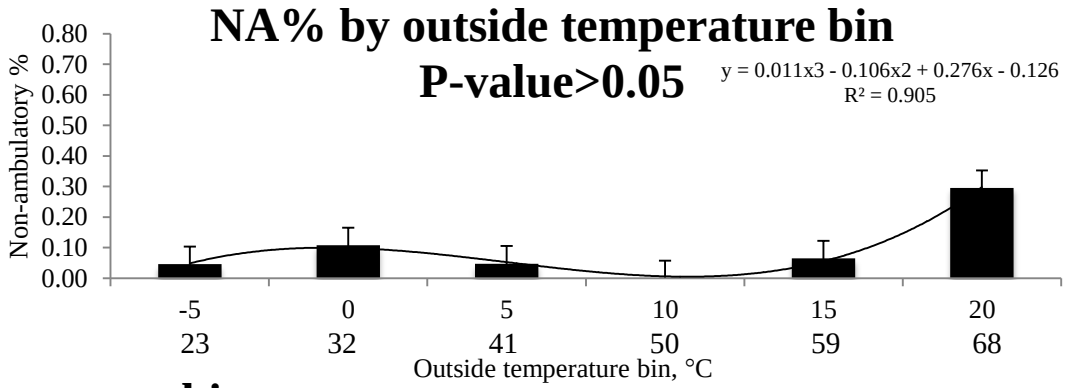
No effect of bedding

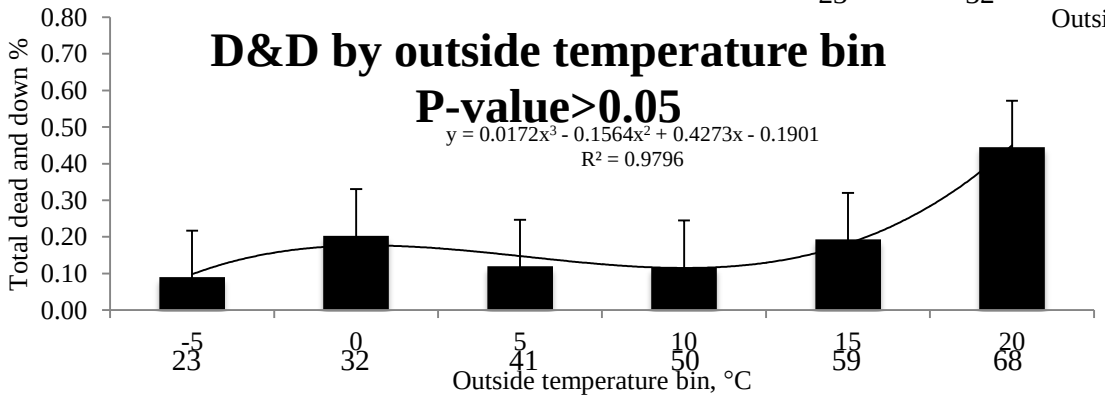


Results – Jan-Feb Temp Effects

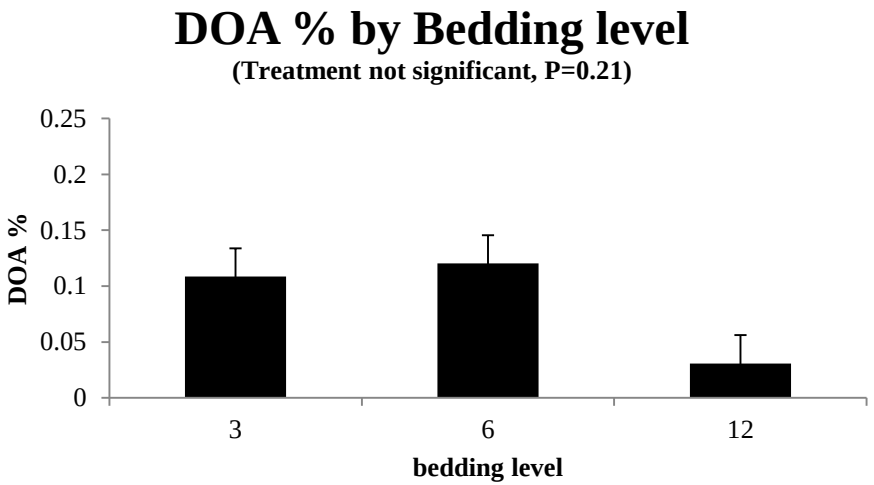


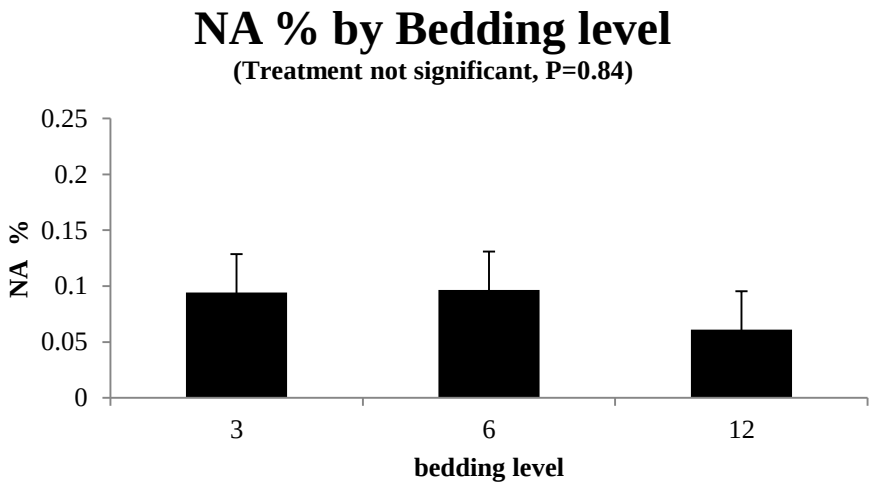
No interaction between bedding and air temperature





Results – March-May Bedding Effects





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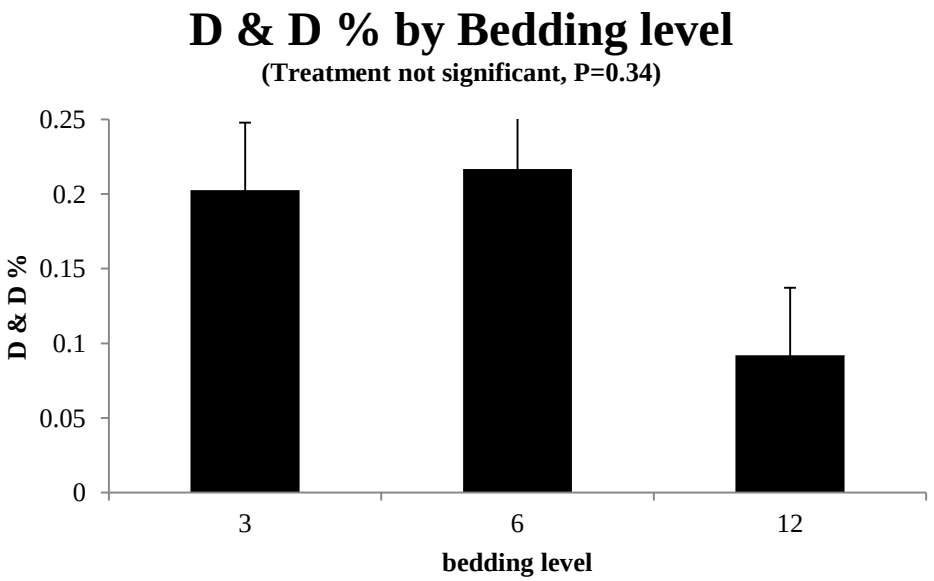

