Cattle Comfort – Reducing Heat and Cold Stress

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Cattle Feeding Facilities

- What is a good environment for cattle feeding
- Heat stress
- Facility Comparison
  - ISU Hoop vs. Open front shed
  - SDSU Total Confinement vs. Open front shed vs. Open feedlot
- Facility differences
- Why the differences
- What factors are important

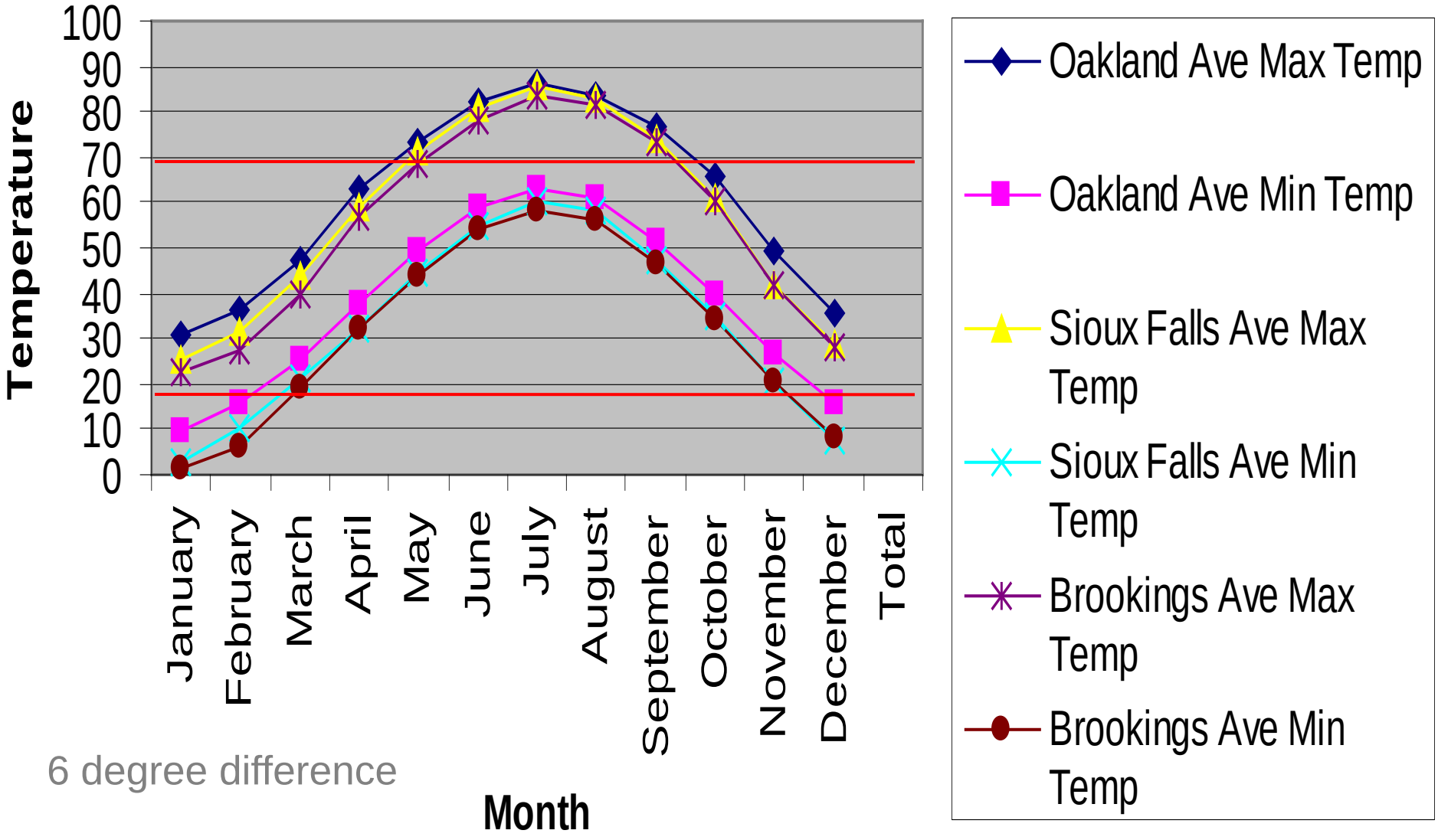
What is a Good Environment for Feedlot Cattle?

- **Dry clean hair coat**
- **Temperature range with no wind 18 to 68 F**
- **What is an advantage in hot weather is a disadvantage in cold weather**
- **Hot Weather**
  - **Wind good**
  - **Wet hide good**
- **Cold weather**
  - **Wind bad**
  - **Wet hide bad**
- **Mud**
  - **Every 4 inches increases maintenance 7%**

Estimated Lower Critical Temperature for 1000 lb Beef Animal

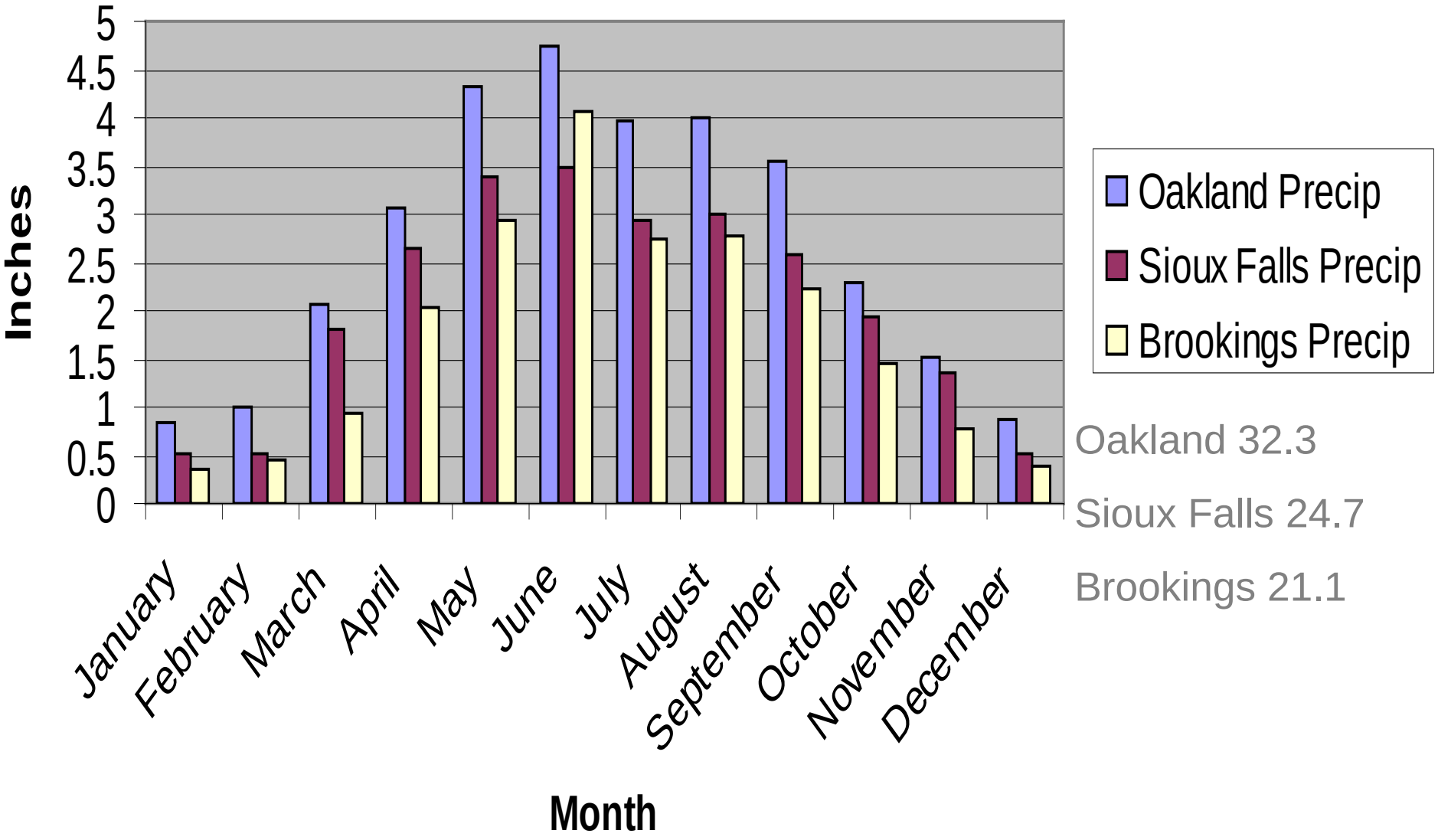
Coat Description	Lower Critical Temperature
Wet or summer coat	59 F
Dry fall coat	45 F
Dry winter coat	32 F
Dry heavy winter coat	18 F

