Impact of 50 Years of Beef Technologies

Dr. Matt Hersom

Department of Animal Sciences

University of Florida

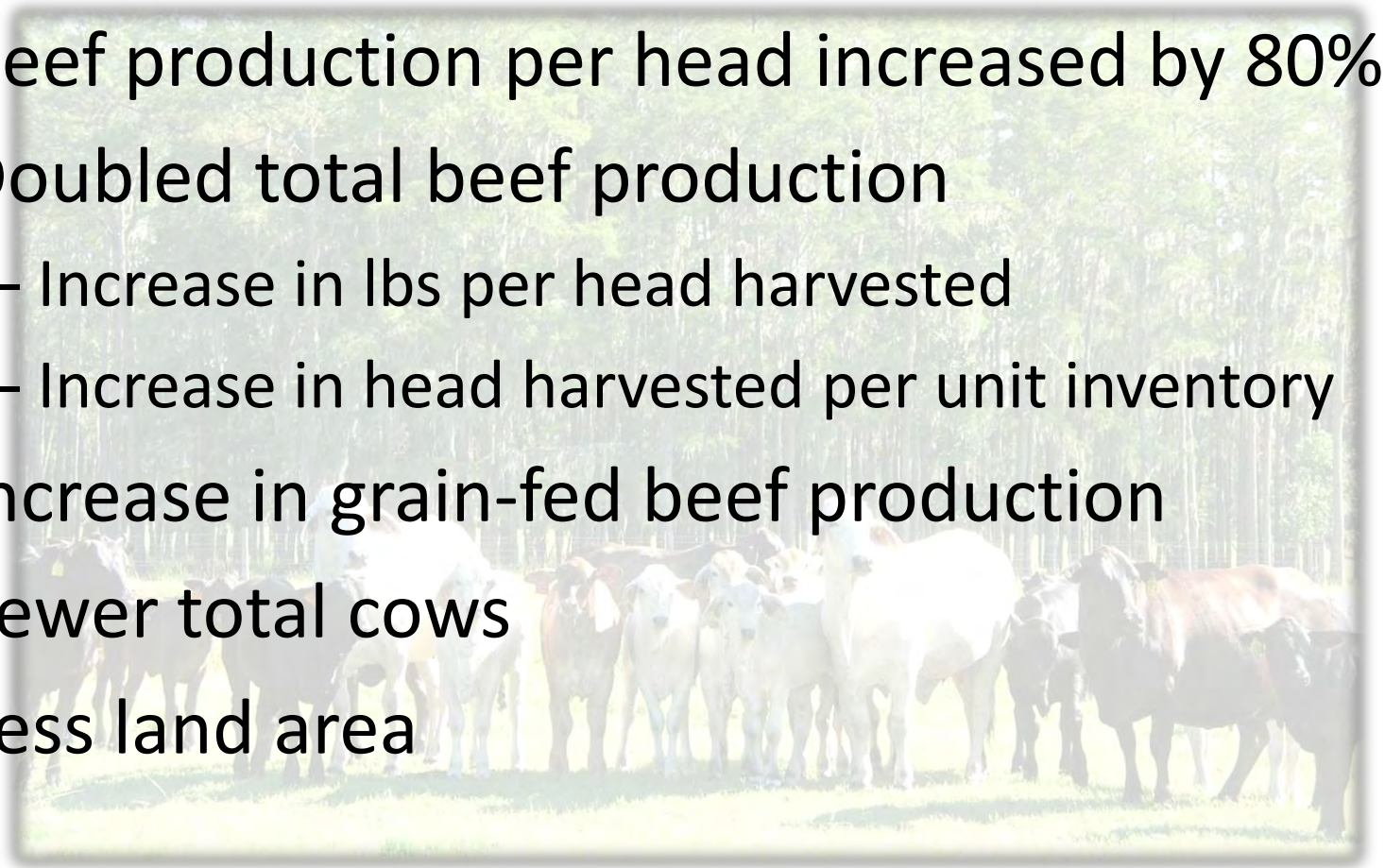
UF UNIVERSITY of FLORIDA IFAS

Why Do We Use Technology

- **Webster Dictionary**
  - **Technology** n., **1.** The application of scientific knowledge, esp. in industry or business. **2.** The methods and material of applied science.
- Hersom Corollary
  - Proven to result in an improvement in animal performance, comfort, health, or enterprise profitability.