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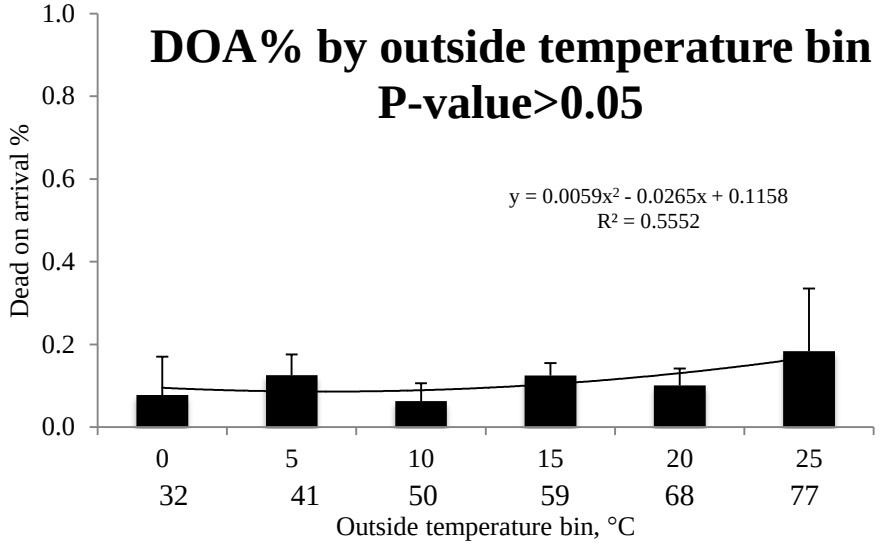
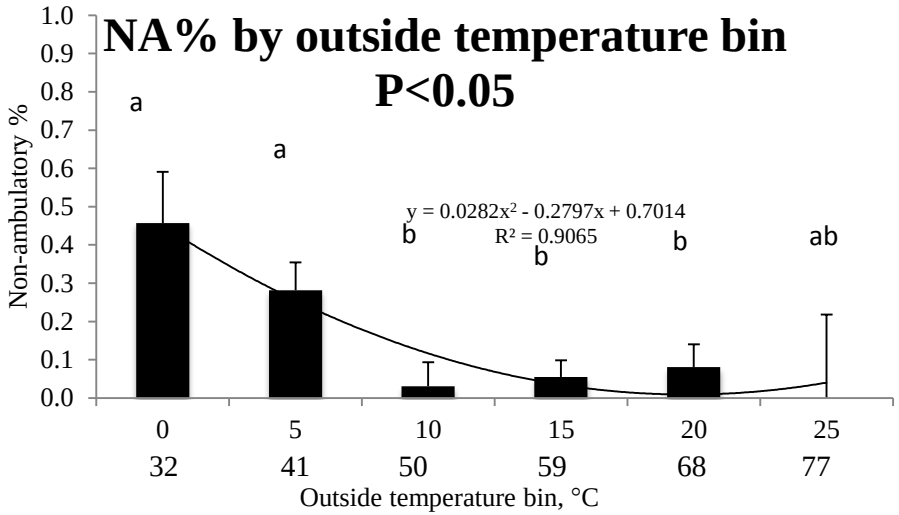
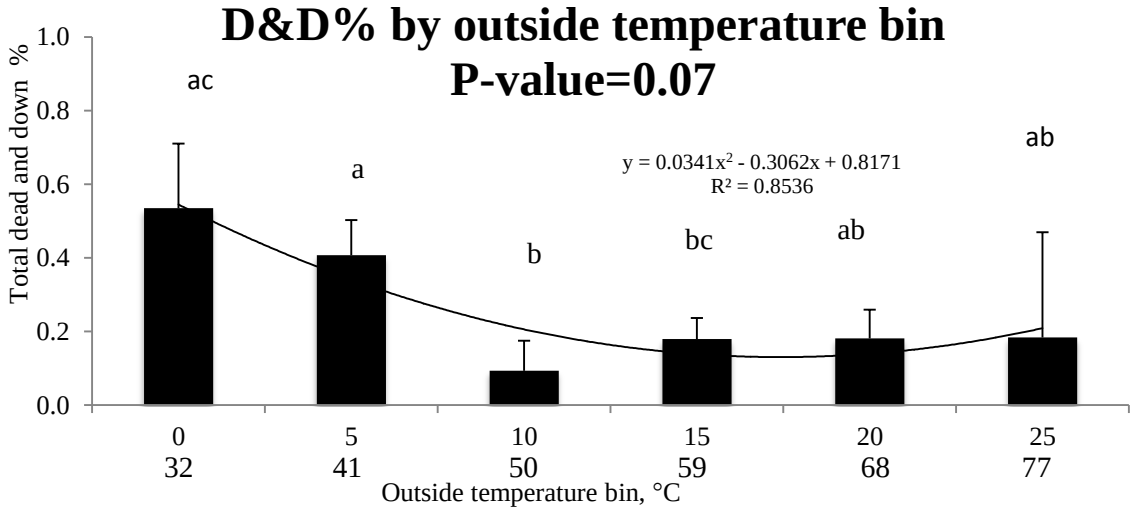
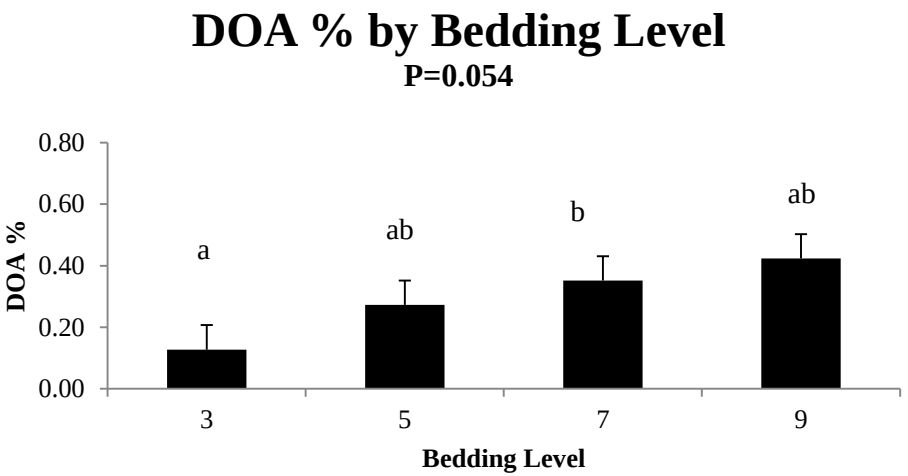


