

## Forage-Finishing Beef Systems

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## Overview

- Finishing systems
  - Grass vs. Grain
- Forage finishing systems
  - Forages
  - Animal performance
  - Carcass quality
  - CLA and n-6:n-3 ratio
  - Palatability
- Supplementation
- Grain first – then forage

## GRASS VS. GRAIN

### Grain

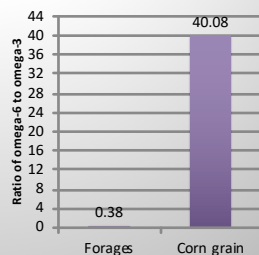
4-6% dietary lipid  
57% is linoleic acid (C18:2; LA)

### **Omega-6**

### Forages

1-3% dietary lipid  
57% is alpha-linolenic acid (C18:3; ALA)

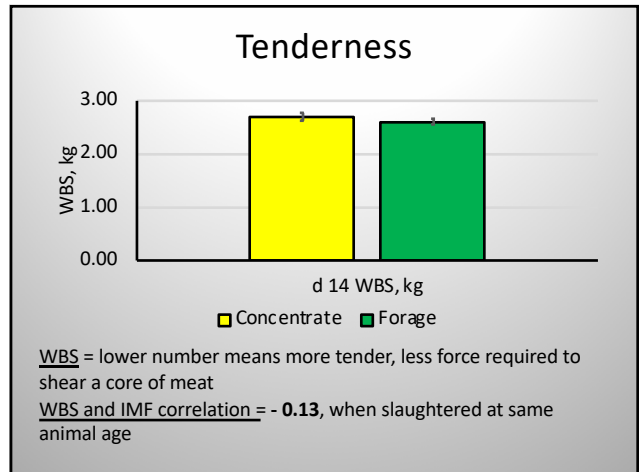
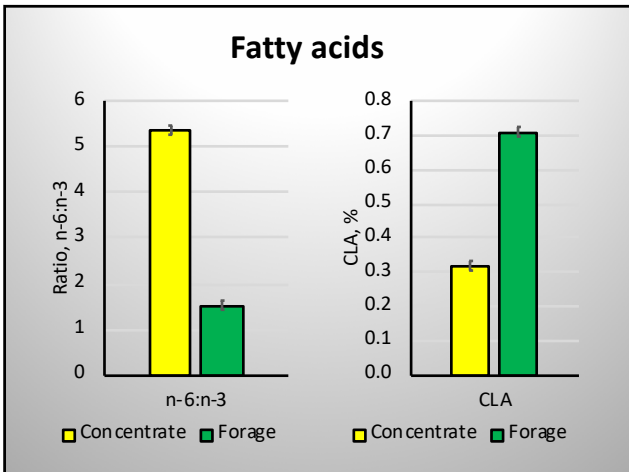
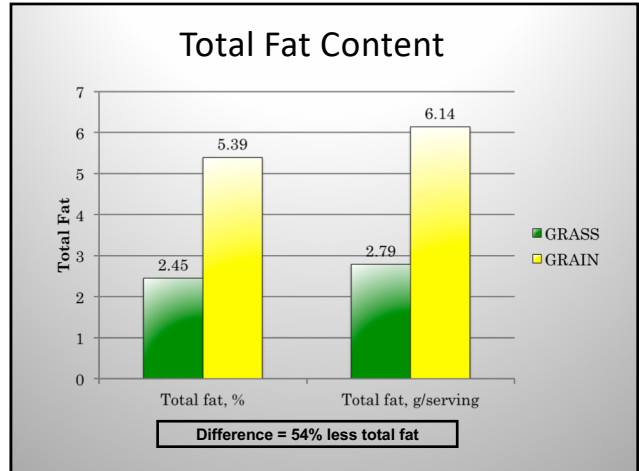
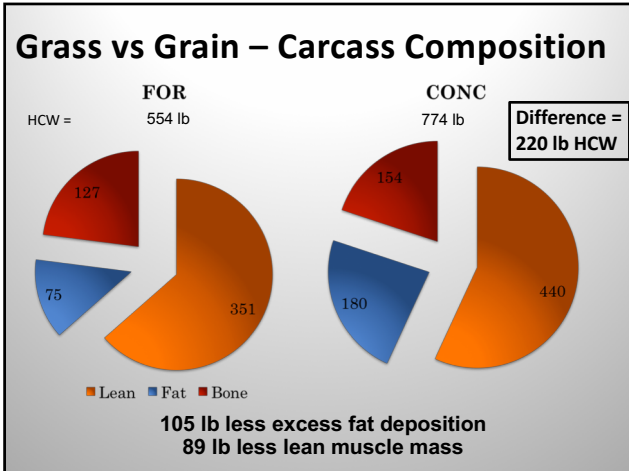
### **Omega-3**