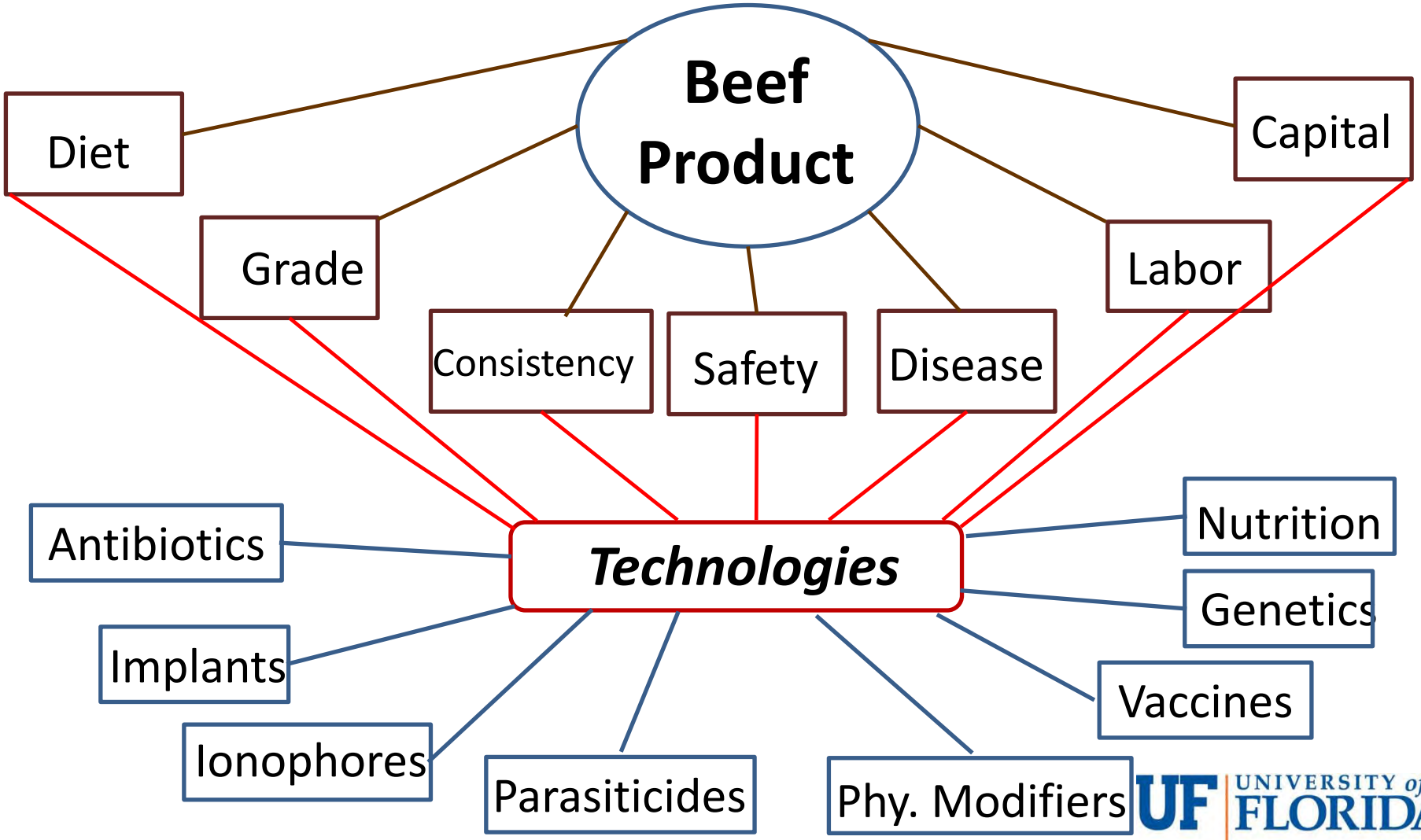
50-Year Impact of Technology

- Beef production per head increased by 80%
- Doubled total beef production
  - Increase in lbs per head harvested
  - Increase in head harvested per unit inventory
- Increase in grain-fed beef production
- Fewer total cows
- Less land area



UF UNIVERSITY of FLORIDA IFAS

Relationships of Technologies to Beef



UF UNIVERSITY of FLORIDA IFAS

Technologies Reviewed

1. Antibiotics
2. Implants
3. Ionophores
4. Parasiticides
5. Physiological Modifiers
6. Vaccines
7. Genetics
8. Nutrition

UF UNIVERSITY of FLORIDA IFAS

Antibiotics-Antimicrobials

- Substances that have bacteriostatic or bactericidal properties.
- Therapeutic
  - Used in response to disease or health issue
  - Metaphlaxis or Pull-Treat
  - Penicillin, LA200, Micotil, Draxxon, Nuflor
- Sub-therapeutic
  - Feed to reduce subclinical incidence of infection
  - May improve ADG and/or feed efficiency
    - CTC, Tylosin

Antibiotic – Antimicrobials metaphlaxis

Item	Mineral - Control	Mineral-Aureomycin	Difference
Initial Cow BW, lb	1013	977	
Initial Cow BCS	5.0	4.9	
Mineral intake, oz/d	4.9	5.2 (910 mg/d)	
152-d Cow Wt Gain, lb	206	198	
152-d Cow BCS Chg	0.2	0.2	
Calf Wt Change, lb	343	362	yes
Calf Weaning Wt, lb	561	579	yes
Pregnancy Rate, %	90.2	92.0	
Foot Rot, %	21.0	9.9	Yes
Repull for Foot Rot, %	22.2	8.3	Yes
Pink eye, %	0.8	0.0	

Breiner et al., 2005

UF UNIVERSITY of FLORIDA IFAS

Antibiotics-Antimicrobials metaphlaxis

Galyean et al., 1995

	Control Calves			Treated Calves		
	Experiment			Experiment		
	1	2	3	1	2	3
ADG, lb/d						
D 1 – 14	1.65[a]	2.20	--	2.22[b]	2.44	--
D 0 – 28	2.56	2.71	3.13[a]	2.82	2.76	3.46[b]
Intake, lb/d						
D 1 – 14	5.70	--	--	6.17	--	--
D 0 – 28	7.80	--	9.74[a]	8.57	--	10.5[b]
Feed:Gain						
D 1 – 14	7.73	--	--	6.17	--	--
D 0 – 28	6.76	--	7.25[x]	6.70	--	6.43[y]
Calves Treated BRD, %	46.4[x]	32.8[x]	43.6[x]	0[y]	12.1[y]	11.9[y]

[a,b] Means within experiment with different superscripts differ P<0.10.
[x,y] Means within experiment with different superscripts differ P<0.05.

UF UNIVERSITY of FLORIDA IFAS

Antibiotics-Antimicrobials

	Num. of Trt for Respiratory Disease			Respiratory Lesions		
	0	1	2	None	Inactive	Active
ADG, lb/d [A,C]	3.37	3.28	2.97	3.48	3.15	2.58
HCW, lb [A,C]	732	719	687	737	708	676
Back Fat, in [B]	0.46	0.43	0.30	0.45	0.42	0.41
Ribeye Area, sq in	13.33	13.18	12.79	13.42	12.93	13.21
Yield Grade [A]	2.6	2.6	2.2	2.6	2.5	2.4
Quality Grade – Marbling Score [C]						
Choice, %	4.9	4.5	0	5.1	3.8	0
Select, %	82.4	83.2	76.9	86.3	75.2	66.7
Standard, %	12.8	12.4	23.1	8.6	18.0	33.3
Shear Force 7-d, lb [C]	7.9	8.4	8.1	7.9	8.4	8.8

[A] Trt number 0 vs 1 and 2, P<0.05.
[B] Trt number 0 vs 1 and 2, P<0.10.
[C] None vs Lesions, P<0.05.

Gardner et al., 1995

UF UNIVERSITY of FLORIDA IFAS

Antibiotics – Impact

		Effect
Cow Herd	Weaning Weight, %	
	Breakeven Selling Price, %	
	Impact on Cost of Production, $	
Stocker	Average Daily Gain, %	6.87
	Breakeven Selling Price, %	1.22
	Impact on Cost of Production, $	9.57
Feedlot	Average Daily Gain, %	3.37
	Feed:Gain, %	-2.69
	Breakeven Selling Price, %	0.56
	Impact on Cost of Production, $	5.86

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

Implants

- Growth promoting implants are pellets that are implanted under the skin of the ear of growing calves
- Pellets release extremely low concentrations of various hormones
- Improve growth rate, feed conversion, and protein deposition

UF UNIVERSITY of FLORIDA IFAS

Implants-Mechanism

- Estrogenic implants increase somatotropin (ST) and insulin-like growth factor-1 (IGF-1).
- Both are produced by the animal and affect how nutrients are used to produce muscle, bone, and fat.
- Androgenic implants (trenbolone acetate, TBA), significantly increase the circulating levels of IGF-1 and decreases the normal loss of muscle tissue.
- The implant response is associated with nutrients available and the level of implant growth promotant circulating in the animal.