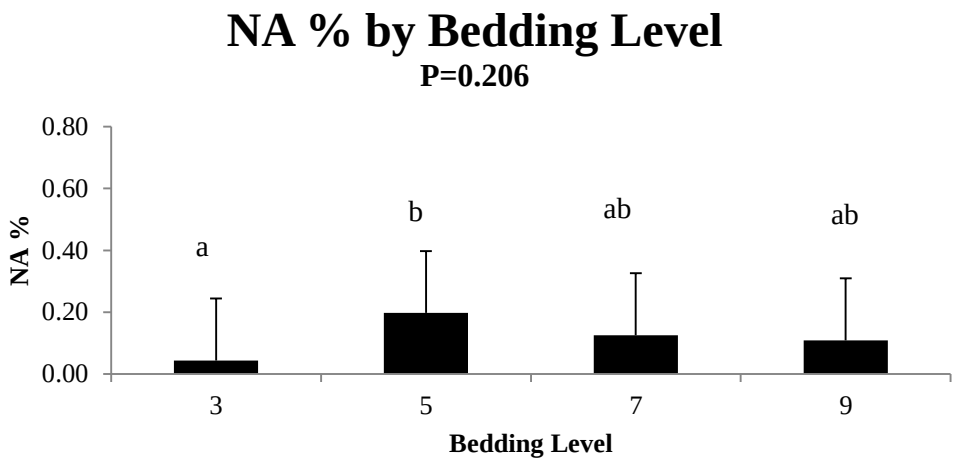


No interaction between bedding and air temperature

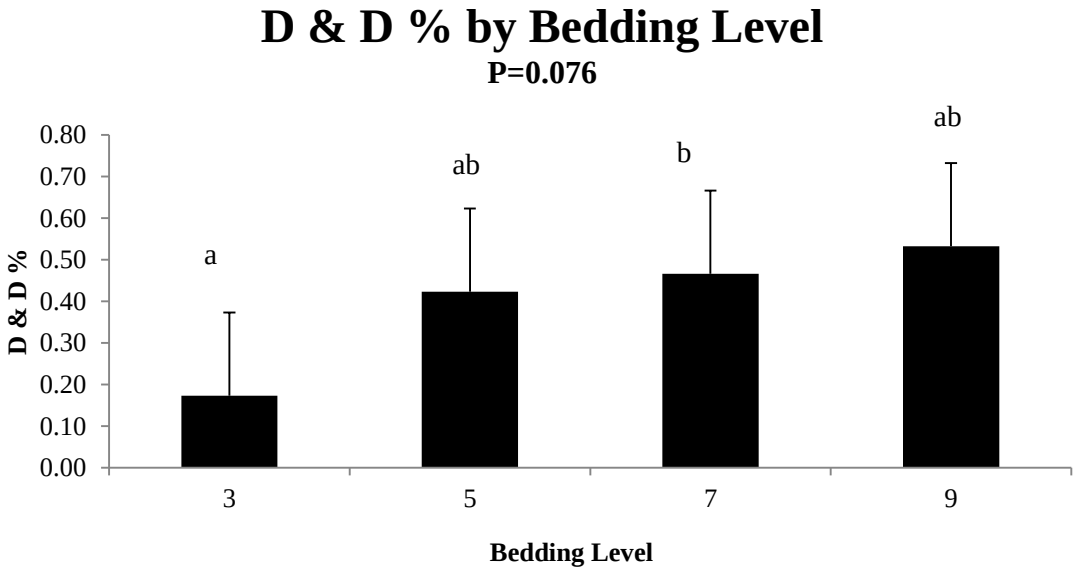


Results – June-July Bedding Effects

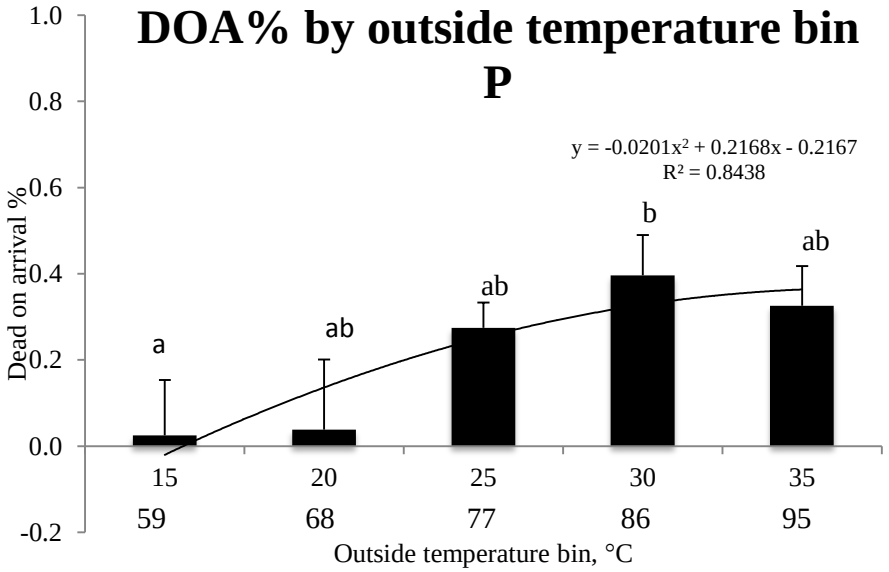


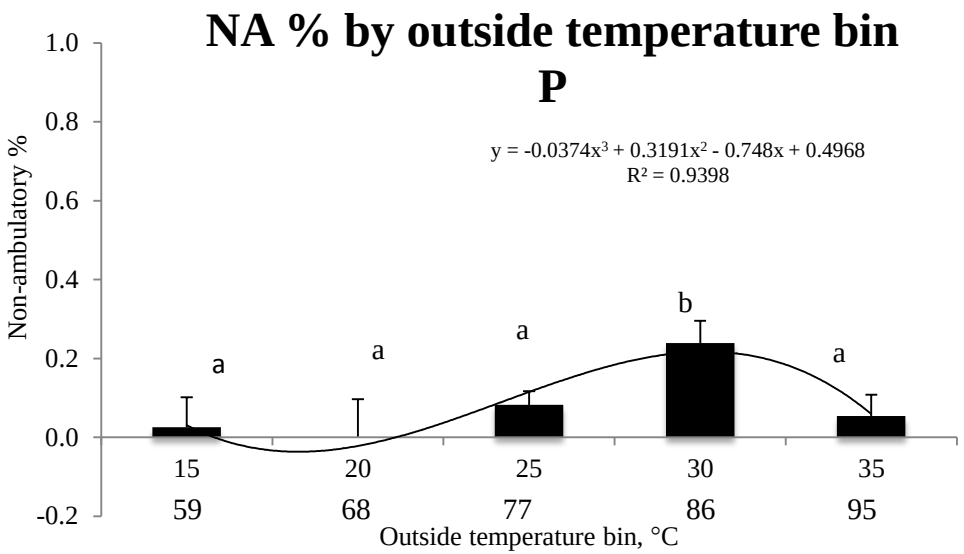


More bedding is harmful in warm weather



Results – June-July Temp Effects