Average Monthly Temperatures



6 degree difference

Monthly Precipation

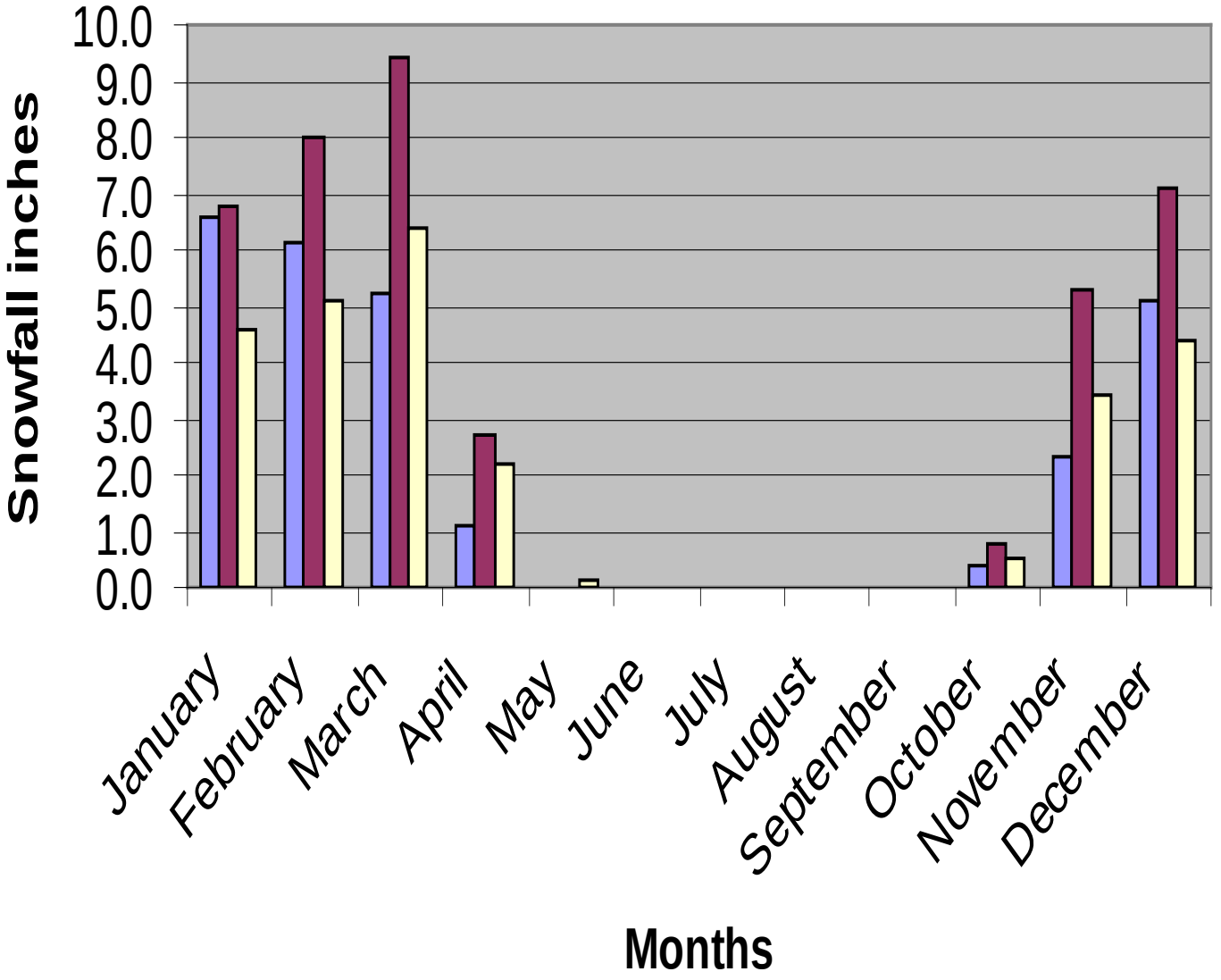


Oakland 32.3

Sioux Falls 24.7

Brookings 21.1

Monthly Snowfall Averages



Oakland 26.8

Sioux Falls 40.2

Brookings 26.7

July 11 & 12, 1995

- High Temperatures
- High Humidity
- No Wind
- Deadly Combination

July 11 & 12, 1995

13 West Central Iowa counties

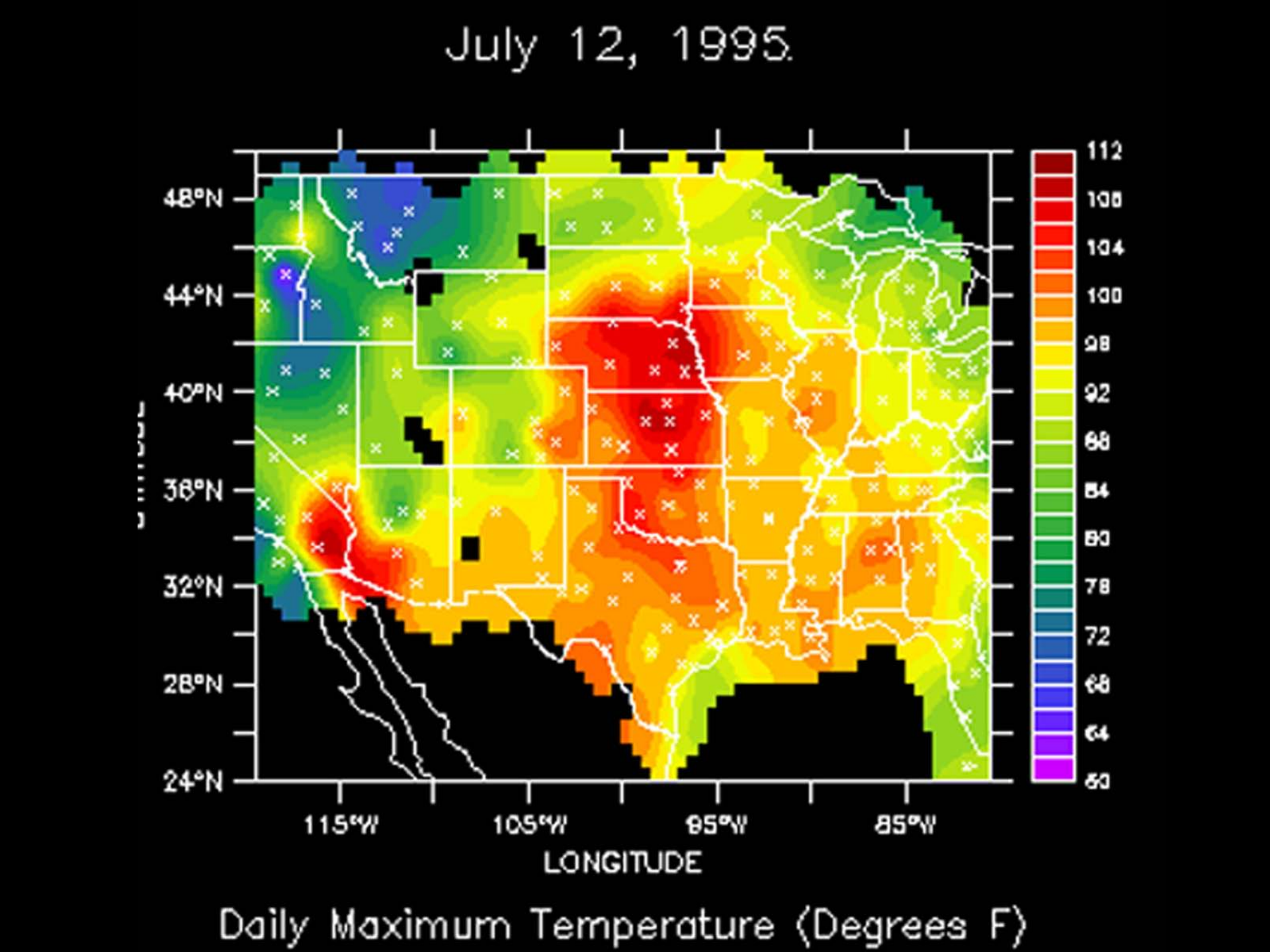
- Market 323,300 HD/year
- Estimates 50% on feed = 161,650 HD
- 3750 HD dead
- 2.32% death loss
- $ 2.8 M cattle losses
- $28.0 M production losses

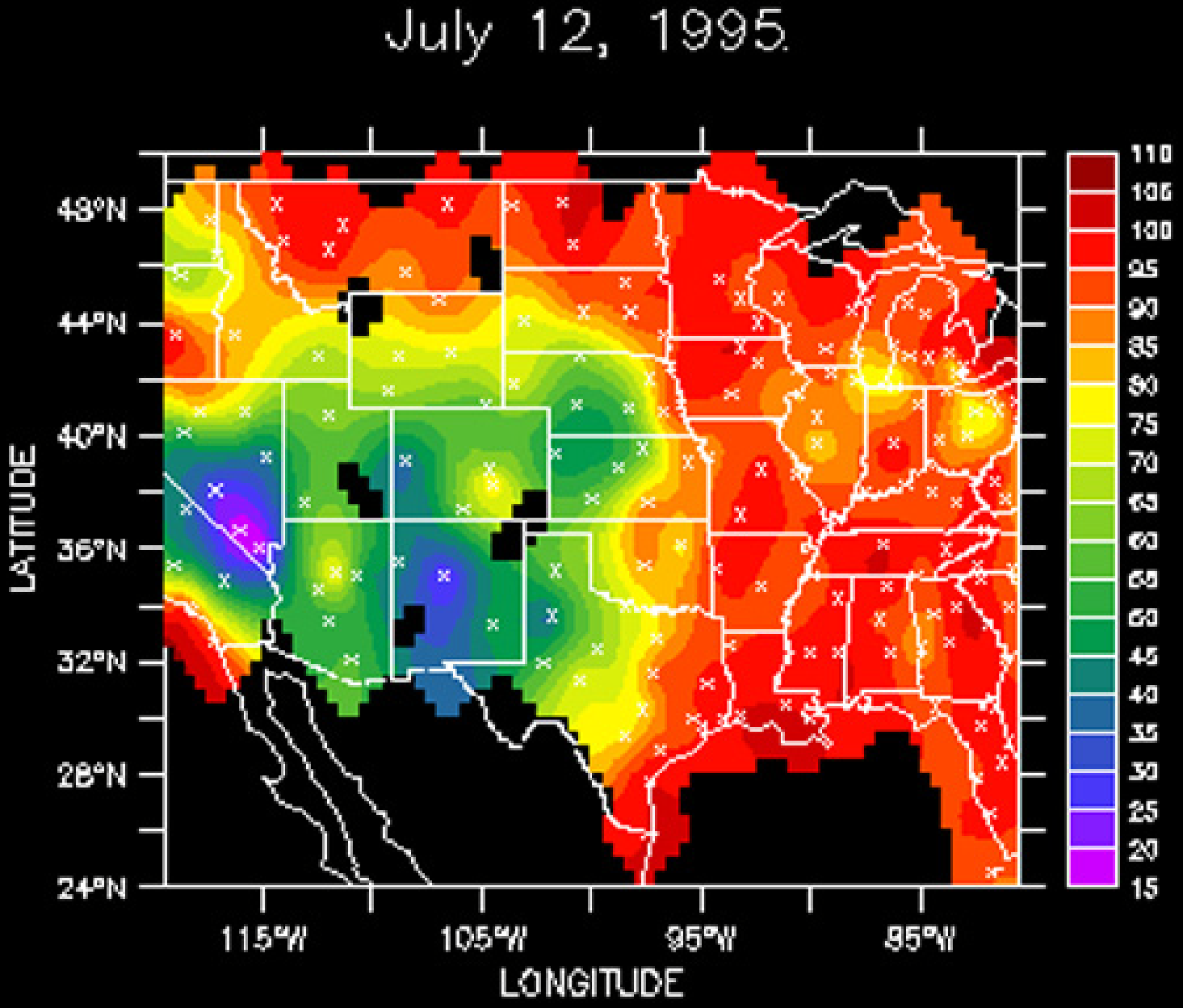
Effective Ambient Temperature

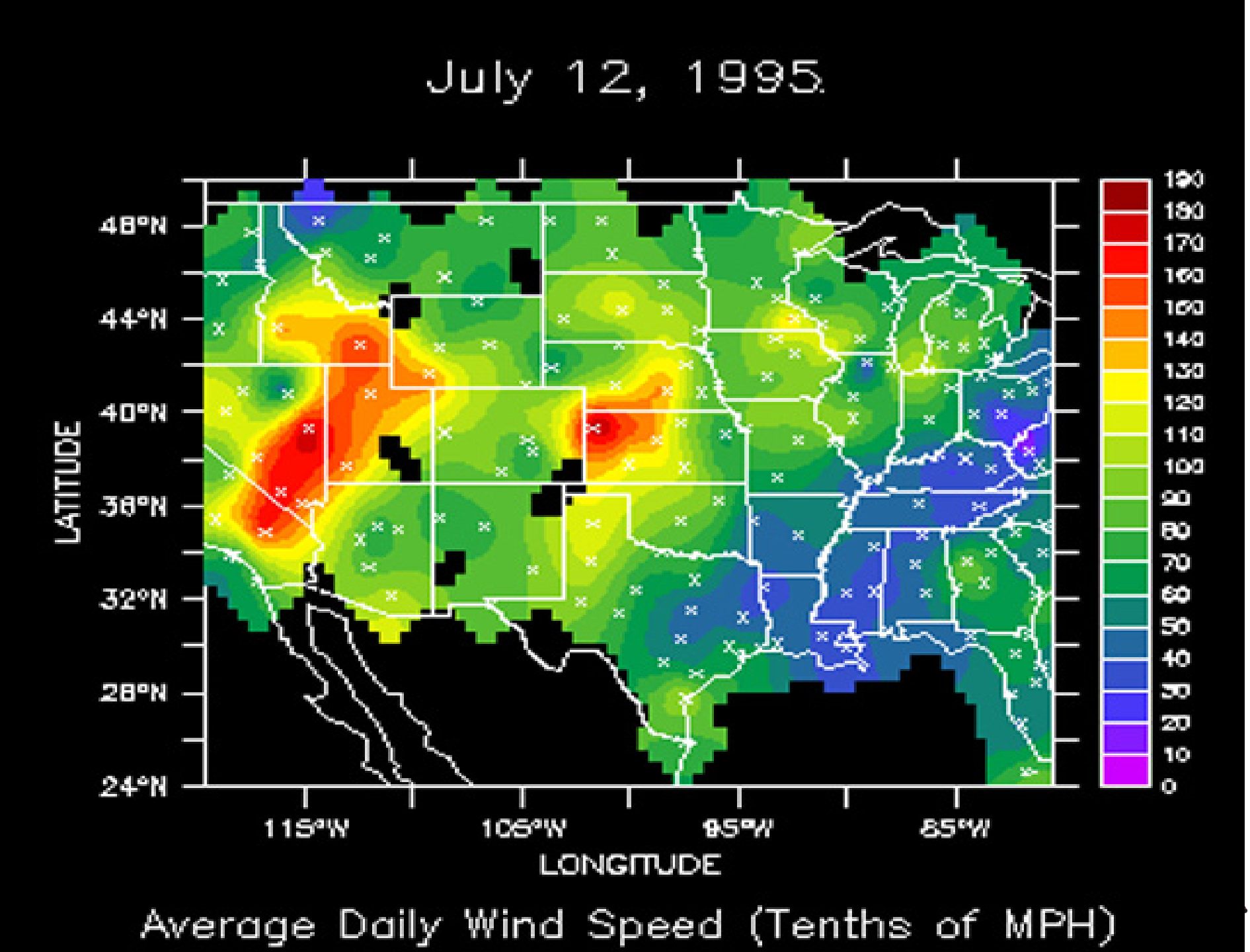
- Air temperature
- Solar radiation
- Air movement
- Contact surfaces
- Precipitation