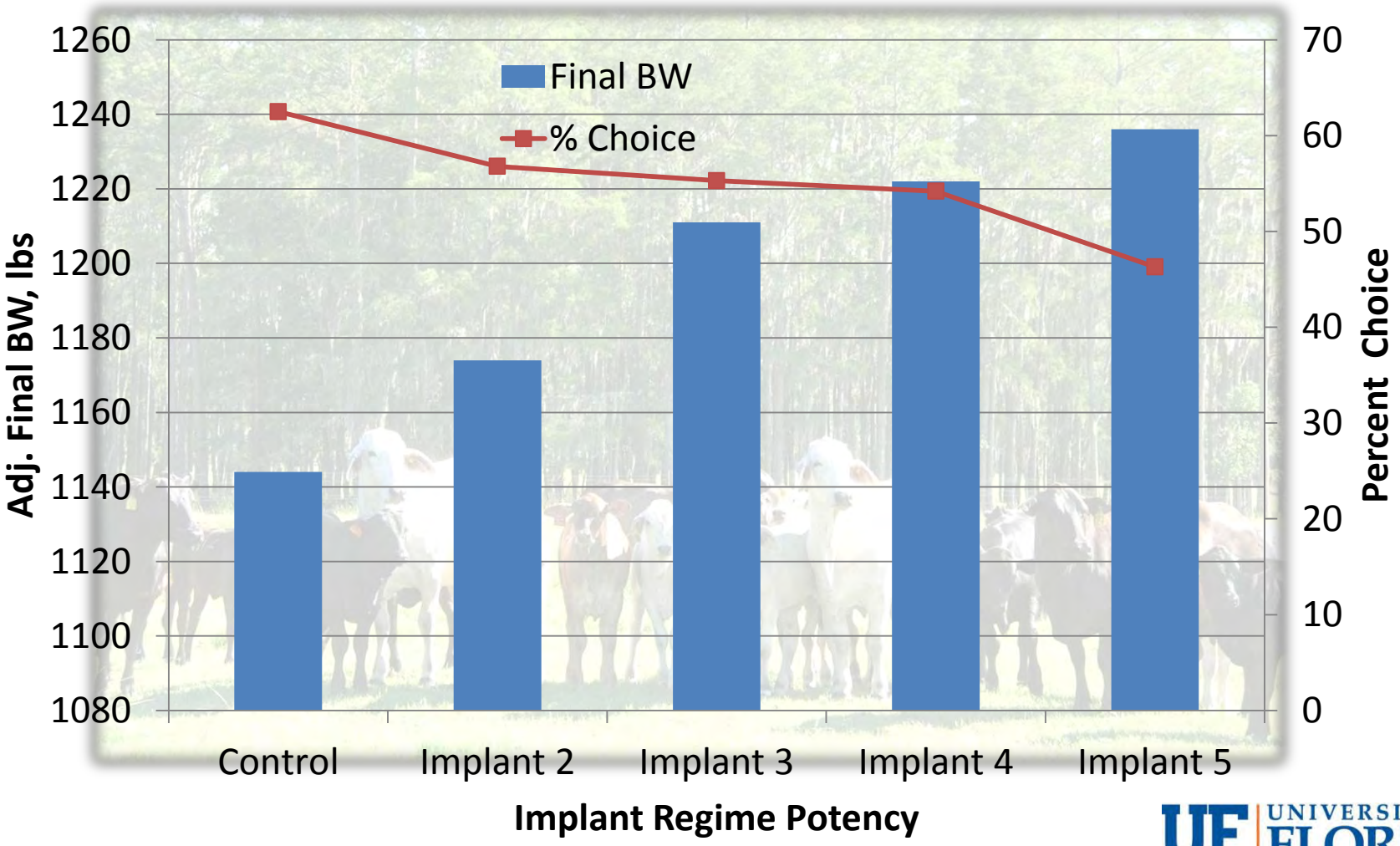
Implants

Implant	Category	Relative Potency
Compudose, Ralgro, Encore, Implus-C, Synovex-C, Component E-C	Estrogen	Mild
Implus-S, Synovex-S, Component E-S, Ralgro Magnum, Duralease	Estrogen	Strong
Component T-S, Finaplix-H, Component T-H	Androgen	
Implus-H, Synovex –H, Component E-H, Revalor-S, Revalor-H, Revelor-G, Revalor-IH, Revelor-IS, Component TE-S, Component TE-G	Combination	Mild
Synovex Plus, Revalor-200	Combination	Strong

Montgomery, et al., 2001.

UF UNIVERSITY of FLORIDA IFAS

Implants



Adapted from Guiroy et al. 2002

UF UNIVERSITY of FLORIDA IFAS

Implants

Item	Winter Stocker Implant Treatment				
	Control	Synovex-C	Synovex-S	Revalor-G	Con vs. Imp
Winter ADG,	0.62	0.70	0.70	0.77	Different
Increment over Control, %	--	14.3	14.3	25.0	
Summer ADG	2.33	2.31	2.31	2.29	Similar
Feedlot ADG	3.63	3.61	3.79	3.66	Similar
Final BW	1,205	1,222	1,247	1,236	Different
Carcass Weight	767	780	793	786	Different
Carcass Maturity	A69	A92	A94	A80	Different
Gross Return to Implant					
Winter	0	11.74	13.41	20.97	
Feedlot - Live	0	6.49	19.46	14.75	
Feedlot - Carcass	0	(18.96)	(10.04)	(12.33)	

Adapted from Paisely et al., 1999

UF UNIVERSITY of FLORIDA IFAS

Implants – Impact

		Effect
Cow Herd	Weaning Weight, %	3.07
	Breakeven Selling Price, %	5.80
	Impact on Cost of Production, $	28.03
Stocker	Average Daily Gain, %	12.85
	Breakeven Selling Price, %	2.31
	Impact on Cost of Production, $	18.19
Feedlot	Average Daily Gain, %	14.13
	Feed:Gain, %	-8.79
	Breakeven Selling Price, %	6.52
	Impact on Cost of Production, $	68.59

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

Ionophores

- Sub-class of antimicrobial products
- Affect bacteria in the rumen
- Alter total rumen metabolism to:
  - shift in ruminal microbial populations
  - increase efficiency of appropriate bacteria
  - increase production of organic acids
  - Increase total microbial protein
  - Decrease waste: ruminal methane and ammonia
  - Decrease coccidiosis, bloat, acidosis

Ionophores

- Monensin – Rumensin
- Lasalocid – Bovatec
- Laidlomycin proprionate – Cattlyst
- Applications:
  - Backgrounding
  - Stocker
  - Replacement heifer development
  - Feedlot

UF UNIVERSITY of FLORIDA IFAS

Ionophores

- 24 trials with 1,057 steers + 0.198 lb/d (16.3% increase over control)
- 11 trials with 853 steers & heifers +0.198 lb/d (15.5% increase over control)
- 24 trials with 914 steers & heifer + 0.181 lb/d (13.5% increase over control)

UF UNIVERSITY of FLORIDA IFAS

Ionophores

	Stocker Gain, lb/d	
	7/20 to 10/13	7/25 to 9/26
Pasture		0.99[a]
Past + Supp	0.93[a]	1.04[a]
Monensin-200 mg	1.15[b]	1.50[b]

[abcdef] Means with different superscripts differ P<0.05

Bermudagrass Stocker Gain, lb/d	
Pasture	1.02[a]
Past+Corn	1.24[b]
P+C – 25 mg	1.55[c]
P+C – 50 mg	1.61[d]
P+C – 100 mg	1.72[e]
P+C – 200 mg	1.56[f]

