

# Integrated Systems Synergy and Regenerative Agriculture: Crop, Grazing, & Soil Health

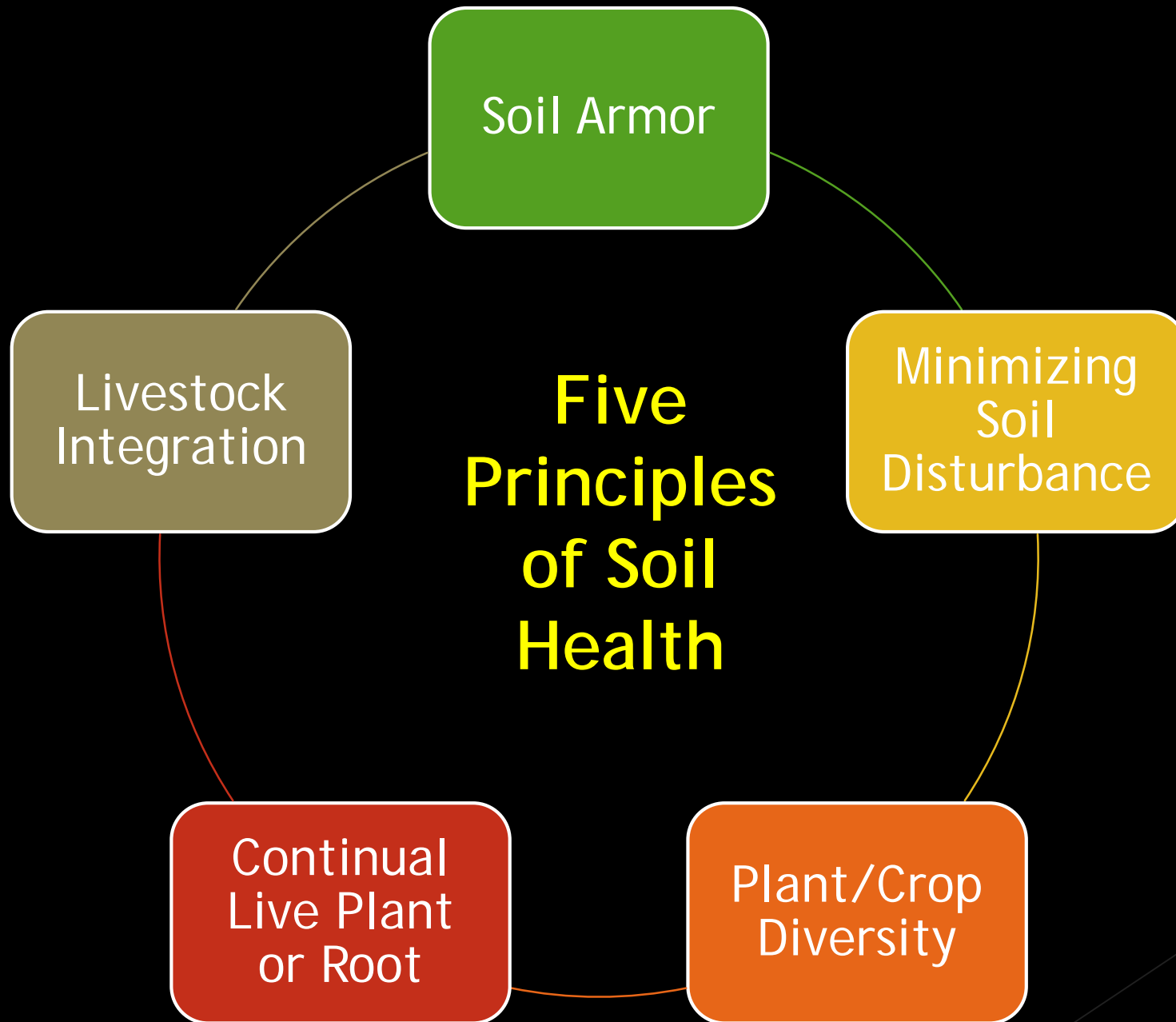
NRCS & DREC Café Discussion Group Meeting