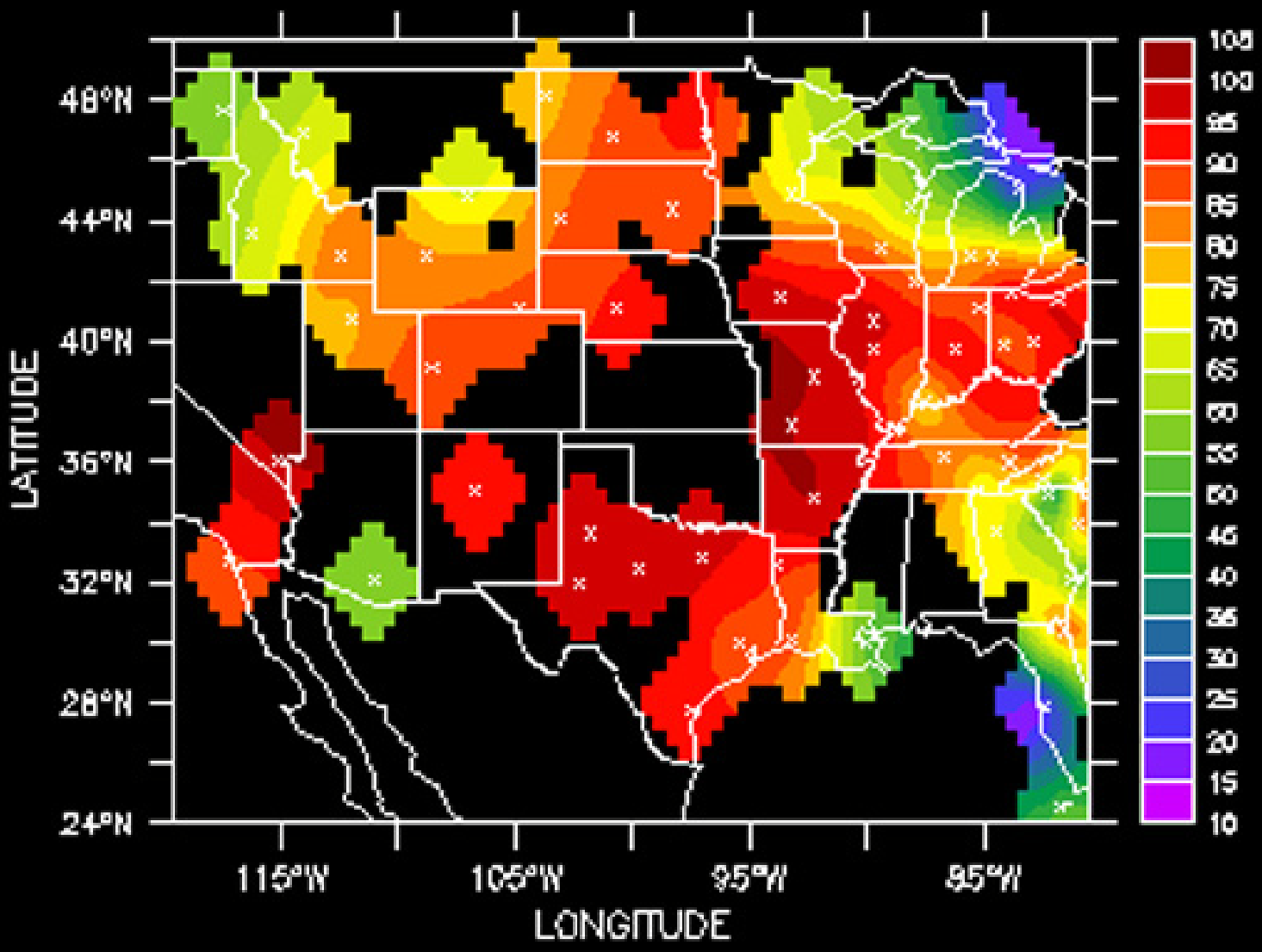
Weather Conditions July 11 & 12

- High 104 F
- 50% Relative Humidity
- Calm winds after 3 to 5 P.M.
- No cloud cover
- Predicted high low 90’s

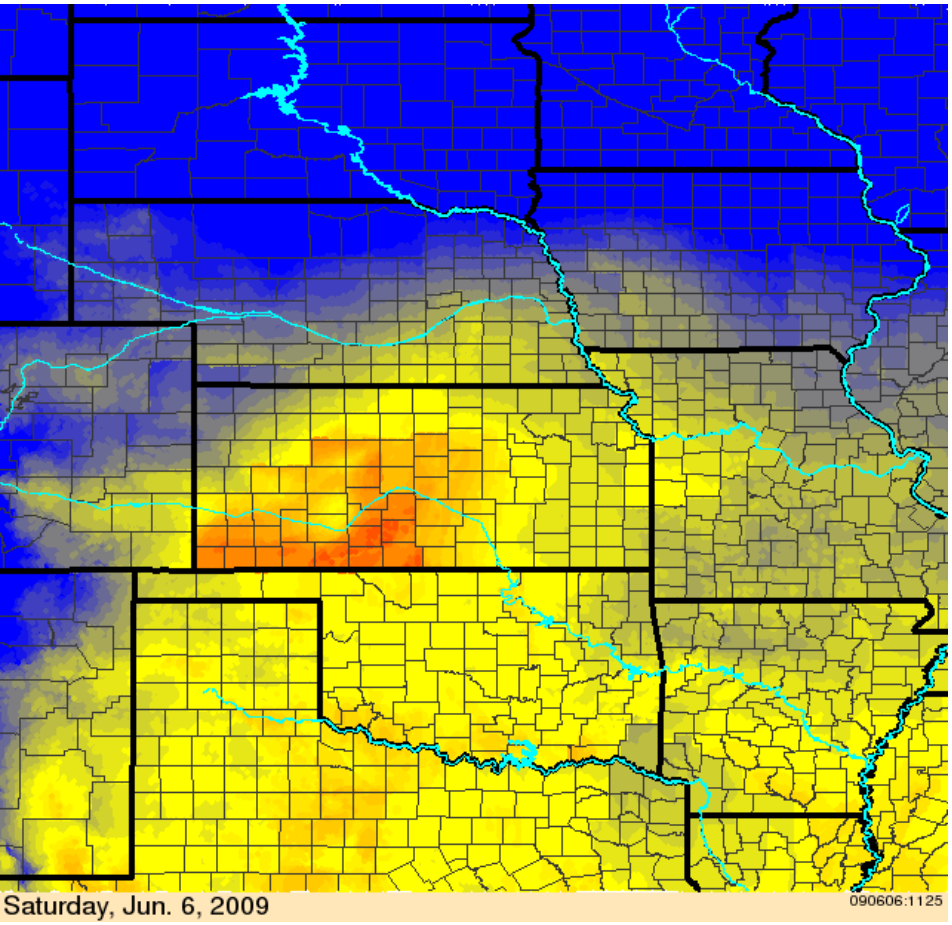

July 12, 1995.
48°N
44°N
40°N
36°N
32°N
28°N
24°N
115°W
105°W
95°W
85°W
LONGITUDE
112
108
104
100
96
92
88
84
80
76
72
68
64
60
Daily Maximum Temperature (Degrees F)

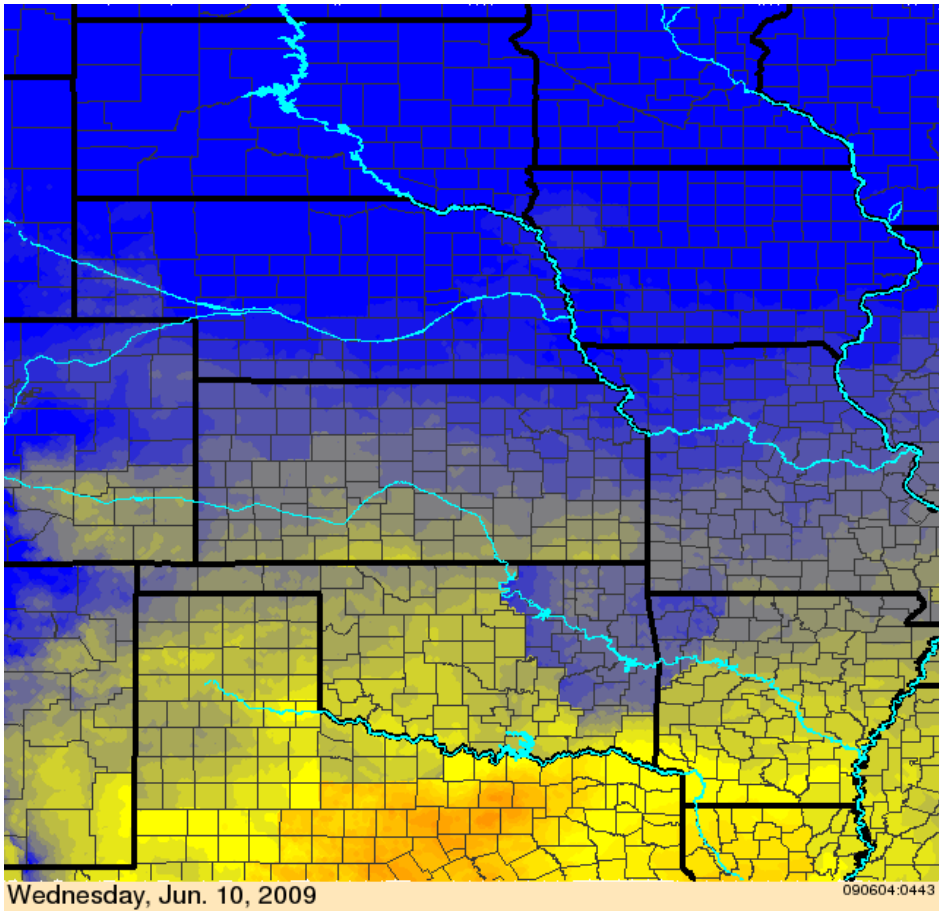

July 12, 1995
48°N
44°N
40°N
36°N
32°N
28°N
24°N
LATITUDE
115°W
105°W
95°W
85°W
LONGITUDE
110
100
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
Maximum Relative Humidity (Percent)