Rouquette et al., 1980
Oliver, 1975

UF UNIVERSITY of FLORIDA IFAS

Ionophores

Feedlot Application of Ionophore

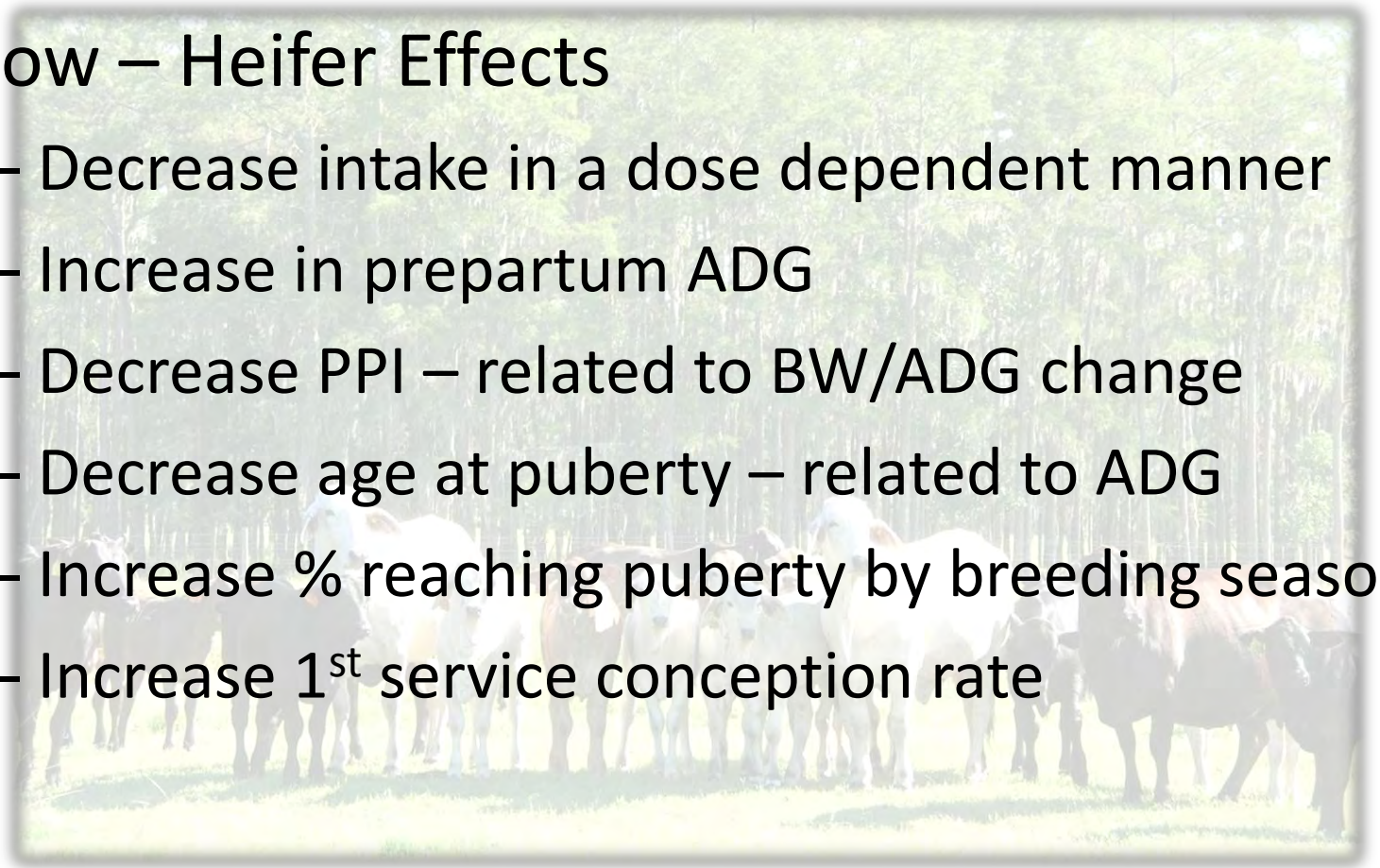
	Monensin		Lasalocid	
Level, mg/d	ADG, lb/d	DMI, lb	ADG, lb/d	DMI, lb
0	2.38	18.72	2.67	20.0
	Improvement, % of Control		Improvement, % of Control	
5.5	+4.6	-1.5	+0.8	-1.6
11	+4.6	-1.5	+3.4	-2.2
22	+1.9	-5.4	+5.2	-2.5
33	0.0	-8.1	+3.4	-3.9

Potter and Wagner 1986

UF UNIVERSITY of FLORIDA IFAS

Ionophores

- Cow – Heifer Effects
  - Decrease intake in a dose dependent manner
  - Increase in prepartum ADG
  - Decrease PPI – related to BW/ADG change
  - Decrease age at puberty – related to ADG
  - Increase % reaching puberty by breeding season
  - Increase 1st service conception rate



UF UNIVERSITY of FLORIDA IFAS

Ionophores – Impact

		Effect
Cow Herd	Weaning Weight, %	--
	Breakeven Selling Price, %	--
	Impact on Cost of Production, $	--
Stocker	Average Daily Gain, %	7.74
	Breakeven Selling Price, %	1.46
	Impact on Cost of Production, $	11.51
Feedlot	Average Daily Gain, %	2.90
	Feed:Gain, %	-3.55
	Breakeven Selling Price, %	1.18
	Impact on Cost of Production, $	12.43

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

Paracitides

- Standard procedure to treat cows 1-2 times/yr
- Stocker systems utilize as routine process
- Feedlots often utilize as a means to ensure performance
- Parasitism in young cattle can have a direct negative effect on performance and also negatively affect ancillary benefits of management procedures (Yawinski et al., 2009)

UF UNIVERSITY of FLORIDA
IFAS

Paracitides
Replacement heifers

Item	Control	Dewormed	Difference
Initial BW, lb	643	648	
Winter BW gain, lb	139	160	Yes
Winter ADG, lb/d	1.17	1.32	Yes
Summer BW gain, lb	50	44	
Summer ADG, lb/d	0.79	0.70	
Total BW gain, lb	187	204	Yes
Total ADG, lb/d	1.01	1.12	Yes
Pubertal prior to breeding, %	69.3	72.0	
Age at puberty, d	378	376	
1st Service Concept, %	45.5	39.2	
Overall Preg, %	78.0	76.1	

Purvis et al., 1994

UF UNIVERSITY of FLORIDA IFAS

Paracitides
Replacement heifers

Item	Control	Deworm	Ionophore	Combination
Gain, lb/d	1.85	1.83	1.94	1.89
Age at Puberty, d	433[a]	424[b]	425[c]	425[c]
BW at Puberty	797[a]	775[b]	780[b]	782[b]
[A,b] Means with different superscript differ P<0.05				