## Finishing Systems: Grass vs. Grain

- Pasture based beef systems for Appalachia
  - USDA-ARS, VT, WVU, CU
- Pasture or Feedlot finishing systems
- Analyzed 425 steaks (2002-2012)
- Harvested at the same animal age (2002-2007; 326 steaks)
- Frame size and animal age (2008-2012; 188 steaks)

Neel et al. 2007. J. Anim. Sci. 85:2012-2018.  
Duckett et al. 2007. J. Anim. Sci. 85:2691-2698  
Duckett et al. 2009. J. Anim. Sci. 87:2961-2970  
Duckett et al. 2013. J. Anim. Sci. 91:1454-1467

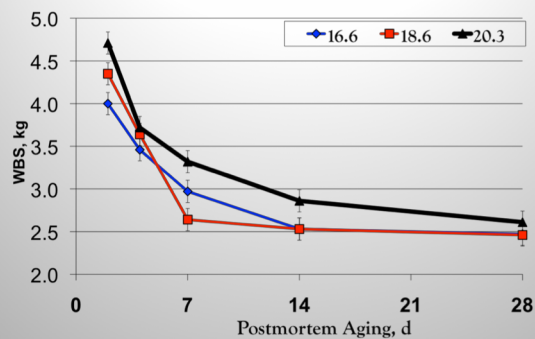


## Frame Size

- Larger Frame Size:
  - Heavier live weights and carcass weights
  - No effect on marbling scores, palatability, fatty acid composition

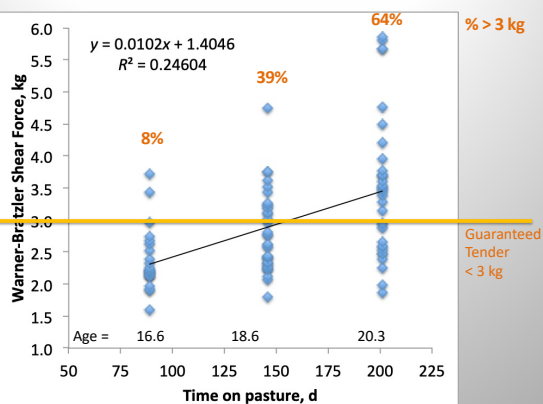
Duckett et al. 2014. J. Anim. Sci. 92:4767-4774  
Volpi-Lagreca et al. 2018. J. Anim. Sci. Res. 2(3)

## Animal Age at Slaughter



Duckett et al. 2014. J. Anim. Sci. 92:4767-4774

## Variation in Tenderness, d 14



## Grain vs. Grass

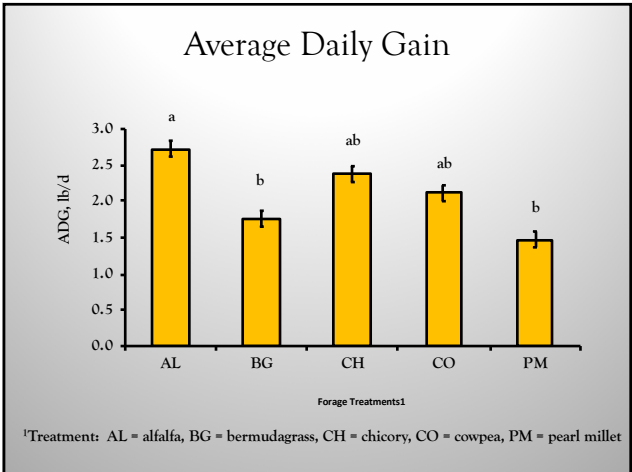
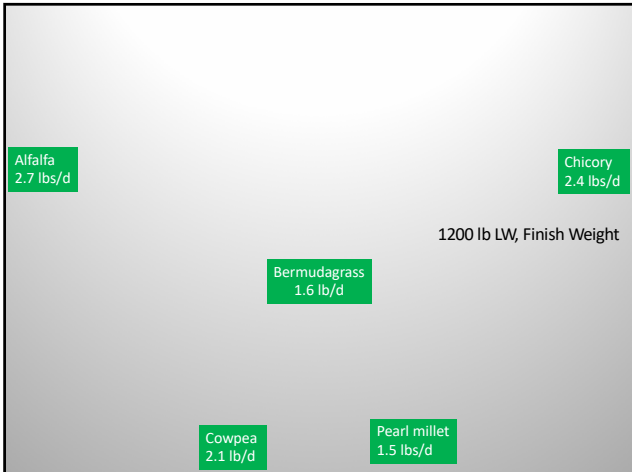
- FAT
  - Grass-fed deposit less fat
  - Changes in fatty acid composition of beef
- Palatability
  - Animal age at slaughter is key
  - < 20 mo of age
  - Great forage and great gains to put on as much weight as possible
  - Growth potential in the animals