July 12, 1995
48°N
44°N
40°N
36°N
32°N
28°N
24°N
LATITUDE
115°W
105°W
95°W
85°W
LONGITUDE
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Average Daily Wind Speed (Tenths of MPH)


July 12, 1995
48°N
44°N
40°N
36°N
32°N
28°N
24°N
LATITUDE
115°W
105°W
95°W
85°W
LONGITUDE
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Daily Percent of Possible Sunshine (Percent)

Heat Stress Prediction Model USDA/ARS





June 6, 2009

June 10, 2009

http://www.ars.usda.gov/Main/docs.htm?docid=17130

1995 Heat Stress Survey Results

- 36 producers responded
- 81 lots of cattle
- 9830 head on feed
  - 7445 steers
  - 2385 heifers
- Average weight 1067 lbs.
- Death loss average 2.82% per lot

1995 Heat Stress Survey Results

Item	2.5% Death Loss	No Death Loss
No. of Lots	27	41
No. of Cattle	3974	4134
No. of Heifers	1262	649
Lot Area	612	407
Shade Area	.89 sq. ft.	19.4 sq. ft.
Death loss	**7.8%**	**0.0%**

1995 Heat Stress Survey Results

Item	Shade	No Shade
No. of lots	35	46
No. of cattle	3940	5890
No. of heifers	329	2056
Lot area	349	568
Shade area	24 sq. ft.	0 sq. ft.
Death loss	**.19%**	**4.81%**
% of lots with no death loss	86%	19%

1995 Heat Stress Survey Results
46 Lots Without Shade Slope Direction

Item	East/SE	South	SW/West
No. of lots	21	11	14
No. of cattle	2822	1261	1807
No. of heifers	666	924	466
Weight	1126	1136	1030
Lot area	602	451	623
Death loss	**2.67%**	**6.33%**	**6.84%**
% of lots with no death loss	29%	0%	29%

1995 Heat Stress Survey Results 46 Lots No Shade

Item	800-1050 lbs.	1075-1180 lbs.	1200-1250 lbs.
No. of lots	16	18	12
No. of cattle	1626	2851	1413
Weight	983	1121	1222
Lot area	708	513	467
Death loss	**3.44%**	**5.90%**	**5.00%**
% of lots with no death loss	25%	22%	17%

1995 Heat Stress Survey Results
20 Lots with Heifers

Item	MGA	No MGA
No. of lots	10	10
No. of head	1437	1294
% heifers	73%	76%
Ave. Wt.	1053	1098
Death loss	**3.76%**	**6.18%**
% Lots with no death loss	40%	10%

1995 Heat Stress Survey
Differences that affected heat stress

- Blacks & Herefords that were the fattest - 2 responses
- Blacks - 2 responses
- 20% cattle black 80% of deads black
- Heifers & blacks
- Red cattle other cattle were Charolais & Simmental
- Feed consumption dropped
- Shade
- **Bunching**
- **Restless**
- Mixed strs & hfrs ? different vaccination program

1995 Heat Stress Survey

What emergency measures were effective

28 out of 36 producers responded to this question

- Water - 25 out of 28 - **89%**
  - Water early 3 responses
  - Shade & water 2 responses
  - Put round tank in pen let overflow
- Open barn & start fans
- Turned out to pasture

Research Reports on Sprinklers
Used when air temp. above 80 F

Item	Sprinkled	Non-sprinkled
Feed Intake	24.4	25.6
ADG	2.65	2.29
Feed to Gain	9.2	11.2
2nd trial	50 out of 57 days above 80 F	Relative Humidity 42% at 4:00 PM
Feed Intake	12.5	12.6
ADG	2.83	2.44
Feed to Gain	4.43	5.20

SW Iowa Feedlot Shortcourse Sprinkler vs. Shade Demonstration

Item	No Shade	Shade	Shade & Sprinkler
No of Steers	34	80	80
Daily Gain 41 days	2.68	3.14	3.60
Feed/Gain	8.60	7.46	6.55
Water use/head/day	0	0	3.75
Cost/head	0	0	$0.89

SW Iowa Feedlot Shortcourse Sprinkler vs. Shade Demonstration

Item	No Shade	Shade	Shade & Sprinkler
No of Steers	34	80	80
Daily Gain 94 days	3.82	4.12	4.13
Feed/Gain	6.58	5.87	5.87
Feed Cost/cwt of Gain	$29.62	$26.43	$26.40
Total Cost/cwt of Gain	$38.78	$36.13	$36.09
Advantage $/hd	Base	$10.26	$10.44

SW Iowa Feedlot Shortcourse Sprinkler vs. Shade Demonstration

Item	No Shade	Shade	Shade & Sprinkler
No of Steers	34	80	80
Daily Gain 94 days	3.82	4.12	4.13
Feed/Gain	6.58	5.87	5.87
Yardage & non-feed	$.40	$.43	$.44
Feed Cost/cwt of Gain	$29.62	$26.43	$26.40
Total Cost/cwt of Gain	$38.78	$36.13	$36.09
Feed Cost/cwt of Gain	$78.96	$70.44	$70.44
Total Cost/cwt of Gain	$89.43	$80.88	$81.09

SW Iowa Feedlot Shortcourse Sprinkler vs. Shade Demonstration

Item	No Shade	Shade	Shade & Sprinkler
No of Steers	34	80	80
Daily Gain 94 days	3.82	4.12	4.13
Feed/Gain	6.58	5.87	5.87
Yardage & non-feed	$.40	$.43	$.44
Feed Cost/cwt of Gain	$78.96	$70.44	$70.44
Total Cost/cwt of Gain	$89.43	$80.88	$81.09
Advantage $/Hd	Base	$33.09	$32.38

SW Iowa Feedlot Shortcourse Once a Day vs. 50-50 Twice a Day

Item	Once a Day	50-50 Twice a Day
No of Steers	80	80
Daily Gain 41 days	3.45	3.14
Feed/Gain	6.99	7.43

SW Iowa Feedlot Shortcourse Once a Day vs. 50-50 Twice a Day

Item	Once a Day	50-50 Twice a Day
No of Steers	80	80
Daily Gain 94 days	4.16	4.09
Feed/Gain	5.83	5.91
Feed Cost/cwt of Gain	$26.24	$26.59
Total Cost/cwt of Gain	$35.84	$36.38
Feed Cost/cwt of Gain	$69.96	$70.92
Total Cost/cwt of Gain	$80.30	$81.43

Advantage $/Hd $4.43

Management Tips For Hot Weather Cattle Feeding

- Provide cattle most susceptible to heat stress with east sloping lots and lots with most shade
  - Blacks
  - Heavier
- Monitor effective temperature = temperature, humidity, wind & solar radiation
- Maintenance requirement increases
  - Rapid shallow panting - 7%
  - Open-mouth panting - 11 to 25%

Management Tips For Hot Weather Cattle Feeding (cont.)

- Water - clean & cool - plenty of space
  - 80 F 1000 LB consumes 14.5 gal.
  - 90 F 1000 LB consumes 20.6 gal.
- Peak water use may = 1.1% of body wt./Hour
- Sprinklers are the quickest & most effective emergency treatment
  - Cattle will shower in & out on their own
- Feed MGA to lots with heifers

Management Tips For Hot Weather Cattle Feeding (cont.)

- Maximum heat production occurs 4 to 6 hours after feeding
- Typical am feeding = peak environmental heat load in early afternoon
- If feeding once per day consider evening
- Major contributor to improved F/G when feeding late afternoon

Weather Stress for Feedlot Cattle

- Whatever is an advantage in cold stress is a disadvantage in heat stress
- Pens that are best for light calves in the winter are not for finished black-hided cattle in the summer
- Wind is bad in the winter
- Wind is good in the summer