Purvis and Whittier, 1996

UF UNIVERSITY of FLORIDA IFAS

Paracitides
Cow-calf

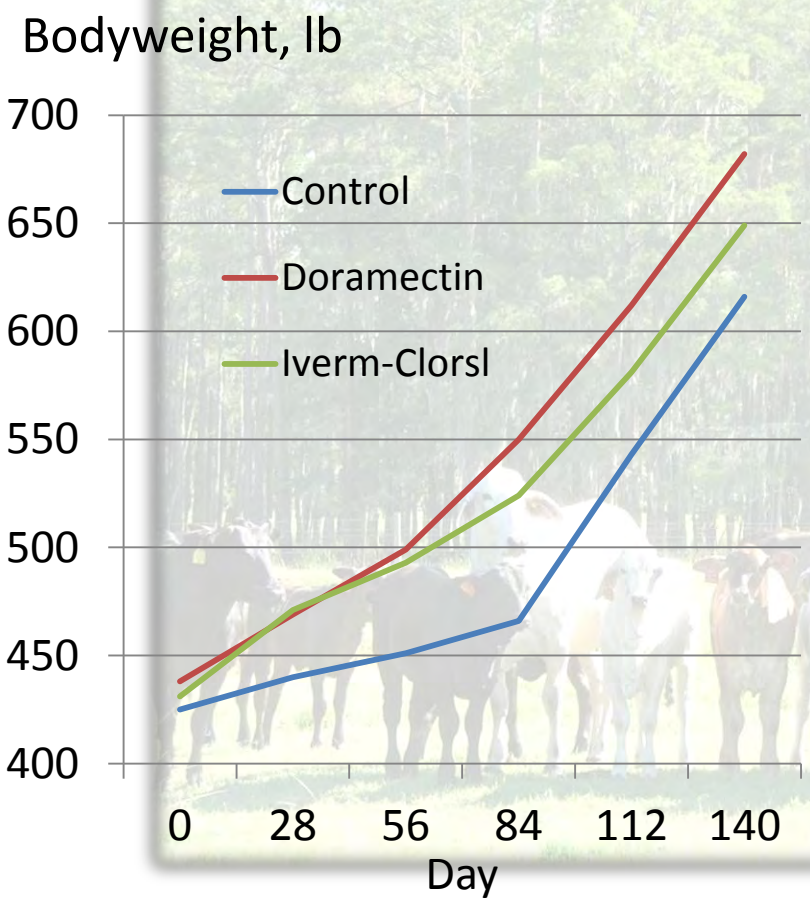
Item	Control	De-wormed	S.E.	P>F
ADG, lb/d[b]	1.37	1.45	0.008	<0.001
Total calf BW gain[b], lb	122.5	131.1	0.88	< 0.001
Calf BW gain, Pd1[c], lb	78.4	84.4	1.98	0.002
Calf BW gain Pd2[c], lb	43.8	46.5	7.05	0.06
Cow BCS at start	5.0	5.0	0.04	0.99
Cow BCS at weaning	4.7	4.8	0.04	0.33
Cow BCS change	-0.21	-0.15	0.04	0.31

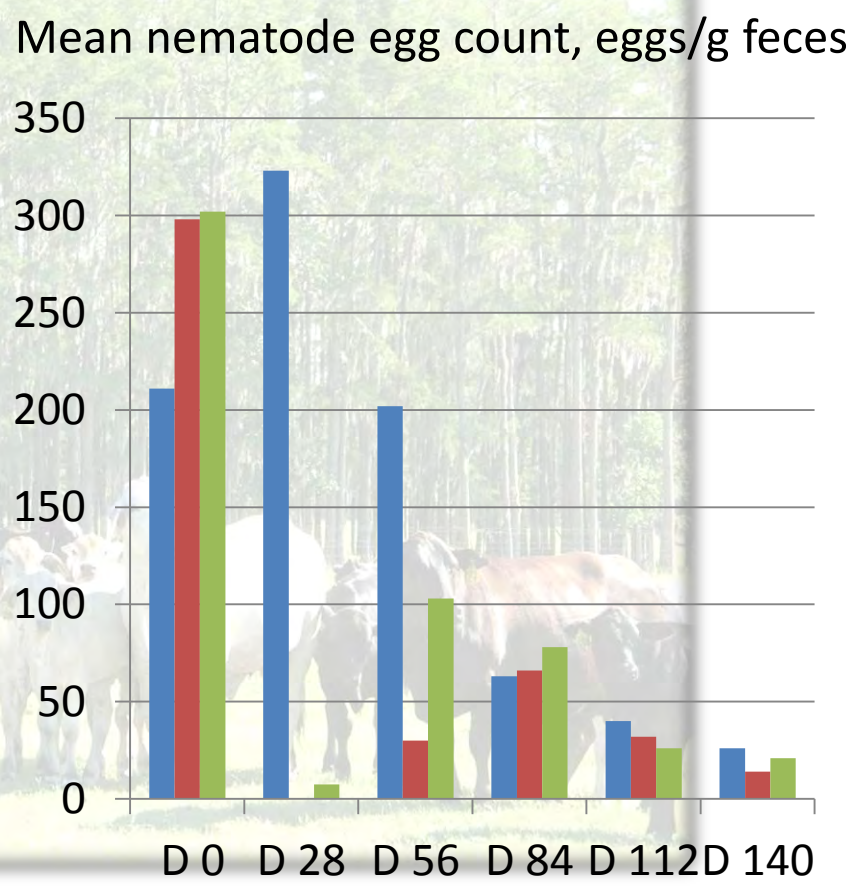
[B] From 90 days prior to weaning to weaning.
[C] Period 1 - from 90 days to weaning to about 45 days prior weaning; Period 2 – from 45 days to weaning.

Hersom et al., 2010

UF UNIVERSITY of FLORIDA IFAS

Paracitides





Loyacano et al., 2001

UF UNIVERSITY of FLORIDA IFAS

Paracitides – Impact

		Effect
Cow Herd	Weaning Weight, %	4.24
	Weaning Rate, %	23.62
	Breakeven Selling Price, %	34.34
	Impact on Cost of Production, $	165.47
Stocker	Average Daily Gain, %	17.79
	Breakeven Selling Price, %	2.74
	Impact on Cost of Production, $	20.77
Feedlot	Average Daily Gain, %	5.59
	Feed:Gain, %	-3.91
	Breakeven Selling Price, %	2.11
	Impact on Cost of Production, $	22.16

Source: Lawrence and Ibarburu, 2006

Physiological Modifiers

- β-agonists (Optaflexx™ - ractopamine HCl, Zilmax® - zilpaterol HCl)
  - Works on muscle fibers
  - Feedlot response to increase:
  - live-weight gain
  - Gain efficiency
  - carcass weight gain
  - Carcass yield
- "Repartioning agent" is a misnomer

UF UNIVERSITY of FLORIDA IFAS

Physiological Modifiers

Item	Control	Optaflexx	P-value
Weighted days on feed	98	98	--
Arrival BW, lb	888	895	0.14
Final BW, lb	1,236	1,264	0.02
ADG, lb/d	3.48	3.75	0.008
Feed offered, lb/d	20.9	21.7	0.01
Feed:gain	5.98	5.78	0.09