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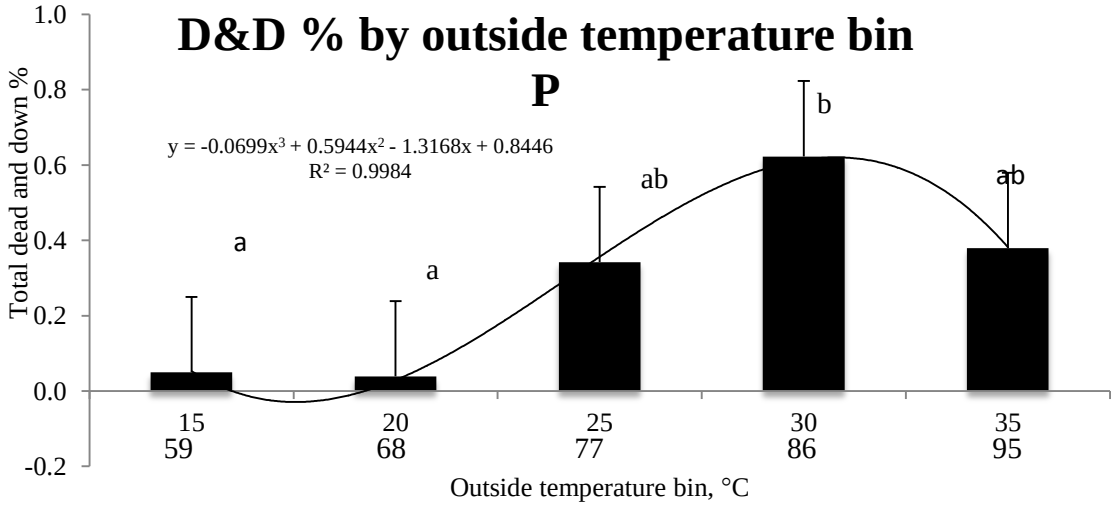
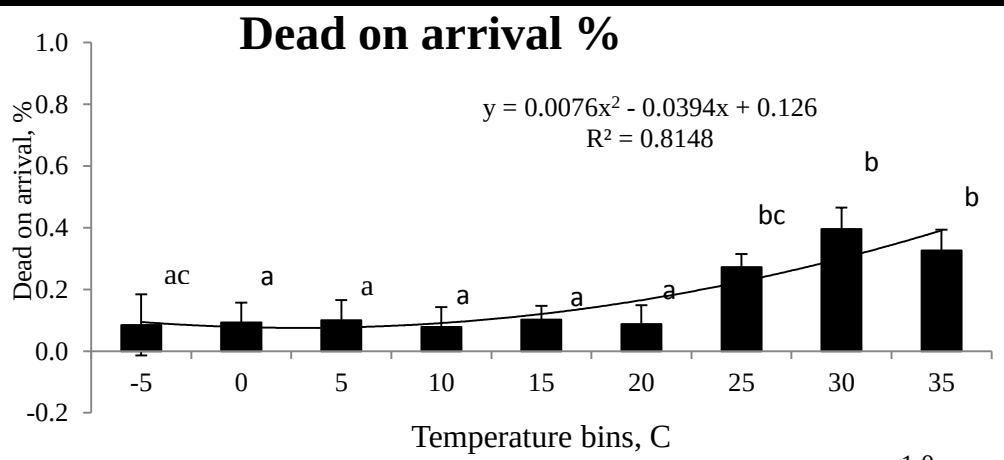
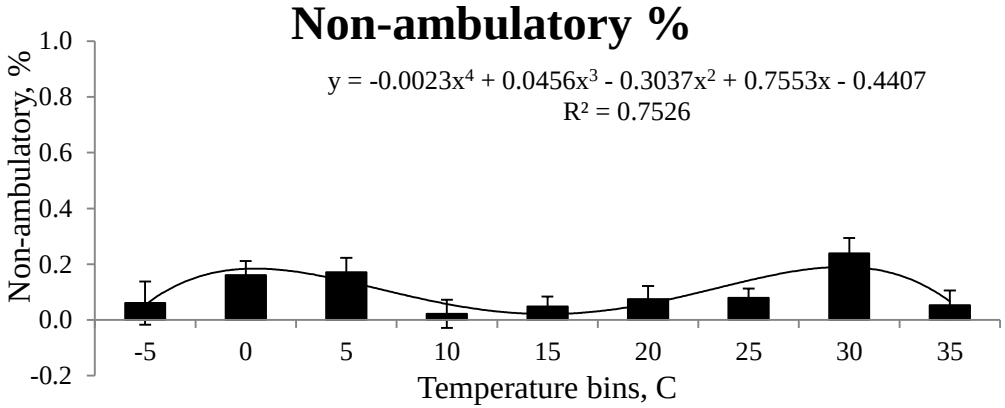
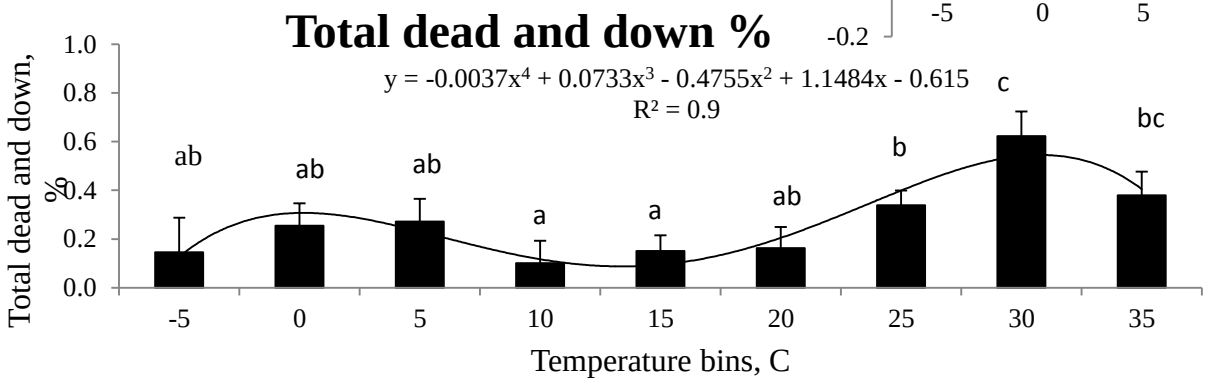


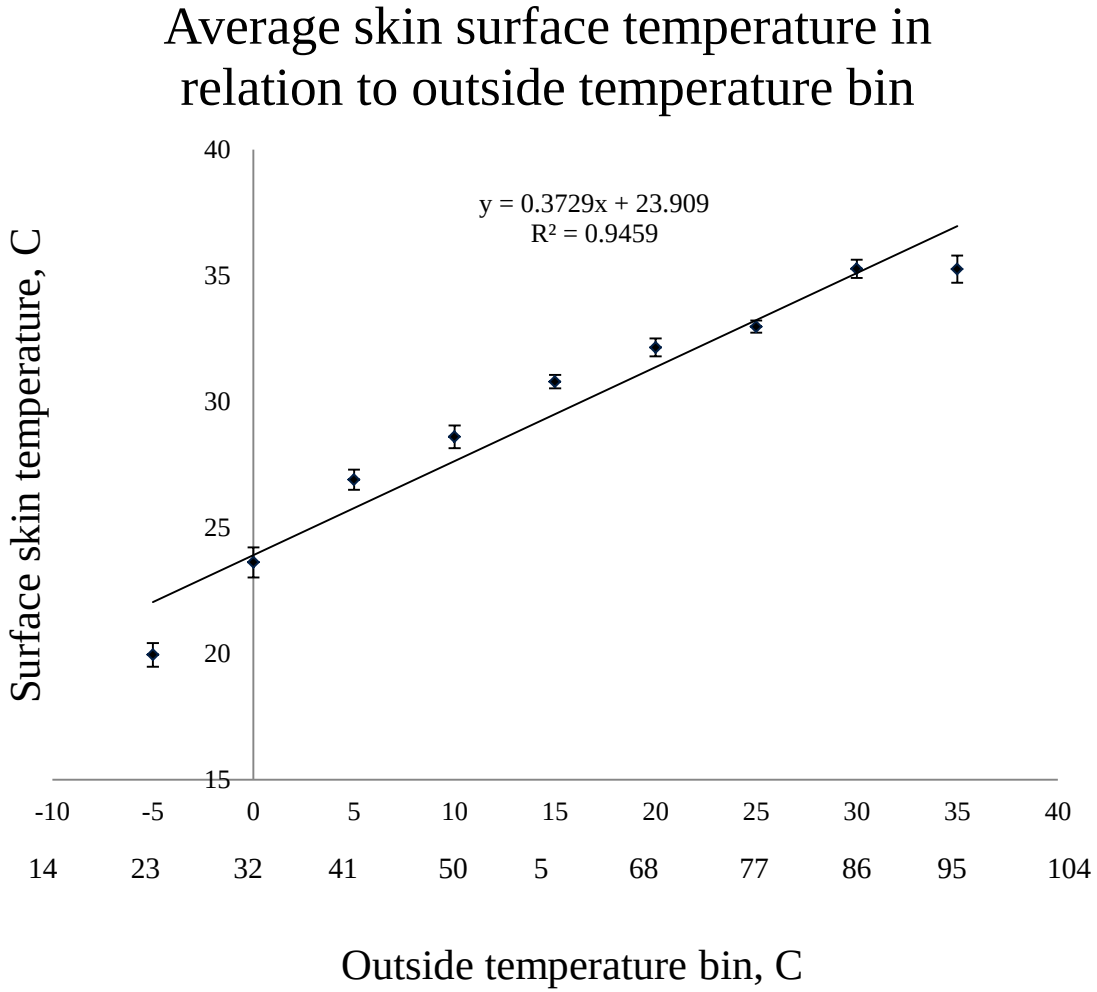
Overall DOA, NA and D&D % with outside temperature