Winter Cattle Feeding in the Upper Midwest

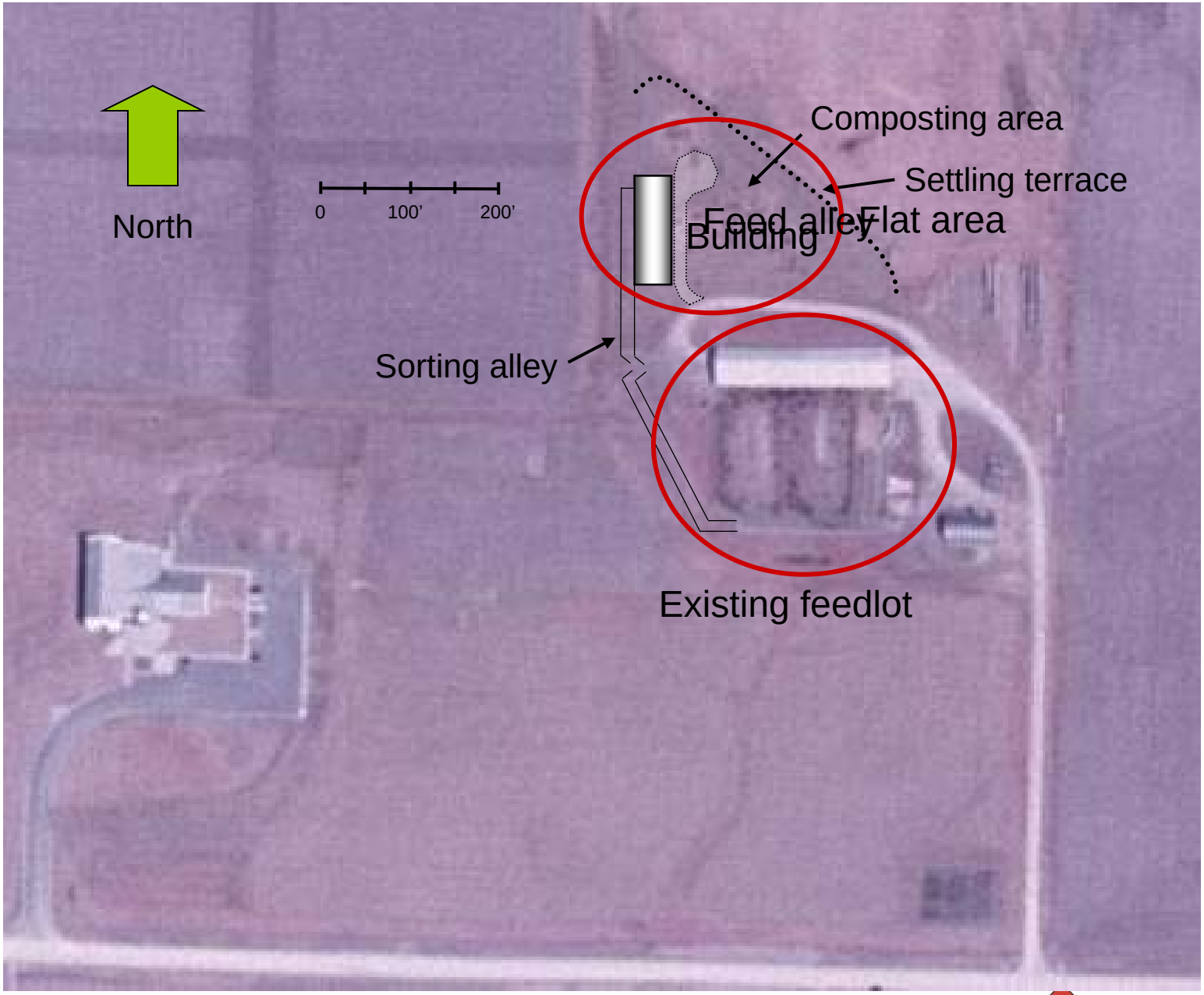
Earthen Lot with Shed

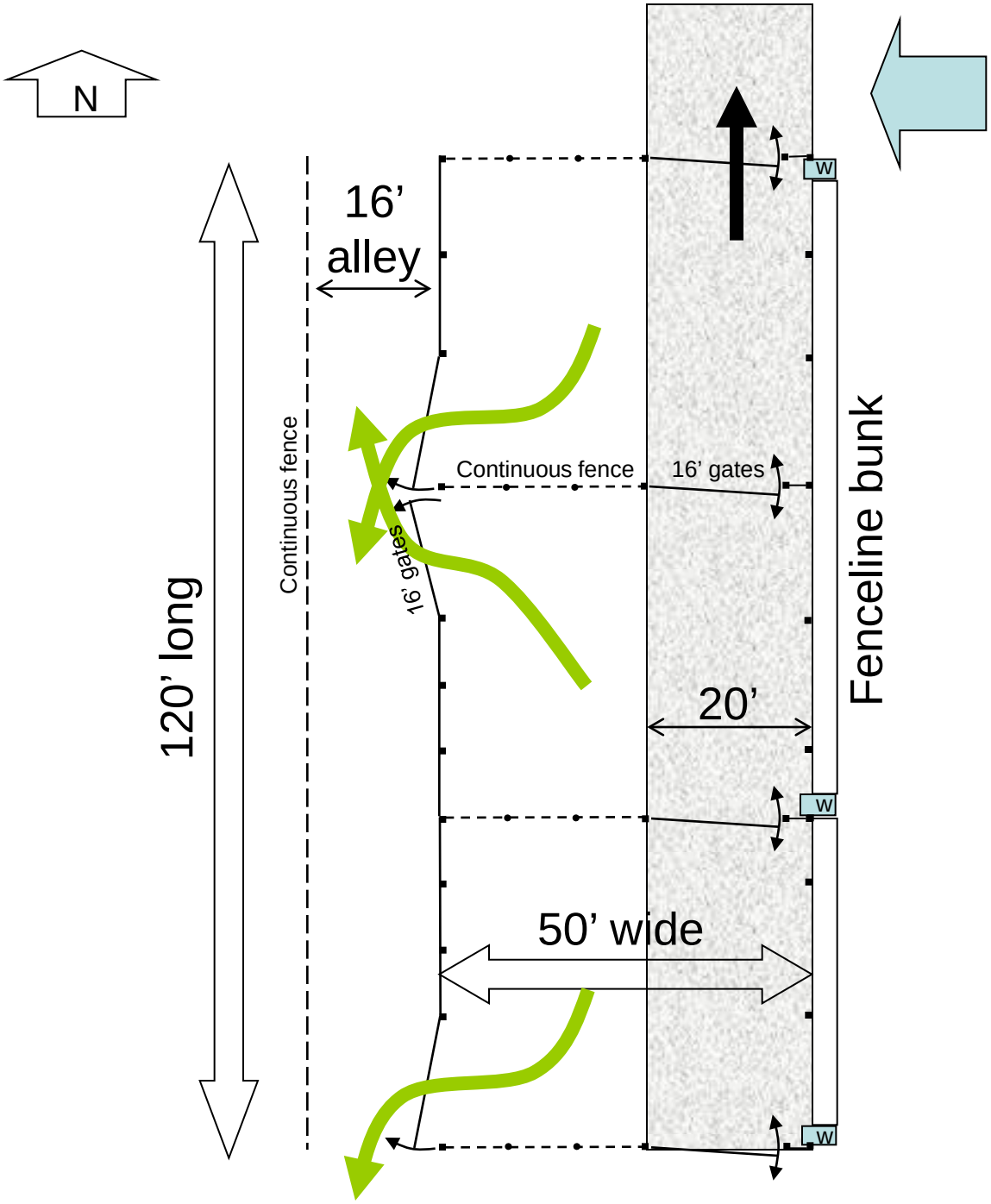
Confinement beef finishing

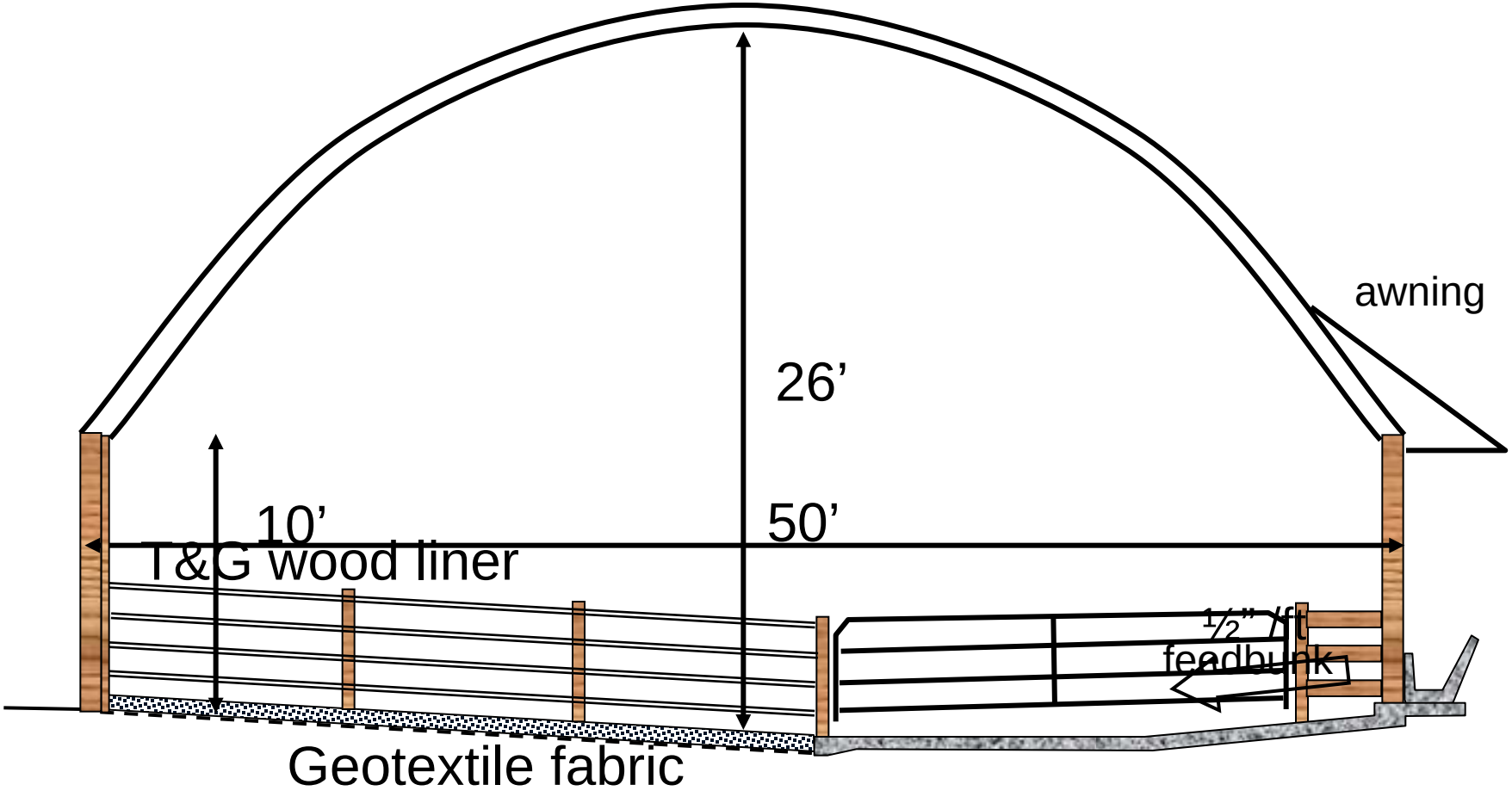
(+) Beef under roof can have higher rate of gain and better feed efficiency

(+) Avoiding outside lots eliminates runoff concerns and increases control over manure nutrients

(-) Higher facility cost than outside lots


North
0
100’
200’
Composting area
Settling terrace
Feed alley
Flat area
Building
Sorting alley
Existing feedlot


N
16’
alley
120’ long
Continuous fence
Continuous fence
16’ gates
16’ gates
20’
Fenceline bunk
50’ wide
W
W
W


awning
26’
10’
50’
T&G wood liner
½” /ft
feedbunk
Geotextile fabric

Comparison facility

125 sq. ft. earthen lot, 25 sq. ft. under roof

Comparison facility

Progress

- Building was finished December 9, 2004
- Cost was around $370/hd
- Calves Dec. 2004 – May 2005
- Yearling steers Aug. 2005 – Nov. 2005
- Yearling steers Dec. 2005 – Apr. 2006
- Yearling steers Aug. 2006 – Nov. 2006
- Yearling steers Dec. 2006 – Apr. 2007
- Yearling steers Aug. 2007 – Nov. 2007
- Yearling steers Dec. 2007 - April 2008
- Building is cleaned between groups

Performance Data 3 Year Summary
18 Pens 1,419 Head

Item	Hoop	Semi-confinement
No of Steers	707	712
On test weight, lb	904	905
Days on Feed	109	109
Final Weight, lb	1315	1331
Final Mud Score (1-5)	1.82	2.27 P=.02
Dry Matter Intake, lb	26.62	26.69
ADG, lb	3.80 **3.2%**	3.92 P=. 16
Feed to Gain Ratio	7.10	6.90

Performance Data 3 Year Summary

18 Pens 1,419 Head

Adjusted for Mud

Item	Hoop	Semi-confinement
No of Steers	707	712
On test weight, lb	904	905
Days on Feed	109	109
Adj Final Weight, lb	1290	1298
Final Mud Score (1-5)	1.82	2.27
Dry Matter Intake, lb	26.62	26.69
ADG, lb	3.56	3.61 P=. 38
Feed to Gain Ratio	7.59	7.63

1.4%

Carcass Data 3 Year Summary

18 Pens 1,419 Head

Item	Hoop	Semi-confinement
Dress %	61.8%	61.4%
Hot Carcass Wt, lb	813	818
Fat Cover, in	.43	.43
% YG 1&2	63%	63%
Marbling Score	Sm 31	Sm 28
% low Choice or better	74%	75%
% upper 2/3 Choice	16%	15%

Lessons / observations

- Outside weather's impact on bedding
- Floor surface
- Awning over the bunk
- Building orientation
- Bedding use and management
- Opportunities for application