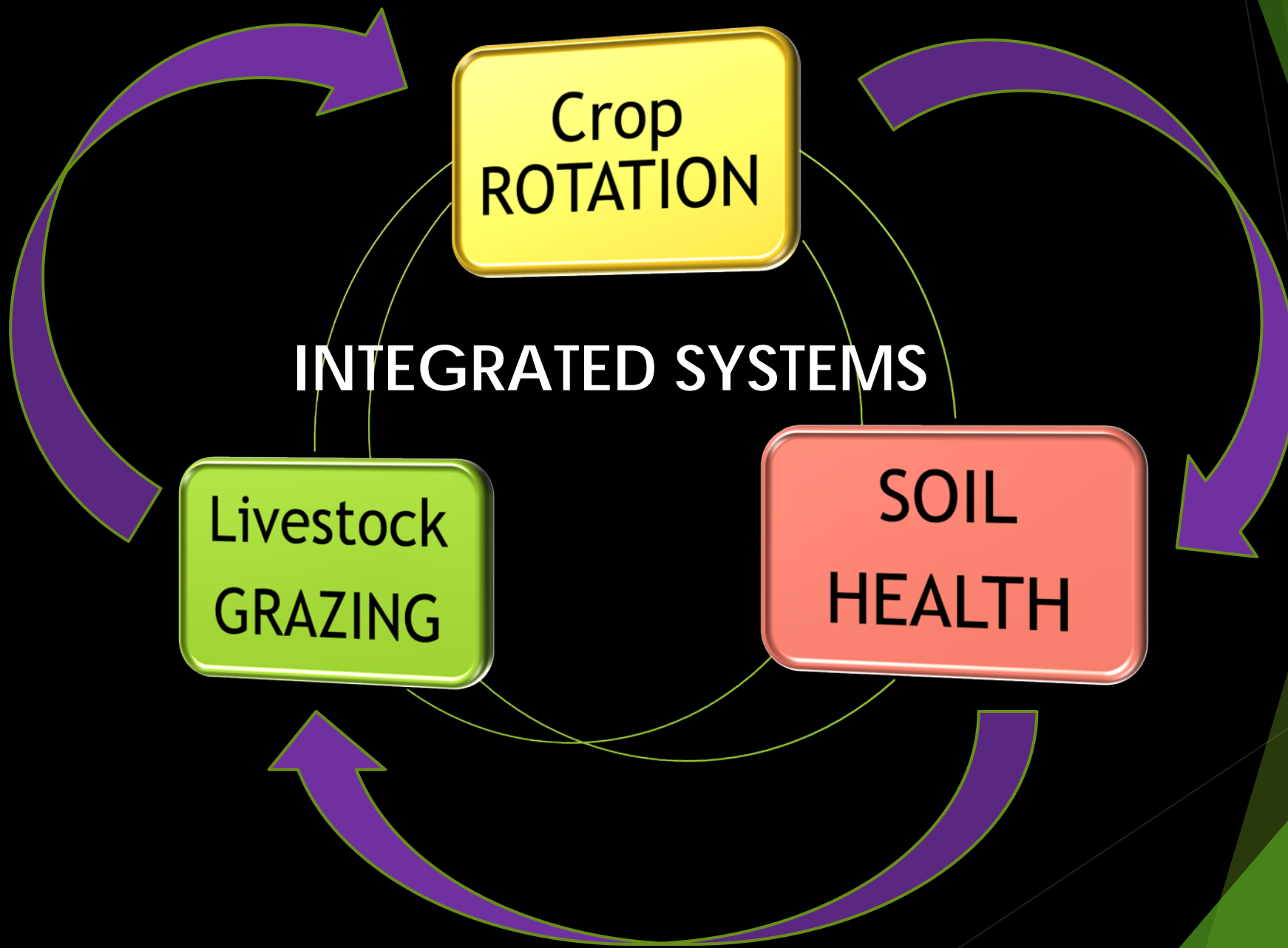
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NDSU - Dickinson Research Extension Center

Canakkale Onsekiz Mart University, Canakkale, Turkey

NDSU Soil Science Department





## Crop rotation

Spring Wheat – Rotation  
Cash Crop



Sunflower:  
Cash Crop



Cover Crop:  
Cows Graze  
After Weaning

Diversity



Corn:  
Yearling Steers  
Beef Income



Field Pea-Barley:  
Yearling Steers  
Beef Income

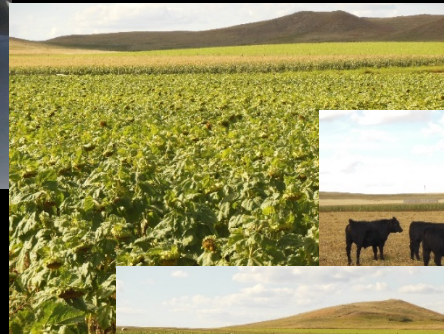
No Diversity



Spring Wheat – Control  
Cash Crop

# "Why Seed A Cover Crop?"

Minimum Disturbance:  
No-Till Seeding &  
Planting



Crop Diversity and  
Livestock  
Integration



Maintaining a Living root &  
Keeping Soil Covered with  
Residue



- Prevent Erosion
- Increase soil organic matter
- Increase soil nutrient cycling
- Reduce fertilizer input
- Produce forage for haying and/or grazing