# FORAGE FINISHING SYSTEMS

## Forage Species for Summer Finishing

Schmidt et al. 2013. J. Anim. Sci. 91:4451-4461

- Alfalfa (*Medicago sativa*) – perennial legume
  - » September establishment with a seeding rate of 17 lb/ac
- Bermudagrass (*Cynodon dactylon*) – warm season perennial grass
  - » Existing paddocks (c.v. 'Coastal') were utilized
- Chicory (*Cichorium intybus*) – short-lived perennial forb
  - » September establishment with a seeding rate of 7 lb/ac
- Cowpea (*Vigna unguiculata*) – warm season annual legume
  - » May establishment with a seeding rate of 50 lb/ac
- Pearl Millet (*Pennisetum glaucum*) – warm season annual grass
  - » May establishment with a seeding rate of 25 lb/ac

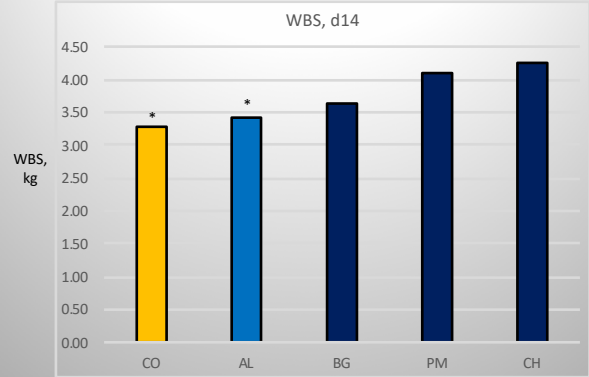


### Forage Species on Beef Quality

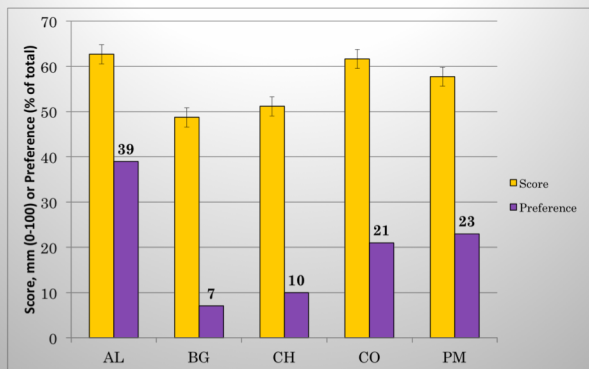
	Alfalfa	Bermudagrass	Chicory	Cowpea	Pearl Millet
Grazing days, d/ha	168	219	135	115	277
Hot carcass wt, lb	710*	719*	676	752*	665
Dressing percent, %	60.9*	57.6	60.4*	62.3*	58.9
Fat thickness, in	0.20*	0.14	0.19*	0.18*	0.11
Marbling score	450	455	433	513	473
Quality grade	3.50	3.75	3.17	4.42*	3.83

Marbling score: 400 = Slight (select); 500 = small (Choice-)

### Forage Species on Beef Tenderness



### Consumer Panel







Consumers preferred beef from alfalfa-finished beef

### Forage Type

- Legumes
  - Increased gain
  - Increased dressing percent
  - Increased palatability


Effect of Forage Type  
and Corn Supplementation on Animal  
Performance and Meat Quality

Wright et al. 2015. J. Anim. Sci. 93:5047-5088



**LEGUME  
SYSTEM**

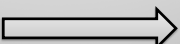
Alfalfa (*Medicago sativa*)  
Alfagraze 600RR, Americas Alfalfa




Forage Soybean (*Glycine max*)  
Large Lad, Eagle Seed Co.