Floor

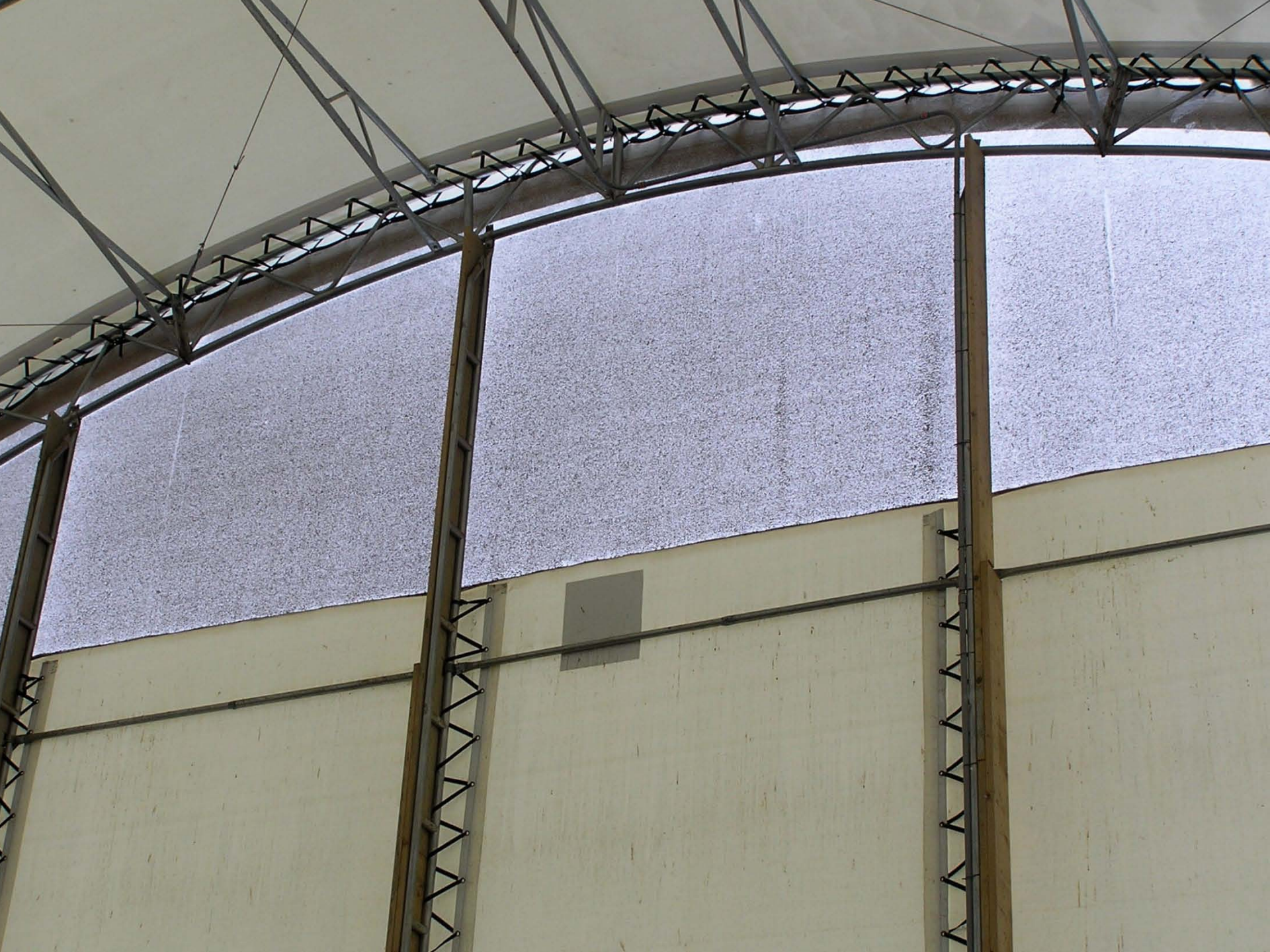

Floor

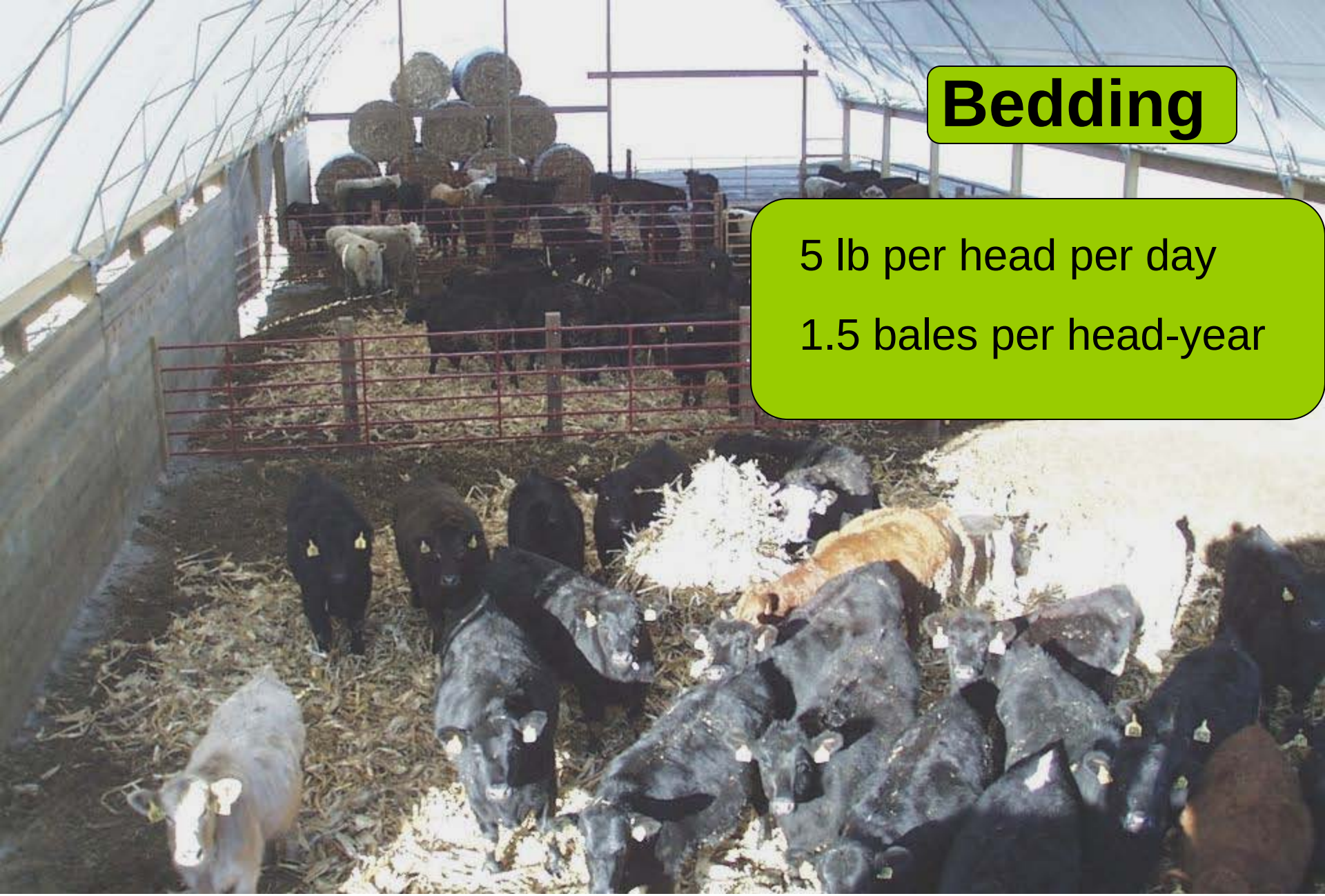

Floor


Awning

Orientation


Orientation





Bedding

5 lb per head per day

1.5 bales per head-year

Applications

South Dakota Cooperative Extension Service

SDSU

Opportunities Farm

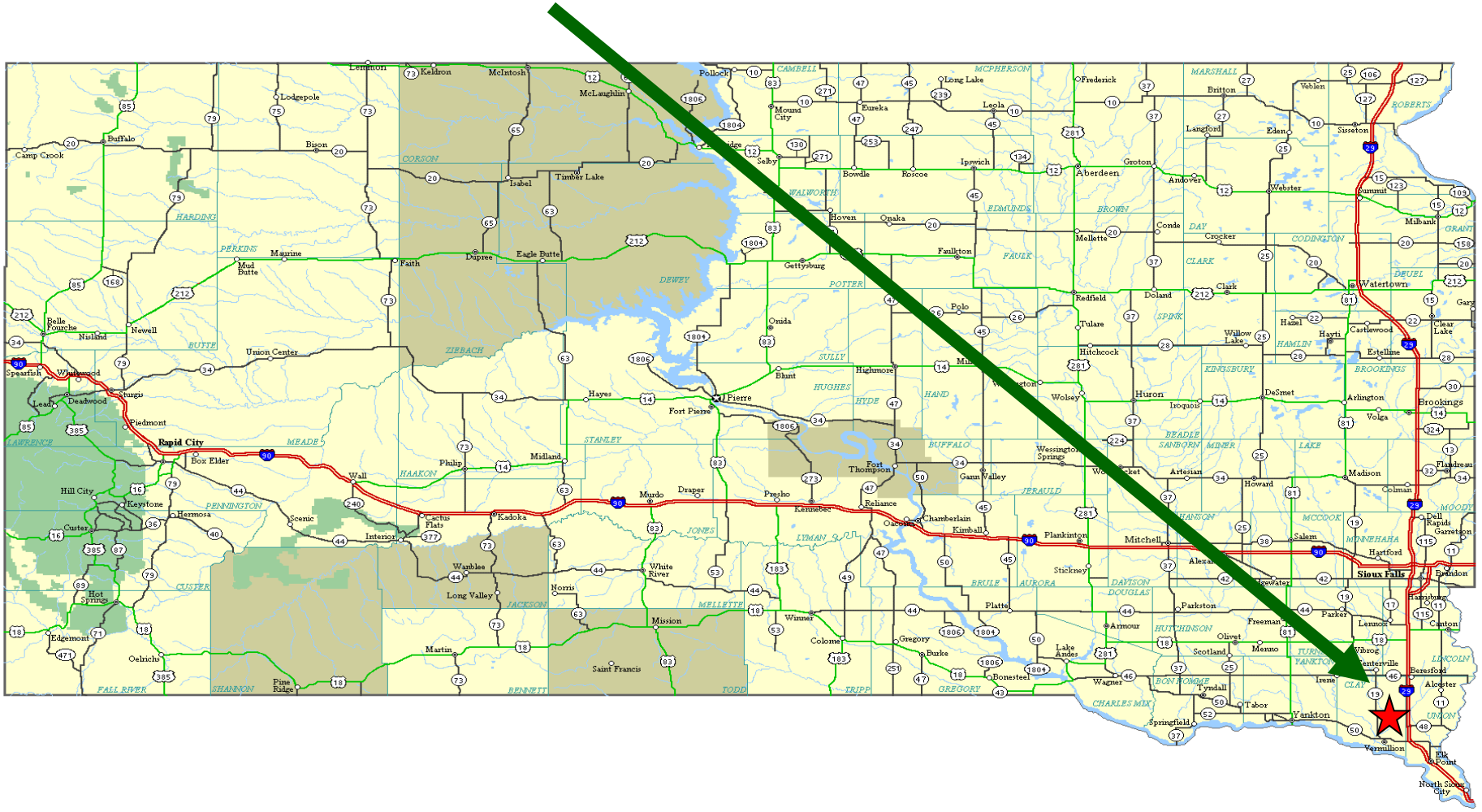
excellence in agriculture

a project of the SDSU Foundation