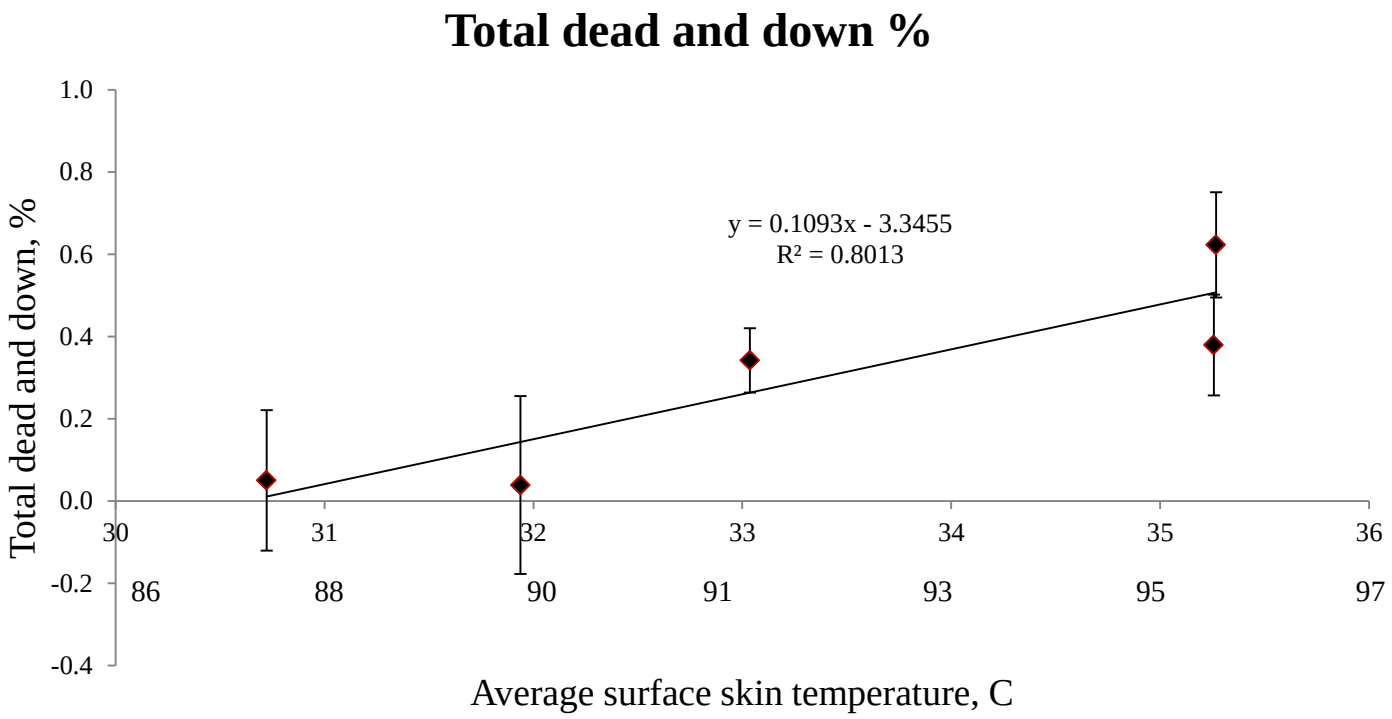


Skin Surface Temperature



P-value:<0.001
The warmer the outside temperature, the warmer was the pig surface

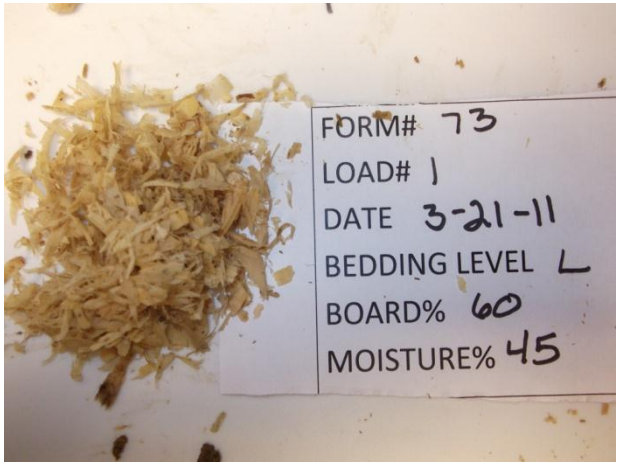
Skin Surface Temperature and Dead and Downs



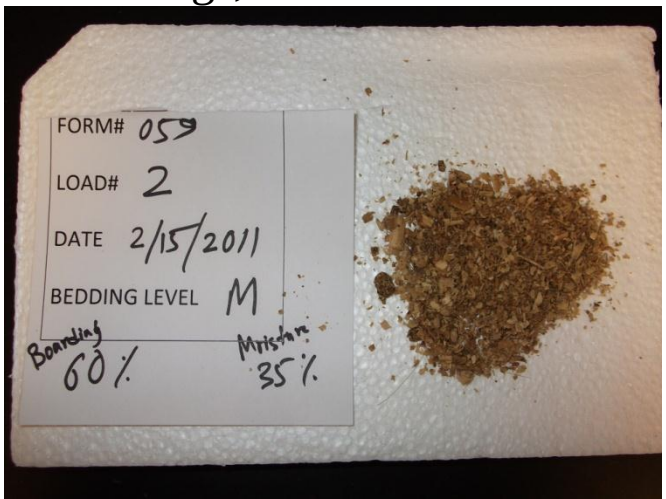
Results

3 bags, second load

Fresh bedding (6 Bags)