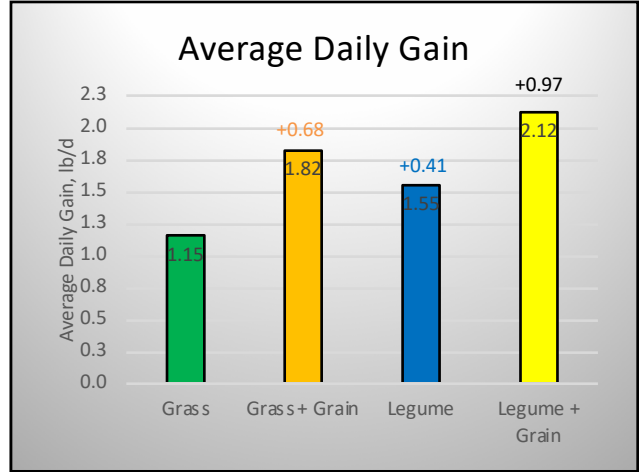
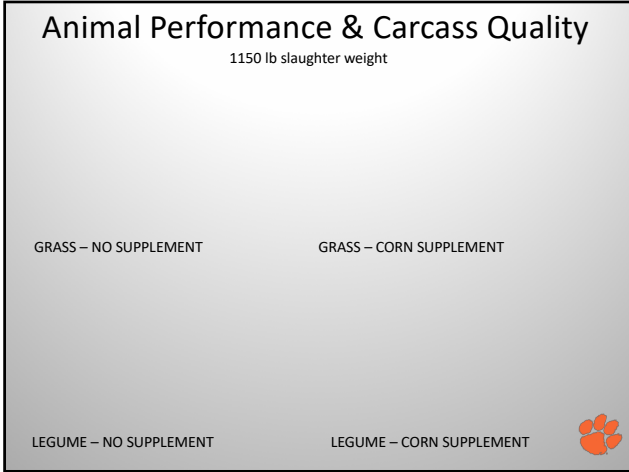
Sudangrass (*Sorghum bicolor*)  
Pro-Max, Ampac Seed Co.

Tall Fescue (*Lolium arundinaceum*)  
MaxQ, Pennington Seed Inc.

**GRASS SYSTEM** 

Half were supplemented with Corn  
at 0.75% Live Weight (LW)

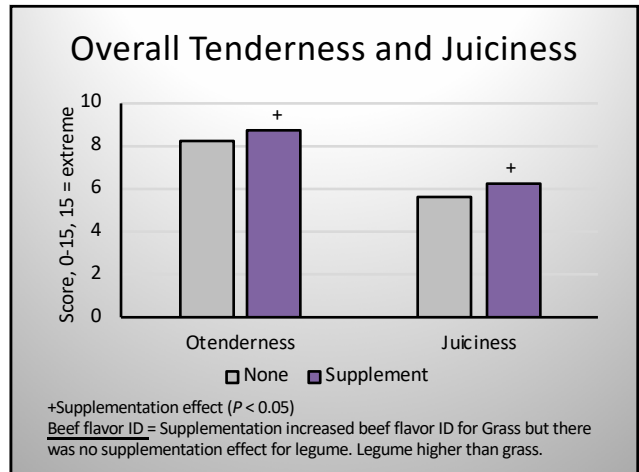




### Forage Type and/or Supplementation

	Grass	Grass + Corn	Legume	Legume + Corn
Final wt, lb	1134	1144+	1146	1172+
Hot carcass weight, lb	655	682+	678	718+
Dressing percent, %	58.0	59.1+	59.0*	60.7+
Fat thickness	0.28	0.39	0.37	0.38
Marbling score	482	545	514	516
n-6:n-3	3.52	3.84+	3.05	3.53+

\* Forage system effect ( $P < 0.05$ )    +Supplementation effect ( $P < 0.05$ )



## Forage Type and Supplementation

- Legumes added 0.4 lb more ADG than grass; and increased DP and HCW.
- Supplements added 0.6 lb ADG regardless of forage system and increased HCW, DP, tenderness, and juiciness.
- Minimal impact of corn supplement (0.75% of LW) on CLA (0.48 vs 0.40%) and ratio of omega-6:omega-3 (3.28 vs. 3.69)