Wtr. Triticale – Hairy Vetch  
Seeded after Spr. Wheat  
Sept 15



Dual crop  
Hay & cover crop



Wtr.  
Triticale/Hairy  
Vetch Hay  
Cut June 18



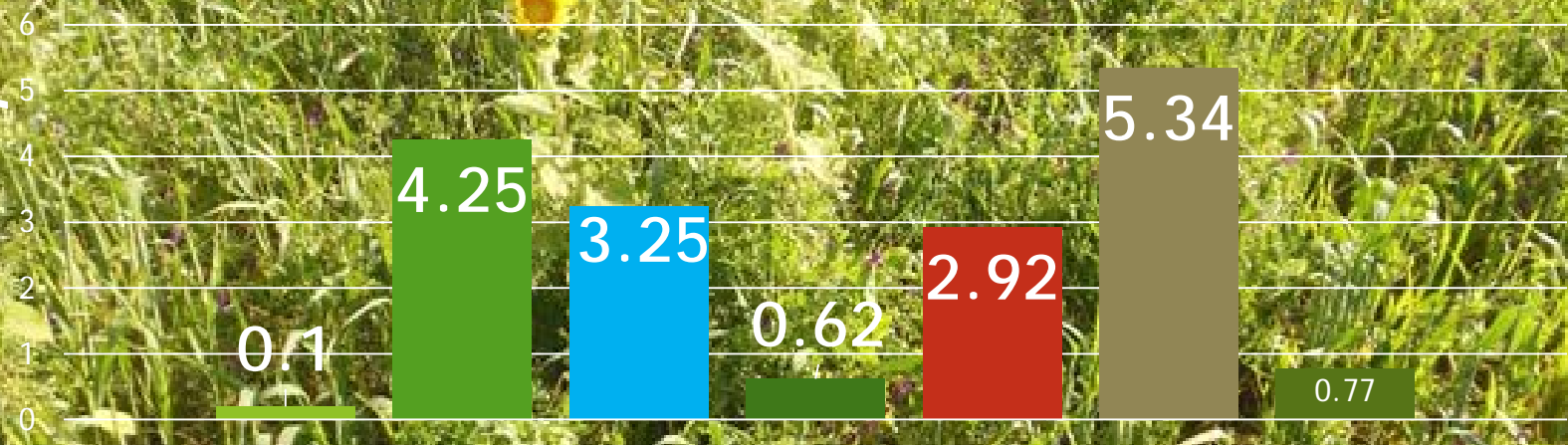
Cover Crop Seeded  
June 27



Graze With Cows  
After Weaning

# MULTI-SPECIES COVER CROP

TONS/ACRE, DM



YIELD (DM)

- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017

09/11/2018 12:00

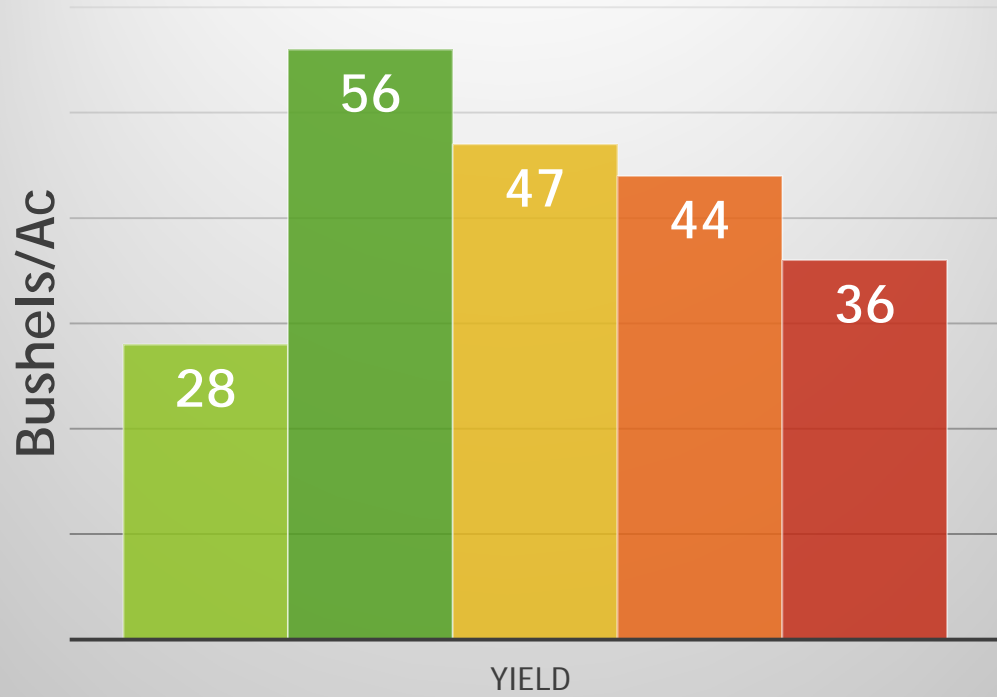
# GRAZE OR HAY COVER CROP MIX

	%	Lb/Ac
Stockford Barley	11.66	5.0
Berseem Clover	0.70	0.3
Crimson Clover	0.70	0.3
Red Clover	0.70	0.3
Bayou Kale	2.33	1.0
Indianhead Lentil	6.99	3.0
German Millet	4.66	2.0
Everleaf Oat (114)	11.66	5.0
Field Pea(4010)	46.2	20.0
Dwarf Essex Rape	2.33	1.0
Sorg-Sudan (BMR)	4.66	2.0
Sunflower	4.66	2.0
Purple Top Turnip	2.33	1.0
Lb Seeded/Ac		42.9