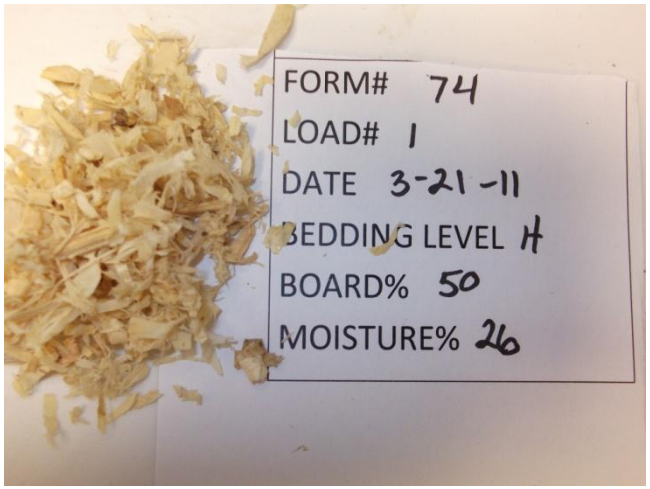


6 bags, second load

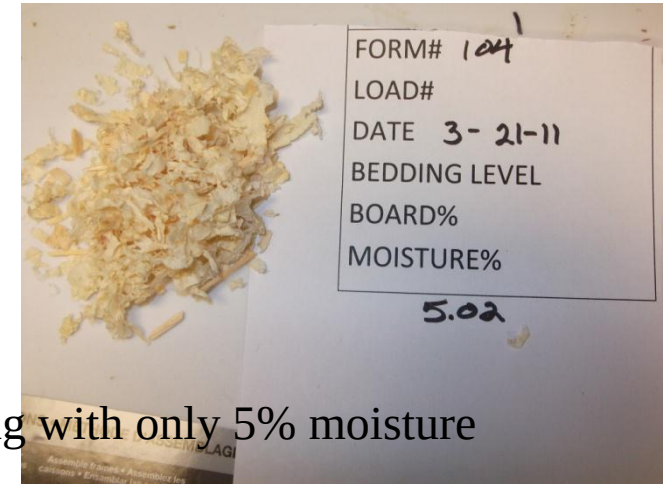


Results

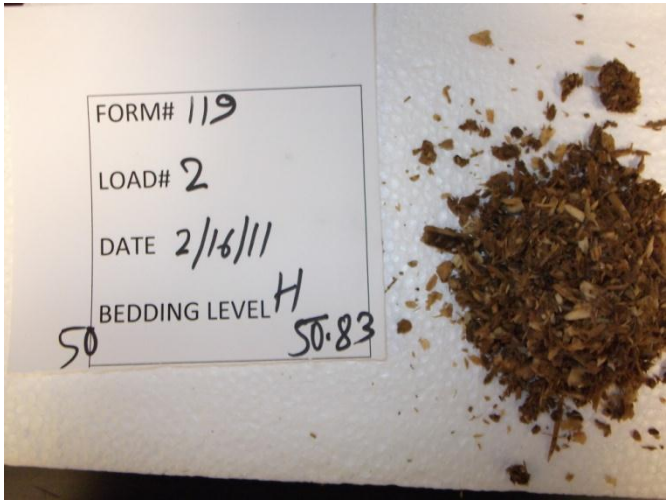
12 bags, first load



12 bags, first load, 26% moisture



Fresh bedding with only 5% moisture



12 bags, second load, 51% moisture

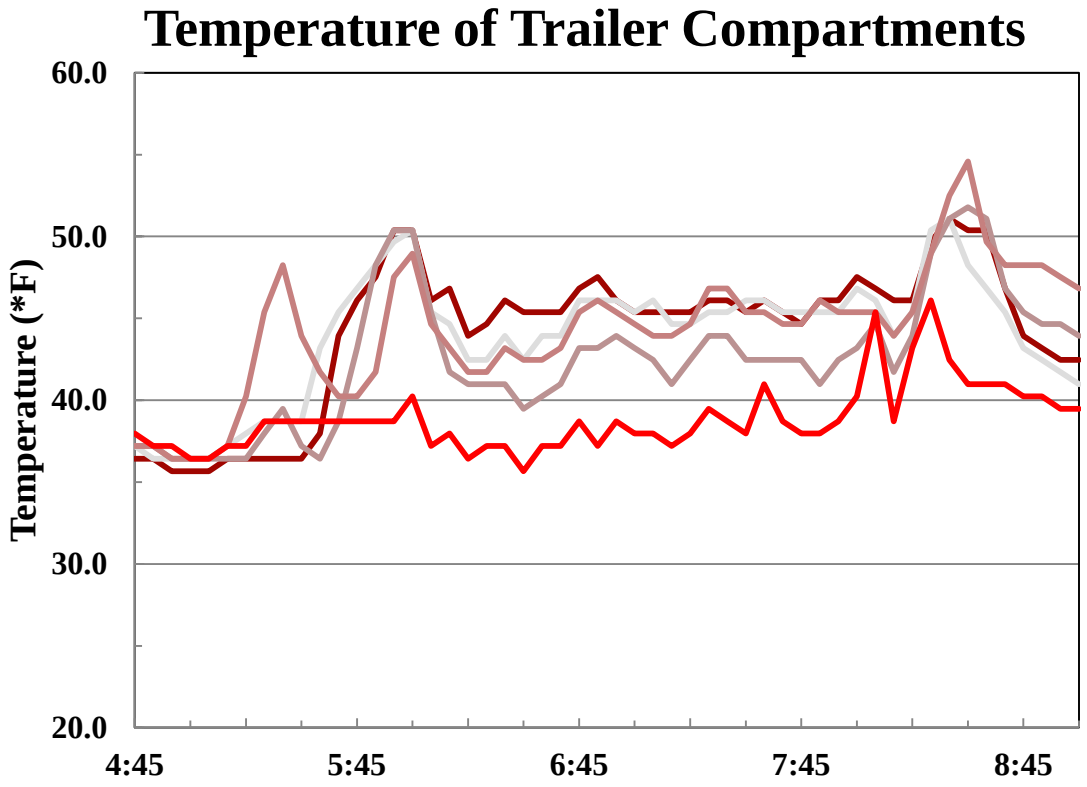
Results

Used bedding inside the trailer

73.87% moisture, 6 bags, 4th load, 60% boarding

Results

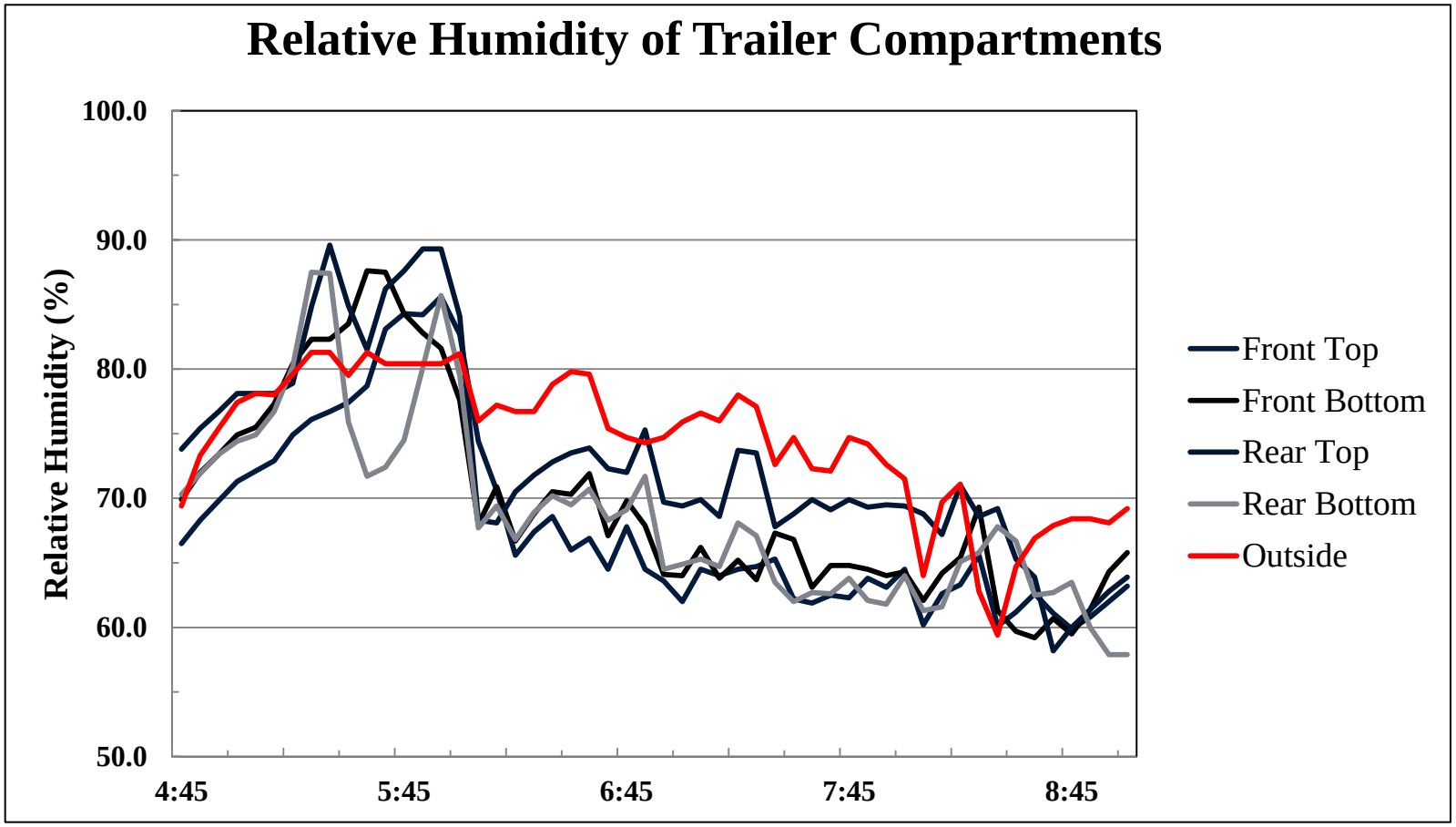
Inside trailer temperature



Front Top
Front Bottom
Rear Top
Rear Bottom
Outside

Results

Inside trailer relative humidity



Conclusions – Bedding

Season	Temp range	Significant bedding effect?	Conclusions	Recom, Bales/trailer
Cold weather	< 32 F	No	Added bedding -- no advantage beyond 6 bales	6* * No data on less than 6 bales
Mild weather	32 - 70 F	No	Added bedding – no advantage above 3 bales	3
Warm weather	> 70 F	Yes	Added bedding negative effect on DOA	3* * No data on less than 3 or 0 bedding

Economics of Bedding Use

Item	Amount
Approximate number of pigs processed per day in the USA	420,000
Average pigs per truck/trailer	170
Approximate number of trucks/trailers/day	2,470
% fresh bedding used per truck/trailer	50%
Trailers using new bedding/day	1,235

Economics of Bedding Use

Item	Amount	Dollar amount, @ $6/bale
Trailers using new bedding/day	1,235	
Number of daily bales at 3 extra bales/day (in summer)	3,705	$22,230
Number of daily bales at 6 extra bales/day (in winter)	7,410	$44,460
30 days cold, added bedding cost	6 extra bales	$1,333,800
120 days warm, added bedding	3 extra bales	$2,667,600
Total added bedding cost	**Per year**	**$4,001,400**

Conclusions – Air Temperature

- Cold weather increased NA
- Warm weather increased DOA
- No interaction between bedding and air temperature

Conclusions – Pig Surface Temperature

- Pig surface temperature changes with air temperature
- In warm weather, increased surface temperature predicts increased DOA

Conclusions

Overuse of bedding causes:

- Increased bedding cost for no return
- Increased pigs losses (dead and down)
- At least a $ 4 million economic cost just by using extra bedding (exact pig losses due to extra bedding yet to be determined) per year unless bedding levels are adjusted
- A welfare problem in warm weather

What Next??