## GRAIN FIRST ?

- 40 steers
  - Phase 1 (about 30-d post weaning; Nov. to Feb. 19)
    - Feedlot (**F**; n = 20; 75% concentrate and 25% silage)
    - Pasture (**P**; n = 20; novel endophyte tall fescue, winter annuals)
  - Phase 2 (Feb. 20 – May 28)
    - All on Pasture (**P**; alfalfa, cowpea)
  - Phase 3 (June 1 – 568 kg LW)
    - Feedlot-Pasture-**Feedlot** (**F-P-F**)
    - Feedlot-Pasture-**Pasture** (**F-P-P**)
    - Pasture-Pasture-**Feedlot** (**P-P-F**)
    - Pasture-Pasture-**Pasture** (**P-P-P**)

## Carcass Data

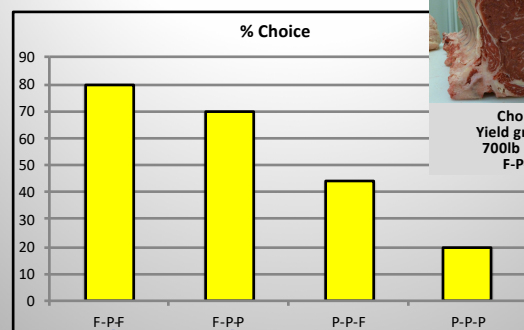
Phase 1	F	F	P	P
Phase 3	F	P	F	P
Treatments	F-P-F	F-P-P	P-P-F	P-P-P
Days to 1250 lb target <sup>#</sup>	286	342	300	342
Live weight, lb	1265	1236	1278	1225
Hot carcass weight, lb <sup>*</sup>	717	678	711	653
Overall ADG, lb/d <sup>+</sup>	2.42	1.85	2.38	1.78
Fat thickness, in <sup>*</sup>	0.43	0.35	0.52	0.32
Ribeye area, in <sup>2#</sup>	12.77	11.17	11.89	11.75
Marbling score <sup>**</sup>	580	536	508	472
Yield grade <sup>#</sup>	2.65	2.76	3.17	2.34

\* Phase 1 (P < 0.05)

+ Phase 3 (P < 0.05)

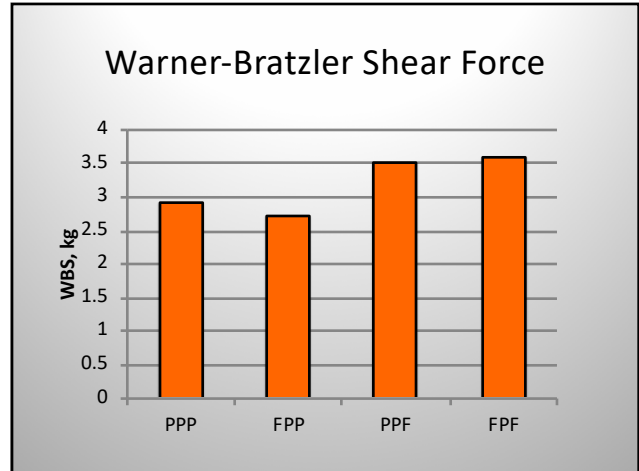
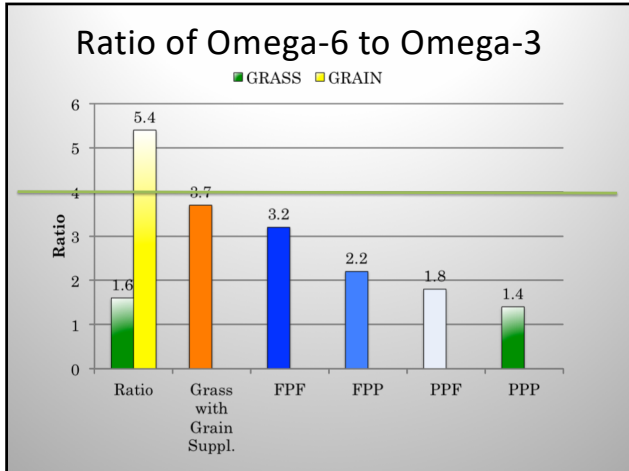
# Phase 1 x Phase 3 Interaction (P < 0.05)

## Percent Grading Choice



Early exposure to high concentrate diet





### What works best?

- Legumes:
  - Increased gains, dressing percentage, palatability
- Supplementation:
  - Increased gains, dressing percentage, palatability
  - Changes in omega-3 and CLA but values lower than Grain-fed
- Grain first:
  - Increased marbling deposition and percent Choice
  - Changes in omega-3 and CLA but values lower than Grain-fed
- Know your customer
  - Many systems can work
  - Palatability – key is animal age