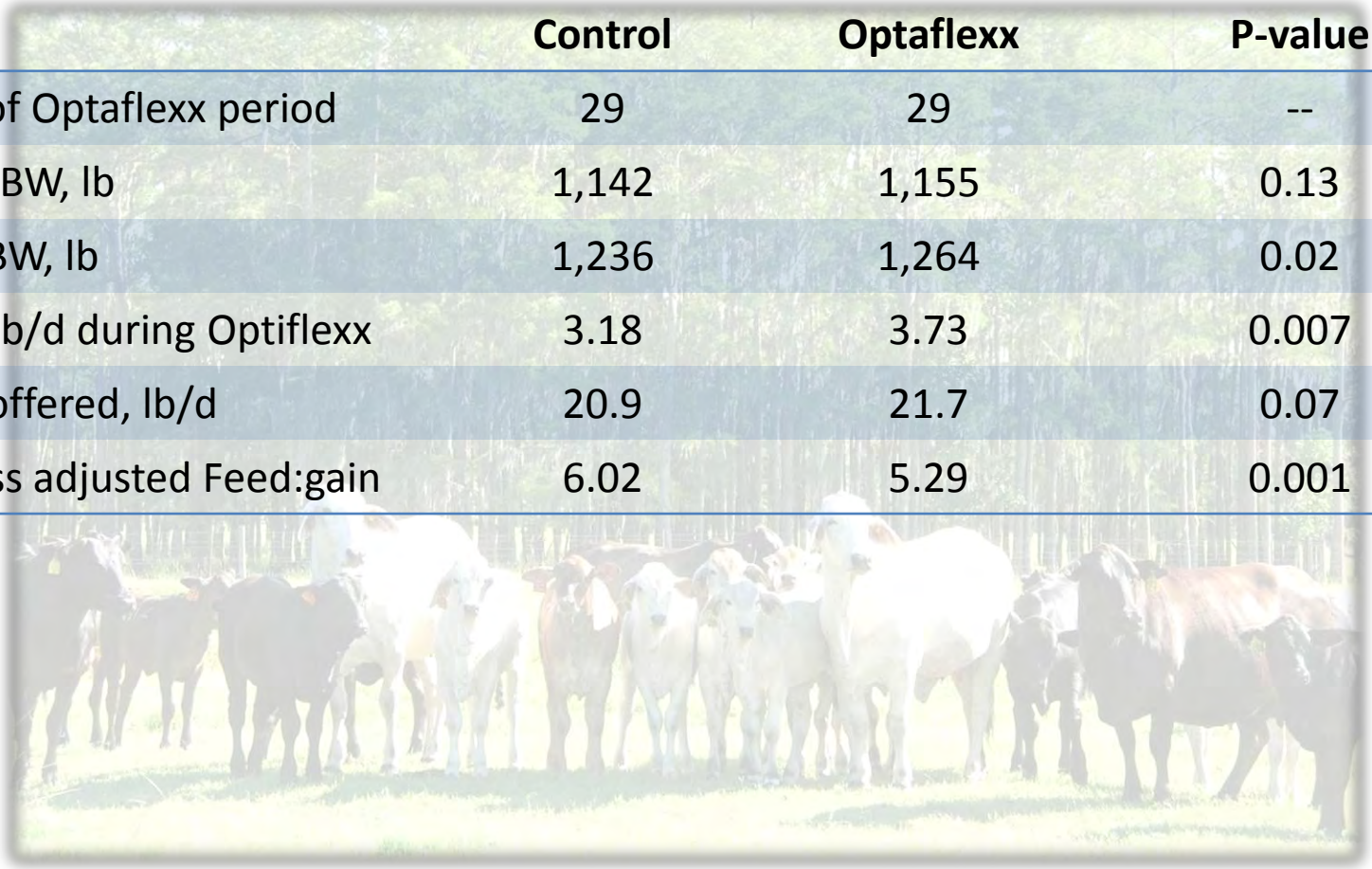
Steer performance from initial processing or re-implantation to harvest, Optaflexx fed During the last 29 days.

Adapted from Loe et al., 2005

UF UNIVERSITY of FLORIDA IFAS

Physiological Modifiers

Item	Control	Optaflexx	P-value
Days of Optaflexx period	29	29	--
Initial BW, lb	1,142	1,155	0.13
Final BW, lb	1,236	1,264	0.02
ADG, lb/d during Optiflexx	3.18	3.73	0.007
Feed offered, lb/d	20.9	21.7	0.07
Carcass adjusted Feed:gain	6.02	5.29	0.001



Adapted from Loe et al., 2005

UF UNIVERSITY of FLORIDA IFAS

Physiological Modifiers

Item	Control	Optaflexx	P-value
Hot carcass wt, lb	789	809	0.009
Dressing %	63.9	64.0	0.25
USDA Prime, %	0.3	0.3	0.97
USDA Choice, %	35.8	36.3	0.84
USDA Select, %	55.1	55.7	0.82
Yield Grade 1, %	0.12	0.11	0.98
Yield Grade 2, %	54.8	49.6	0.02
Yield Grade 3, %	26.6	28.7	0.37
Yield Grade 4, %	1.7	3.3	0.05
Yield Grade 5, %	0.1	0.2	0.36