- Is bedding needed and positive for the pig?
  - Examine zero bales in the summer and less than 6 bales in cold weather for efficacy
- Define the boarding needs for the industry
- Define misting requirements

Boarding Study

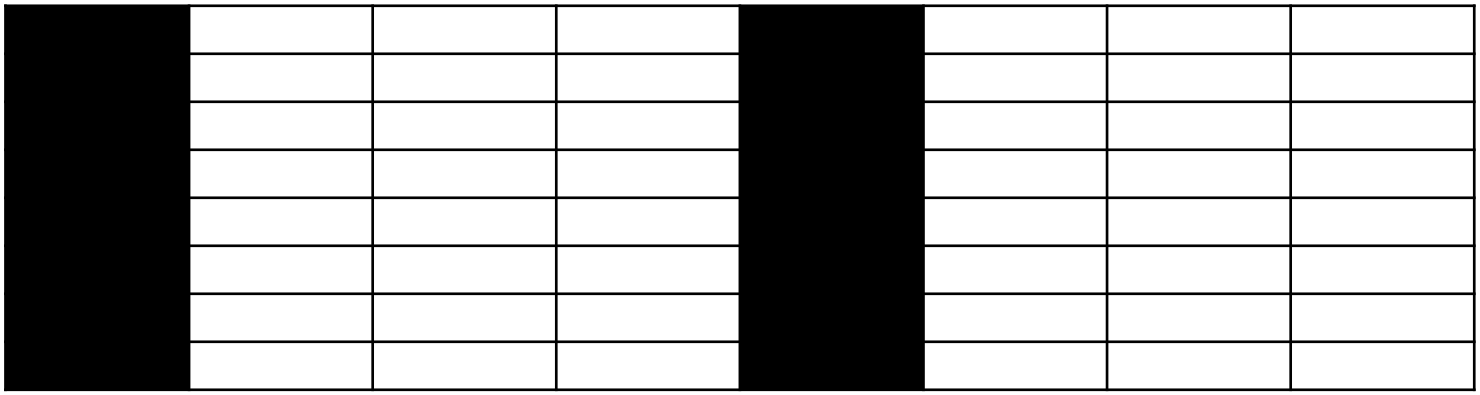
Objective

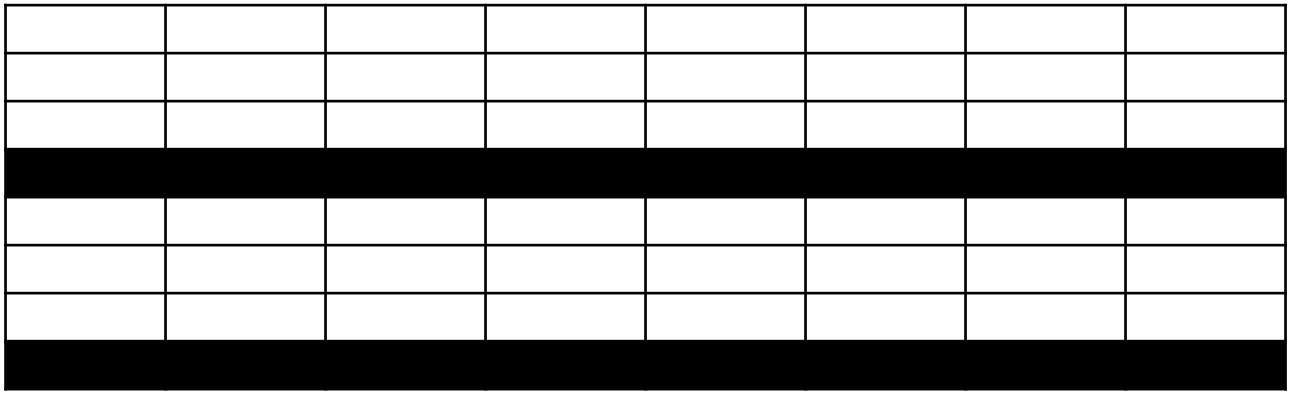
Determining the proper use weather boards/plugs in controlling the internal environment of the trailer to provide for the thermal comfort of the pig during cool temperatures.

Materials and Methods

	% Closed or boarded/plugs*			
Air temperature, F	Current TQA	Treatment 1	Treatment 2	Treatment 3
10-19 F	**75**	**50**	**75**	**90**
20-39 F	**50**	**25**	**50**	**75**
40-49 F	**25**	**0**	**25**	**50**
50-60 F	**0**	**0**	**25**	**--**

100 trailers per temperature bin (400 trailers in total) will be used





Materials and methods

Truck status at the farm

- bedding depth, boarding rate, trailer type (straight deck vs. pot), air temperature and humidity (by Hobos; 4 inside per trailer and 1 outside on a sample of trailers), load time at the farm

- A data sheet completed at the farm site and handed to the driver for delivery to researchers at the plant.

Materials and methods

Truck status at the plant

- bedding status, boarding rate, straight deck vs. pot, travel time

- Times

• arrival time at the plant, wait time at the plant, time to unload

- Environmental measurements at the plant:

• air temperature & relative humidity: internal on trailer at pig level & outside

• wind speed & wind chill index will be determined

Materials and methods

Truck status at the plant

- pig temperature (at least 10 pigs) – skin surface temps

- transport loss incidence (NANI, NAI, DOA; some plants collect only DOA and Non-ambulatory[NA])