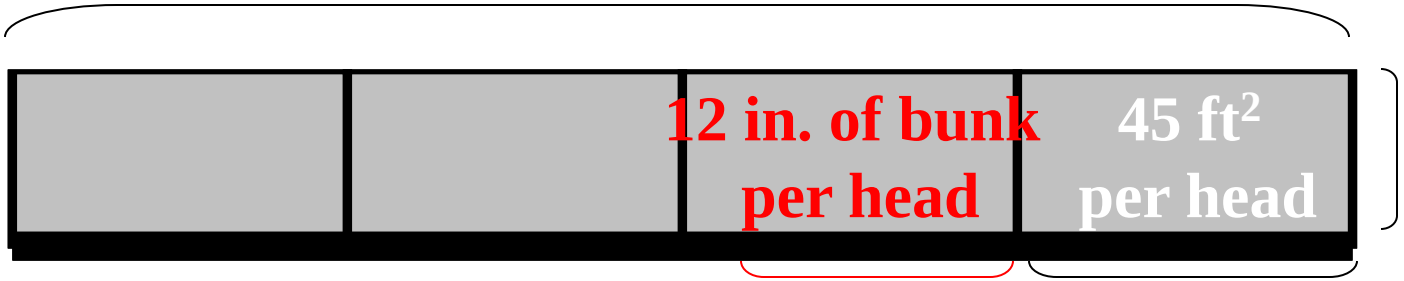
www.opportunitiesfarm.com

Matt Loewe, Manager
Erik Loe, SDSU Beef Specialist

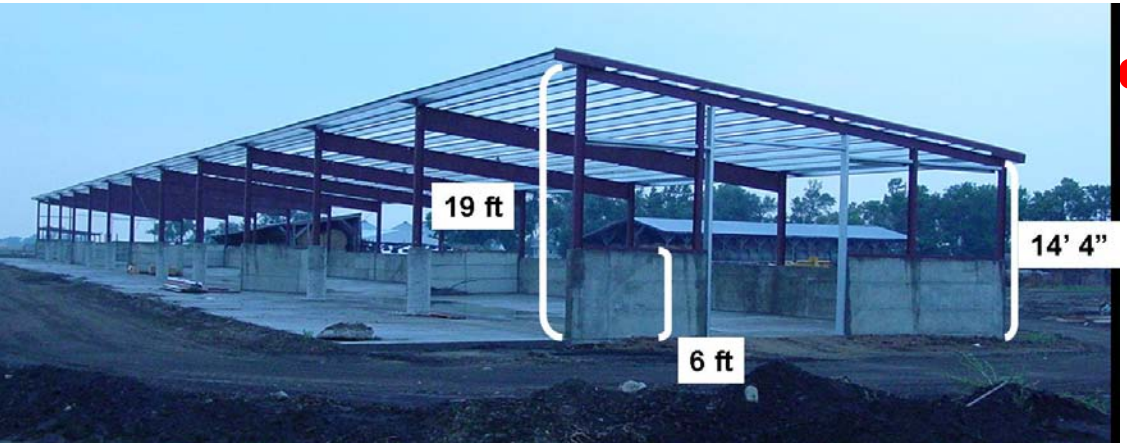
South Dakota



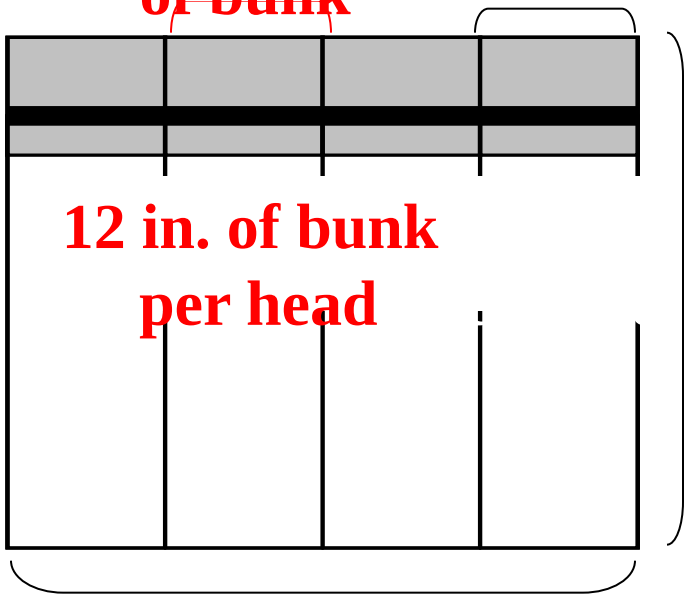
Bed-pack Confinement



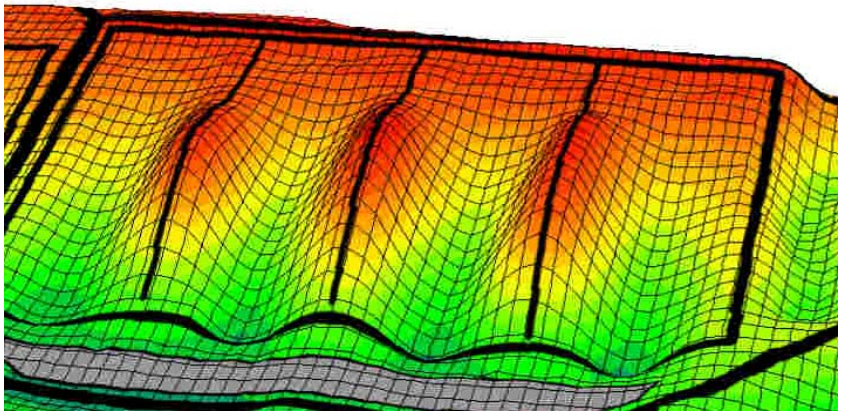
80 ft of bunk

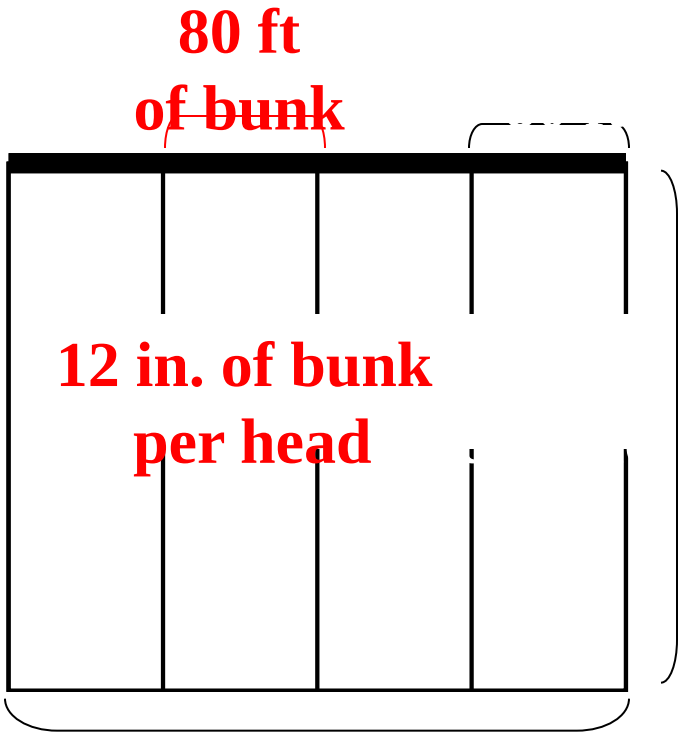


Partially-covered pens (Iowa)