Adapted from Loe et al., 2005

UF UNIVERSITY of FLORIDA IFAS

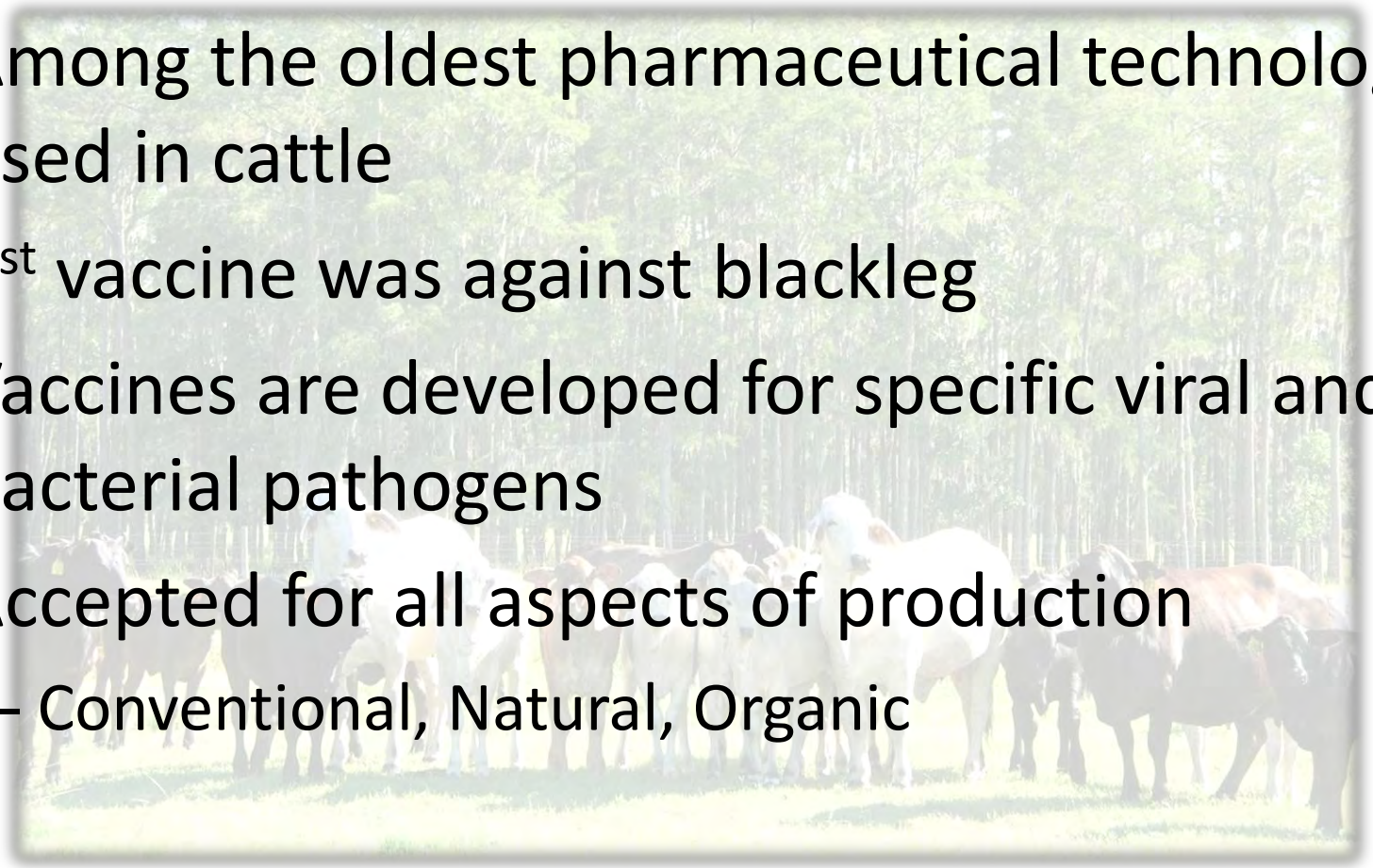
Physiological Modifiers – Impact

		Effect
Cow Herd	Weaning Weight, %	--
	Breakeven Selling Price, %	--
	Impact on Cost of Production, $	--
Stocker	Average Daily Gain, %	--
	Breakeven Selling Price, %	--
	Impact on Cost of Production, $	--
Feedlot	Average Daily Gain, %	14.04
	Feed:Gain, %	-12.59
	Breakeven Selling Price, %	1.24
	Impact on Cost of Production, $	13.02

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

Vaccines



- Among the oldest pharmaceutical technology used in cattle
- 1st vaccine was against blackleg
- Vaccines are developed for specific viral and bacterial pathogens
- Accepted for all aspects of production
  - Conventional, Natural, Organic

UF UNIVERSITY of FLORIDA IFAS

Vaccines

- Infectious bovine rhinotracheitis (IBR)
- Bovine viral diarrhea (BVD)
- Bovine respiratory syncytial virus (BRSV)
- Parainfluenza
- Clostridium perfringens A, B, C, D
- Clostridium chauvoei (blackleg)
- Haemophilus
- Pasteurella
- Leptospria
- Pasturella
- Vibriosis
- Rotavirus, Coronavirus
- Esherichia coli O157:H7

UF UNIVERSITY of FLORIDA
IFAS

Vaccines

- Prophylactic use
- Hard to quantify efficiency benefits
  - Either exposed and useful or not exposed
- Healthy animals perform better
- “Permissive” for all other technologies

UF UNIVERSITY of FLORIDA
IFAS

Genetics

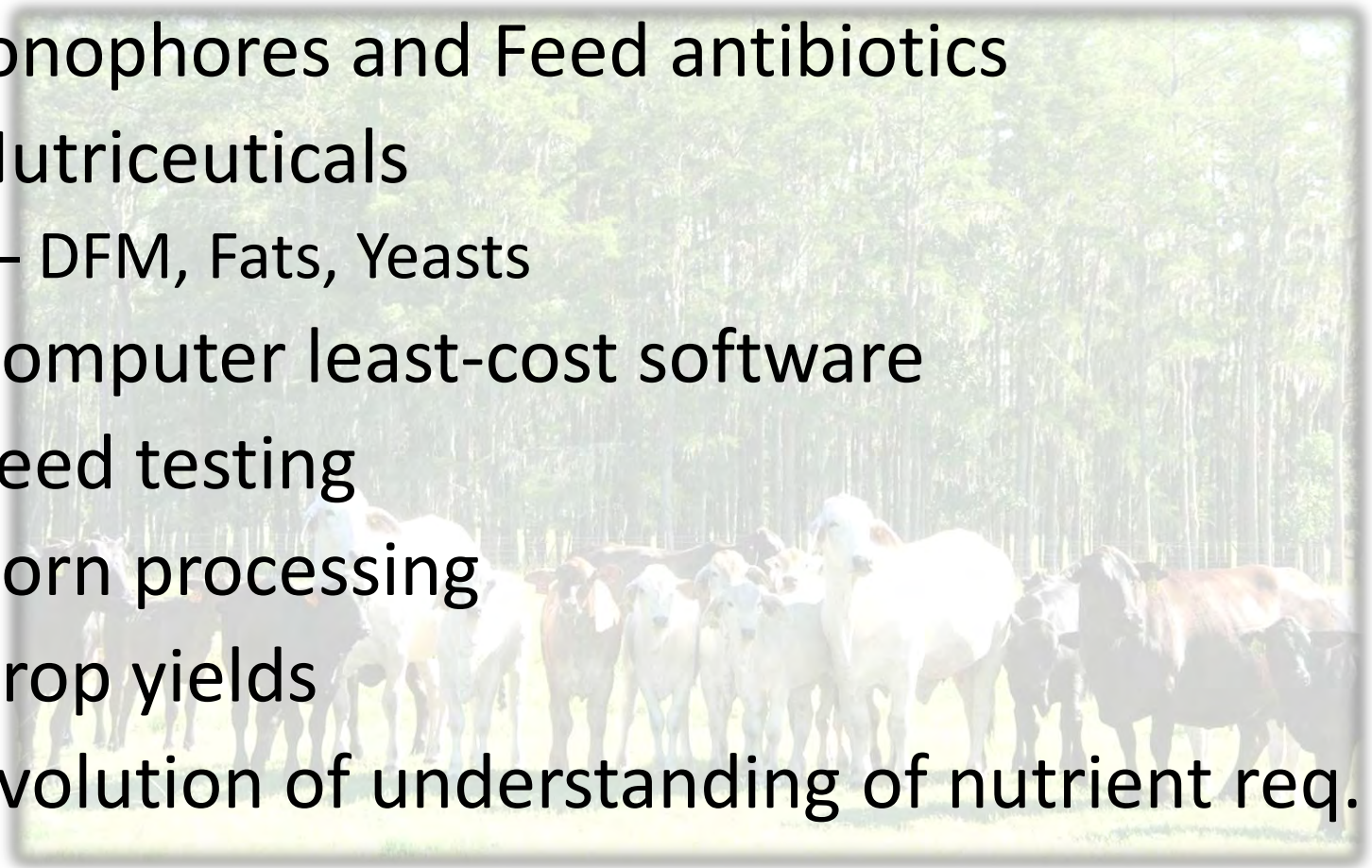
UF UNIVERSITY of FLORIDA
IFAS

Genetics

- Genetic Technology
  - Crossbreeding
  - Artificial insemination
  - Bull testing
  - EPDs
  - DNA-typing
  - Gene mapping and markers
  - Residual feed intake