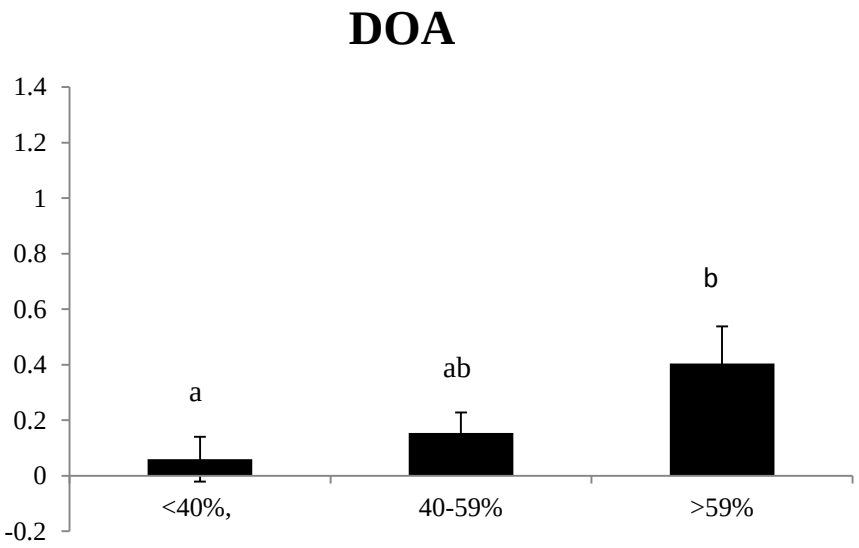
- trim loss per trailer

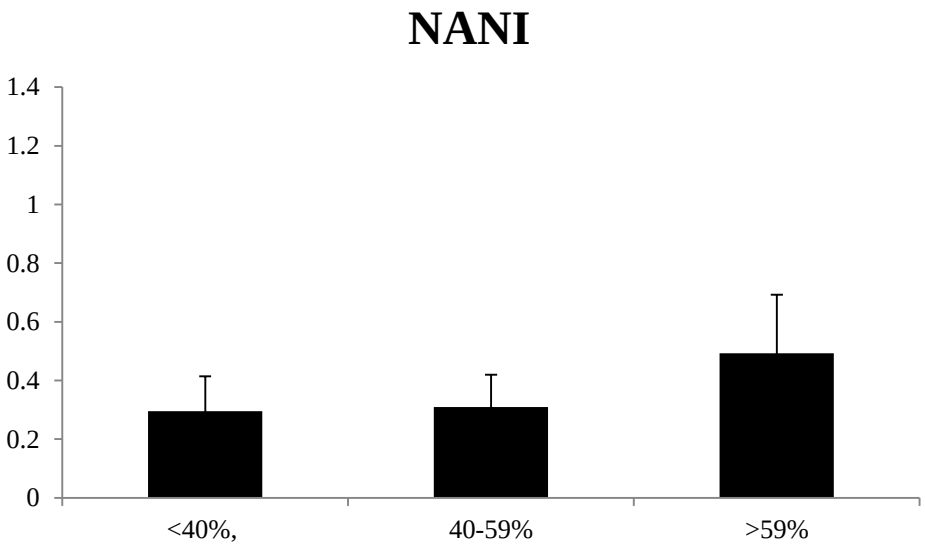
- audit of pigs coming off the truck – slips & falls, vocalizations, incidence of frostbite, signs of stress (ex., open-mouth breathing, skin discoloration, muscle tremors)

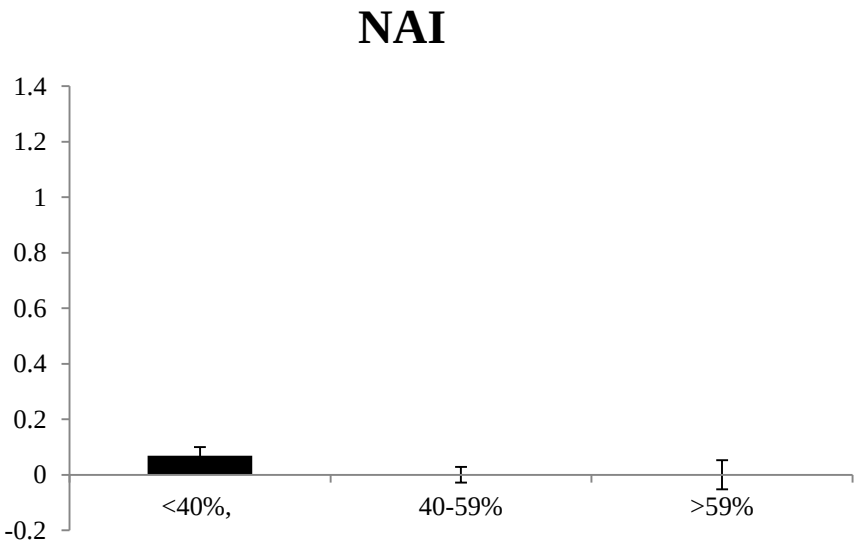
Till now

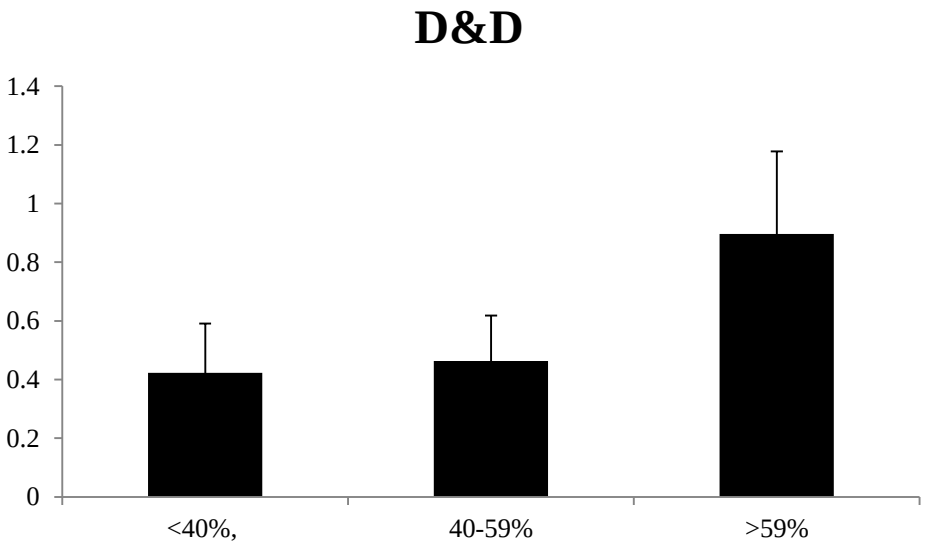
- Only 74 trailers covered (out of 400 required), so analysis is not complete yet.
- Minimum temp: 32 F, Max: 73.2 F
- If boarding percentage <40%, then low (total: 29) and
- If boarding percentage 40-59%, then medium (total: 34)
- If boarding percentage >59%, then high (total:11)

Results

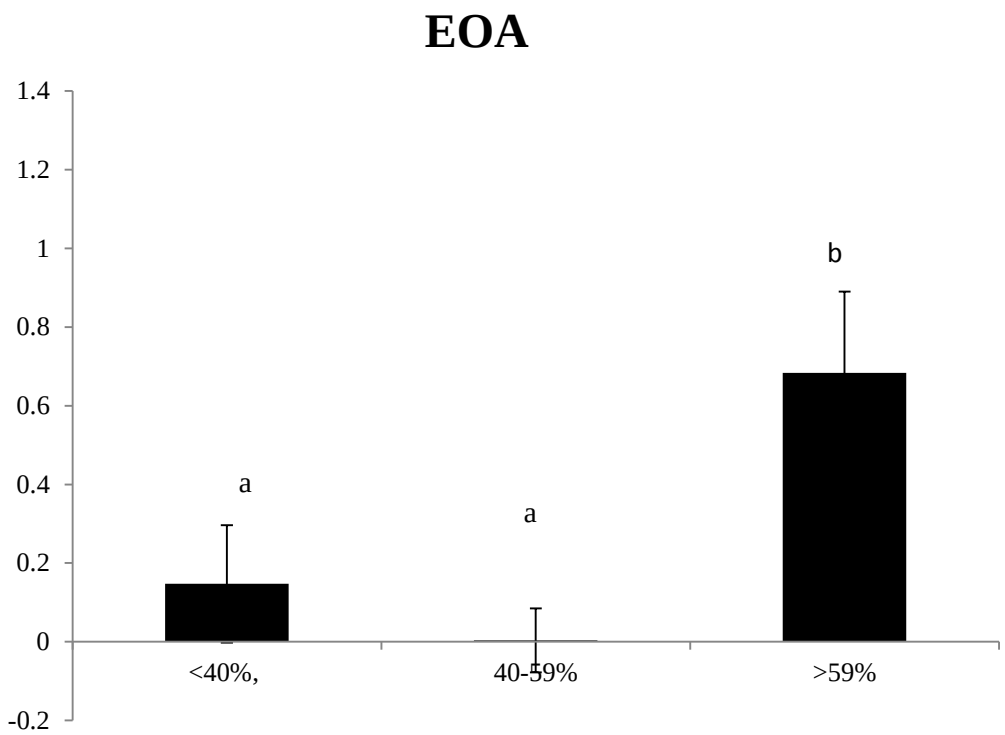

DOA
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
a
ab
b
<40%,
40-59%
>59%


NANI
1.4
1.2
1
0.8
0.6
0.4
0.2
0
<40%,
40-59%
>59%


NAI
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
<40%,
40-59%
>59%


D&D
1.4
1.2
1
0.8
0.6
0.4
0.2
0
<40%,
40-59%
>59%

Result



Conclusion

- DOA highest when boarded highest
- NANI, NAI, D & D did not differ significantly with boarding percentage
- EOA highest when highly boarded

Thank you

Questions?