Open Pens





Evaluation: Matched Sets

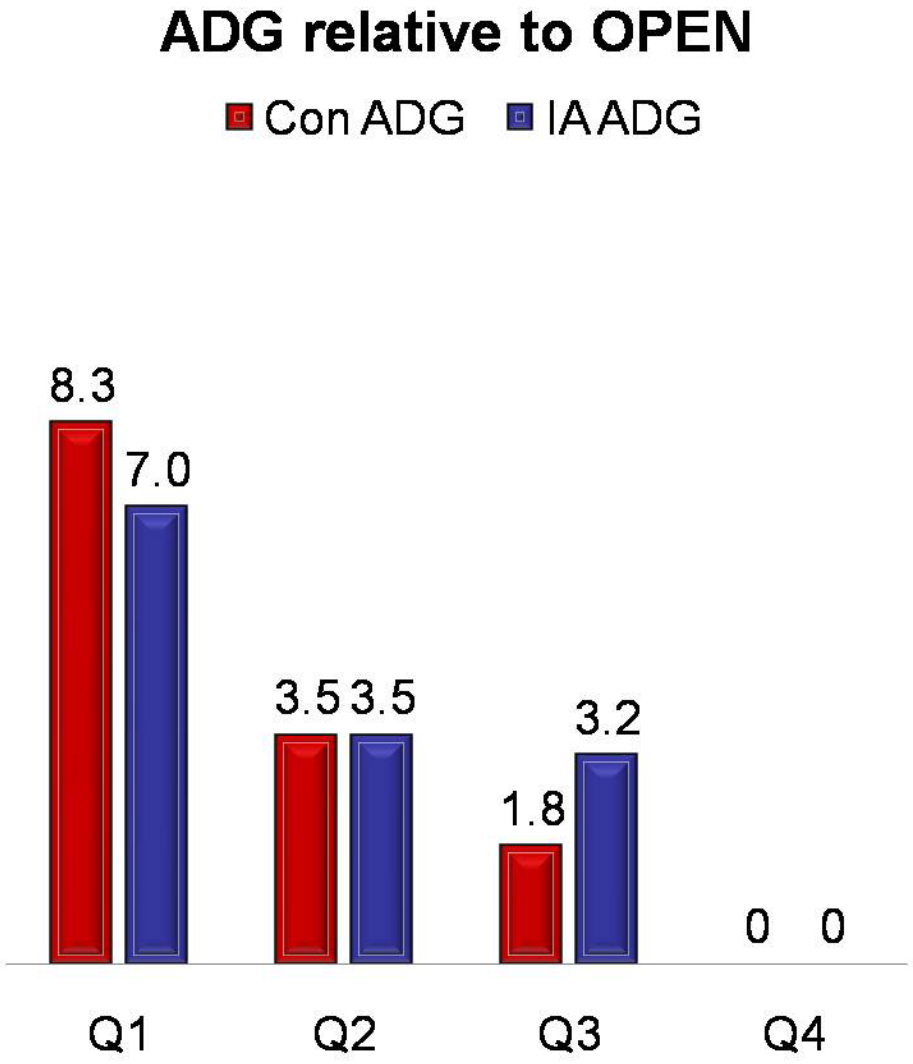
Performance Data

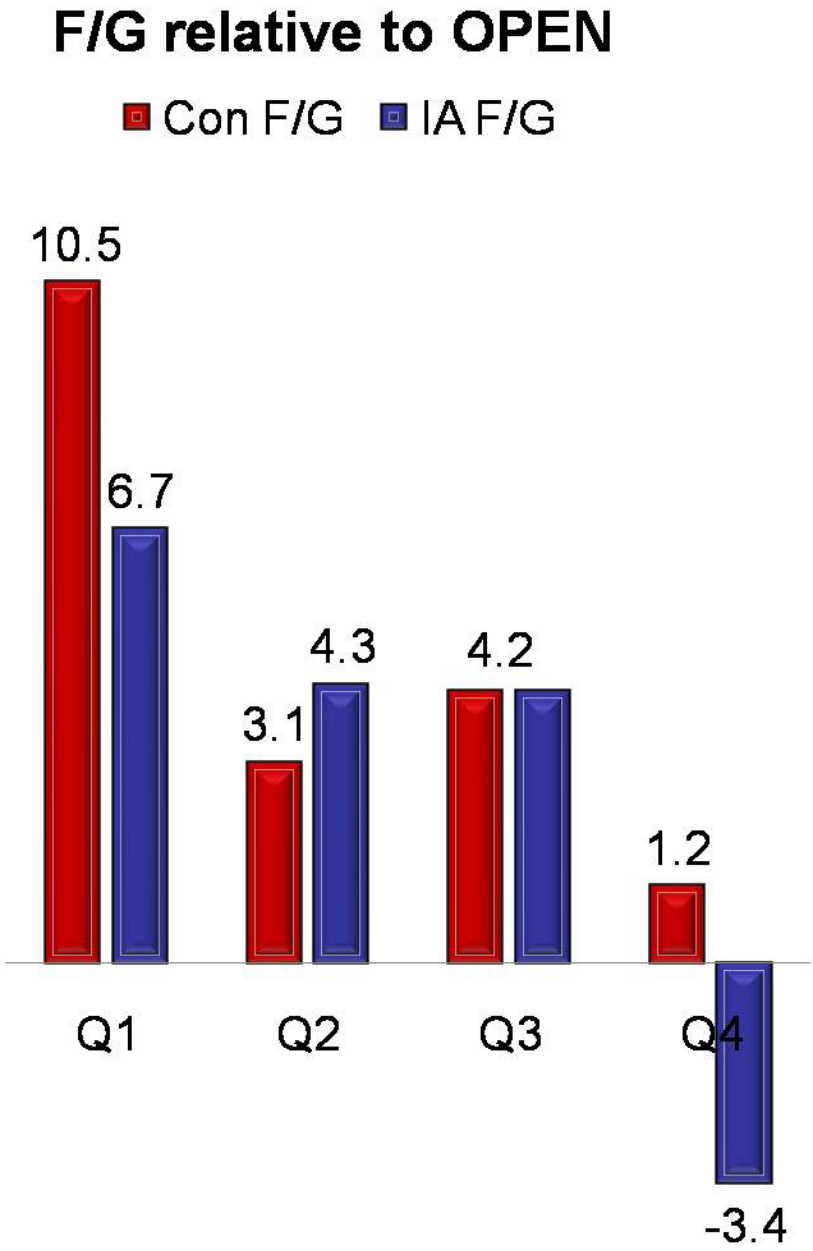
Feb. 2004 to Oct. 2007

Item	OPEN	CON	IOWA	Improvement vs OPEN			
				Con	IA	Con	IA
Pens	18	18	18				
Cattle received	1,407	1,406	1,412				
Cattle sold	1,397	1,400	1,401	%		lb	
Initial BW	785.8	785.8	785.6				
Final BW [a]	1,341	1,357	1,361	12	15	16	20
ADG, lb [a]	3.40	3.53	3.52	3.8	3.5	0.13	0.12
Feed intake, lb/d	24.0	23.8	24.0				
F/G [a]	7.11	6.76	6.86	5.2	3.6	-.35	-.25
Death loss, %	0.92	0.44	0.79				

[a] P <0.001

Performance Data by quarter marketed





Strategic Use of Facility

- Cold – for light weight calves
- Mud - newly arrived or market ready
- Hot weather – shade fat and black hided
- 35 degrees and rain – light weight calves

Mud Impact on Feedlot Performance

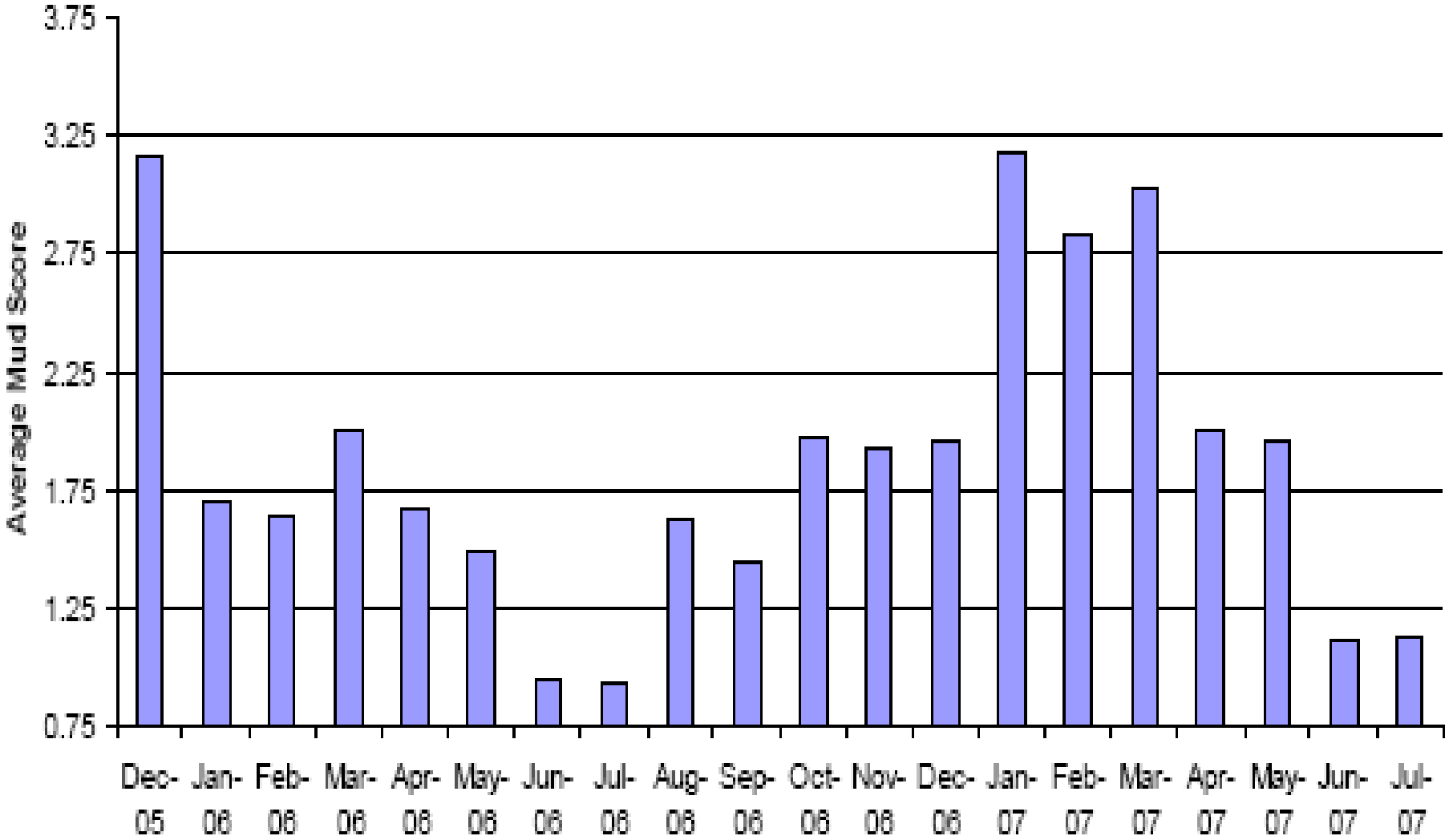
15 years of Holstein Data, Rayburn and Fox, 1990

Inches	ADFI	ADG	Chg v 0	F/G	Chg v 0
0	15.1	3.02		5.02	
1.6	12.8	2.38	-21%	5.41	8%
3.1	11.7	2.05	-32%	5.73	14%
4.7	10.6	1.70	-44%	6.22	24%

4-6 inches of mud and manure reduces ADG by 14%.
Dr John Sweeten, Texas A & M

Mud Scores 1, 2 and 4

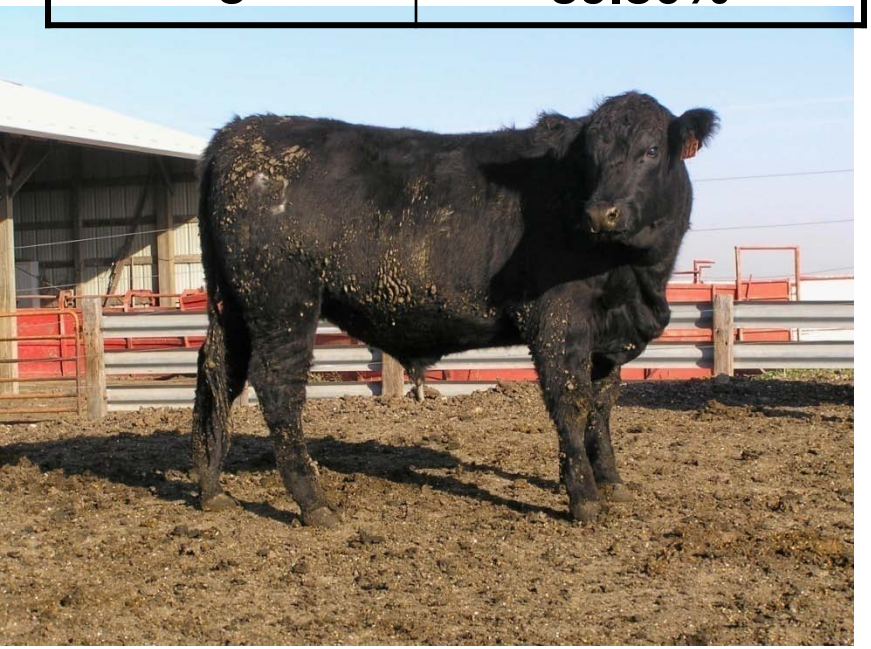
Figure 1. TriCounty Mud Score Averages by Month: December, 2005 to July, 2007



Impact of Mud Score on Dressing % ISU 2008

Mud Score	Dressing %
1	62.00%
2	62.02%
3	61.96%
4	61.59%
5	59.50%

Item	Mud 1	Mud 5
Live Wt	1300	1300
Carcass Wt	806	774
Carc. Value	$1169	$1122
Live $/cwt Diff		$-3.61



Effect of Bedding Level - NDSU

Item	No Bedding	Modest Bedding	Generous Bedding
No. of Steers	34	35	35
Lb of Bedding/Head	0	385	677
Dry Matter Intake	21.99	21.96	22.16
Daily Gain	2.83	3.69	3.53
Feed/Gain	7.77	5.95	6.28

Effect of Bedding Level - NDSU

Item	No Bedding	Modest Bedding	Generous Bedding
Carcass wt, lb.	674	715	721
Dress %	61.9%	62.3%	63.4%
% low Choice or better	23%	45%	63%
Fat Cover	.39	.43	.46
Bedding cost ($60/ton)	0.00	$11.54	$20.30
Economic advantage	0	$55.99	$71.46

How much can you invest for 3.5% improvement in gain and feed efficiency?

- Assumptions
- Interest 5%
- Years of life 15 Years
- Taxes Insurance & Repairs 7%
- Occupancy rate 85%
- Ration cost/ton of DM $250

$300/Hd Facility Investment

Reducing Weather Stress In Feedlot Cattle

- Hot weather
  - Either shade or sprinklers
- Cold weather
  - Wind protection
  - Wet – either roof – bedding and/or scraping
- Mud
  - Well drained lots and mounds
  - Concrete

System Comparison and Approximate Construction Costs per head capacity

- Beef Feedlot Systems Manual available on line at iowabeefcenter.org
- Feedlot costs only, does not include feed storage, handling, land, etc.

Beef Facilities

- ISU and SDSU data slight difference between total confinement and open front sheds
- SDSU 3.5% in gain and feed to gain compared to open lots
- Due to reduction in weather stress for groups closed out in the first half of year
- Facilities that keep cattle dry, clean and protected from winter winds improve cattle performance

Beef Facilities

- Shade and sprinklers will help reduce heat stress
- Your management will determine the success of your facilities
- Fuel prices – reevaluate bedding options
- Fertilizer prices – reevaluate manure value and handling options
- Our feed cost advantage remains intact but attention to details will determine your profitability