UF UNIVERSITY of FLORIDA IFAS

Nutrition



- Ionophores and Feed antibiotics
- Nutriceuticals
  - DFM, Fats, Yeasts
- Computer least-cost software
- Feed testing
- Corn processing
- Crop yields
- Evolution of understanding of nutrient req.

All Technologies – Impact

		Effect
Cow Herd	Breakeven Selling Price, %	46.78
	Impact on Cost of Production, $	225.55
Stocker	Breakeven Selling Price, %	10.40
	Impact on Cost of Production, $	80.79
Feedlot	Breakeven Selling Price, %	11.99
	Impact on Cost of Production, $	126.09

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

What About "Naturally Raised" Programs?

- Most will not allow the use of:
  1. Antibiotics-Antimicrobial
  2. Ionophores
  3. Implants
  4. Paracitides
- Are you willing to give up the production advantage?
- Does the possibility of a "premium" outweigh the decrease in production

UF UNIVERSITY of FLORIDA IFAS

Model of Beef Production

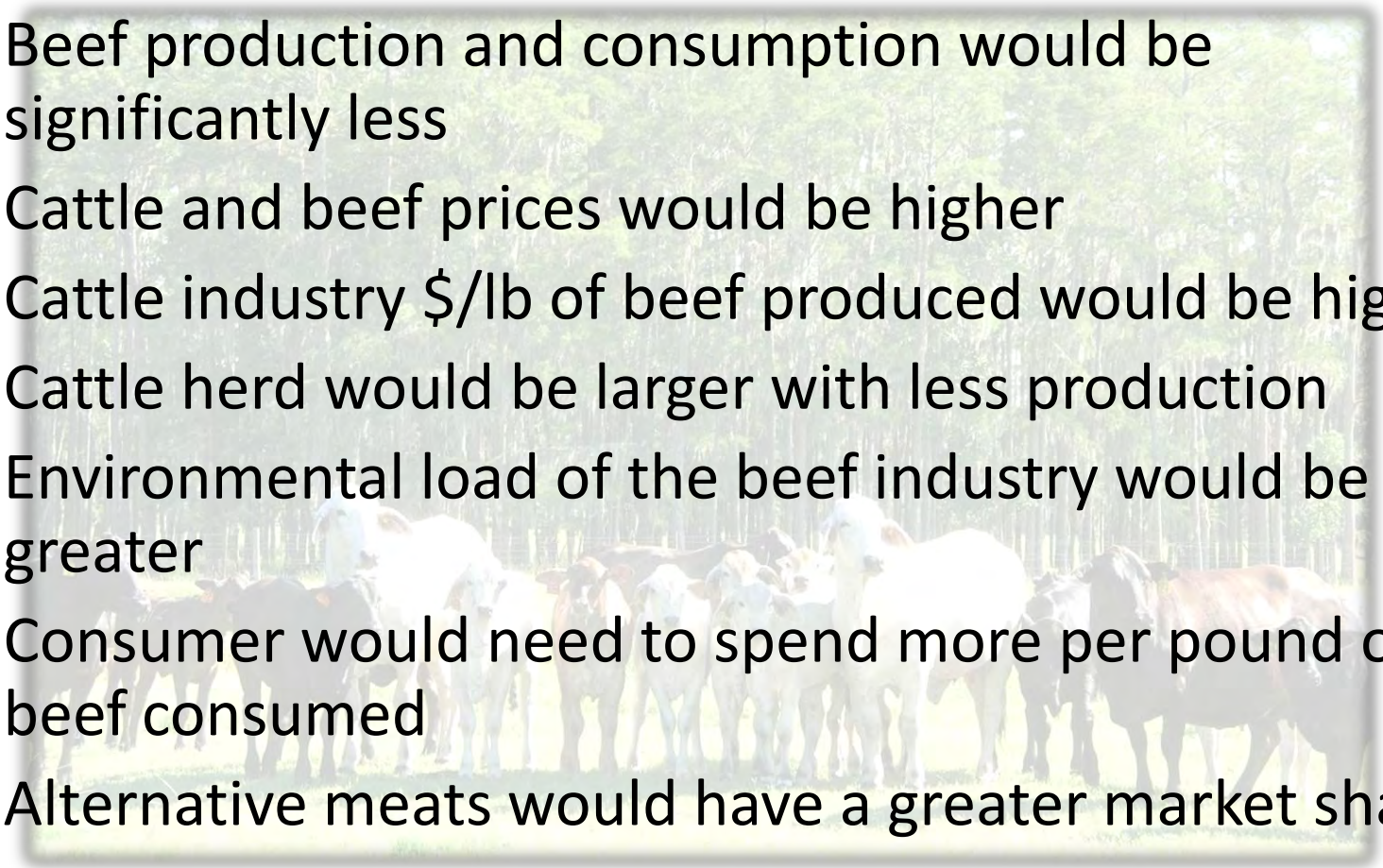
		With Technology	Without Technology	Percent Change
Inventory (million head)	Beef Cows, Jan1	32.9	33.0	0.2
	Total calf crop	37.8	32.5	-14.1
	Steer & heifer harvest	27.2	22.6	-16.5
	Cattle and calves, Jan 1	98.4	93.7	-12.2
	Cattle on feed, Jan 1	13.7	11.4	-16.9
Beef Supply and Use (million lbs)	Production	24,784	20,225	-18.1
	Net imports	2,901	5,123	180.7
	Retail consumption	65.4	59.9	-8.5
Cow-calf Returns ($/cow)	Receipts	584.51	627.28	7.0
	Expenses	446.17	491.29	10.1
	Net Returns	138.34	135.99	-7.9

Source: Lawrence and Ibarburu, 2006

UF UNIVERSITY of FLORIDA IFAS

Beef Industry Landscape Without Technologies

1. Beef production and consumption would be significantly less
2. Cattle and beef prices would be higher
3. Cattle industry $/lb of beef produced would be higher
4. Cattle herd would be larger with less production
5. Environmental load of the beef industry would be greater
6. Consumer would need to spend more per pound of beef consumed
7. Alternative meats would have a greater market share



UF UNIVERSITY of FLORIDA IFAS

Questions

UF UNIVERSITY of FLORIDA
IFAS