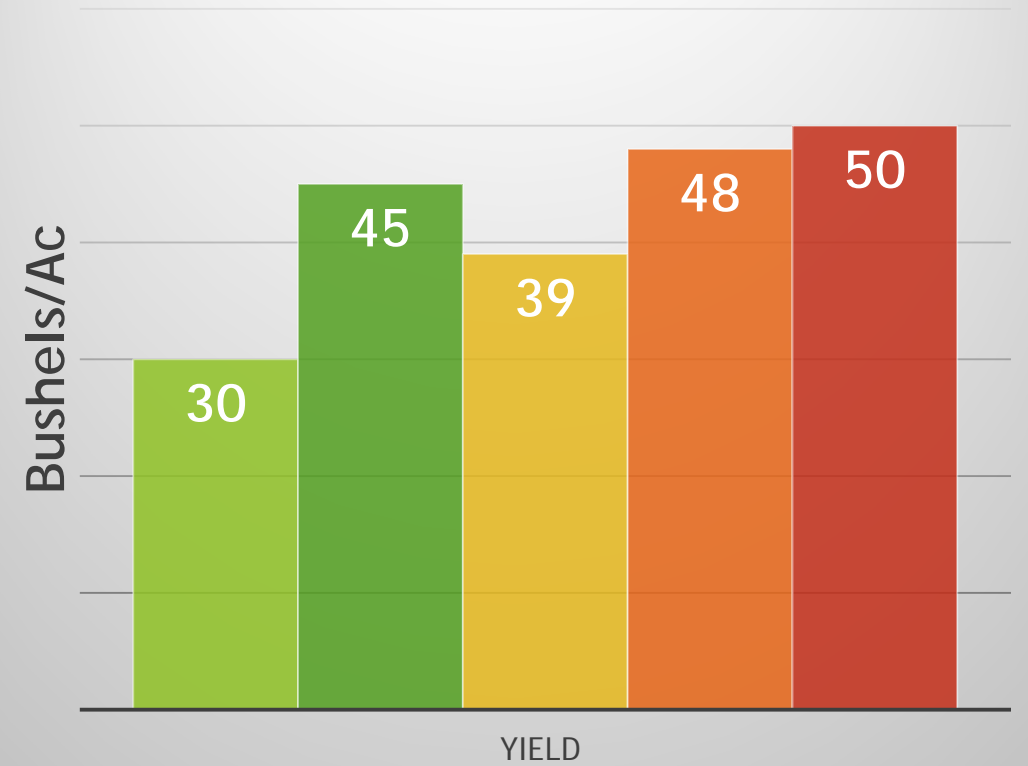


### Spring Wheat - Control



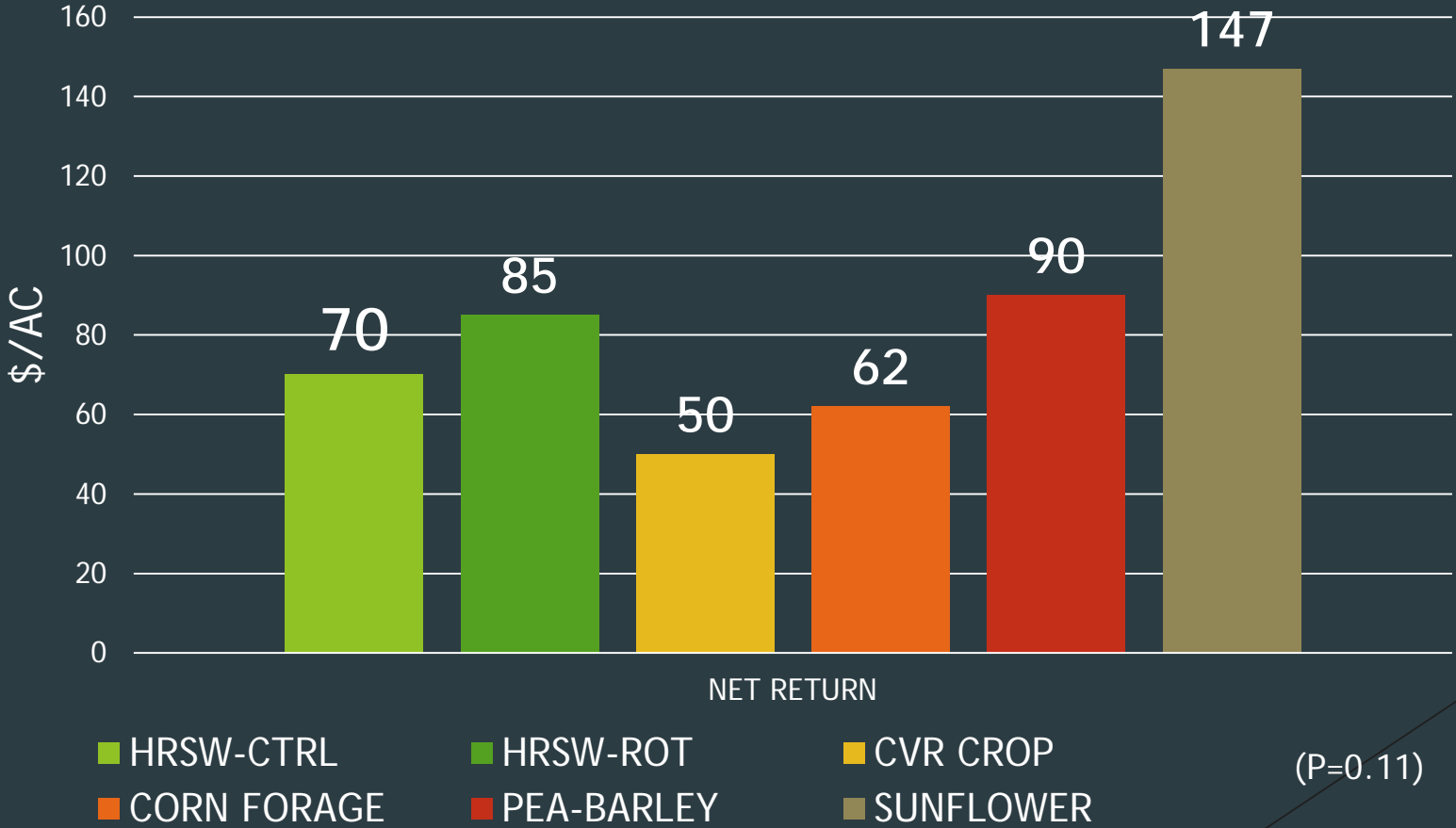
2011 2012 2013 2014 2015

### Spring Wheat - Rotation

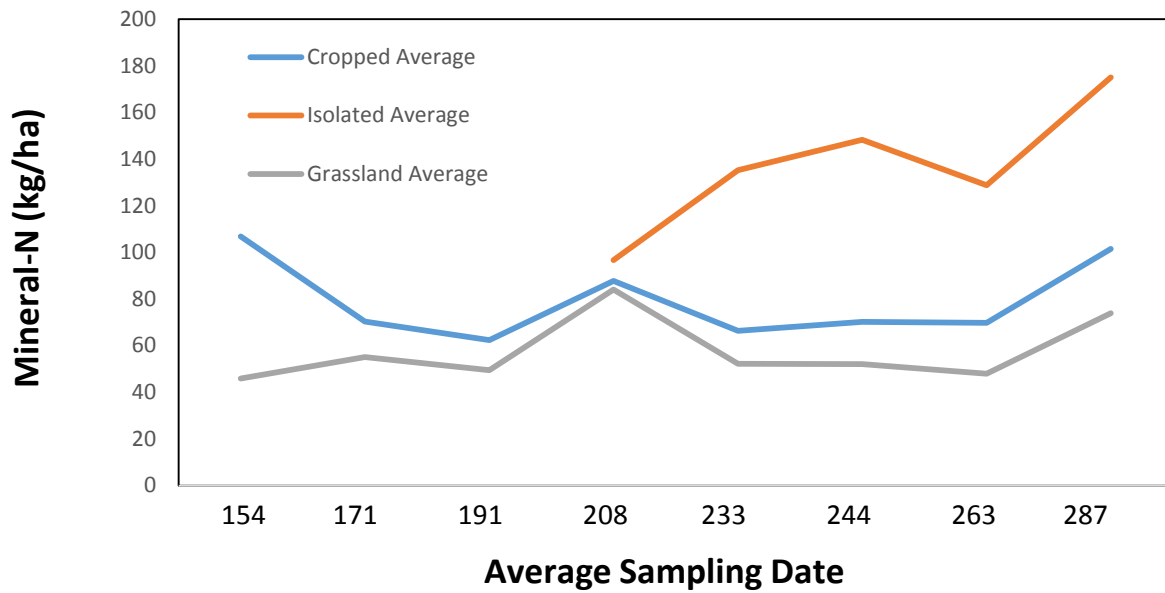


2011 2012 2013 2014 2015

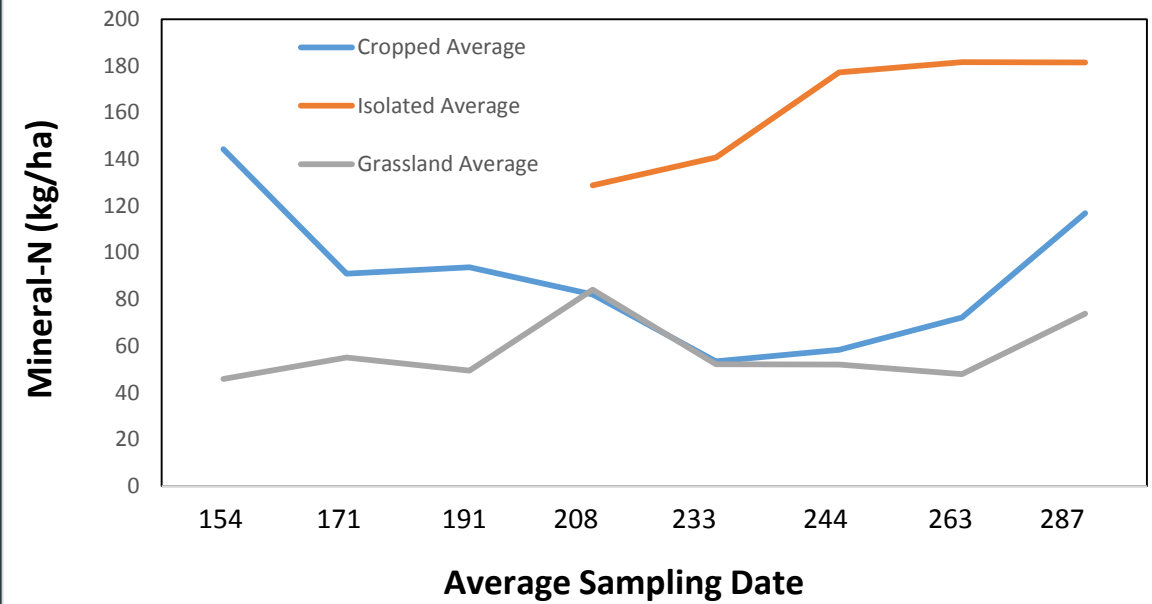
# CROP ROTATION: 5-YR NET RETURN



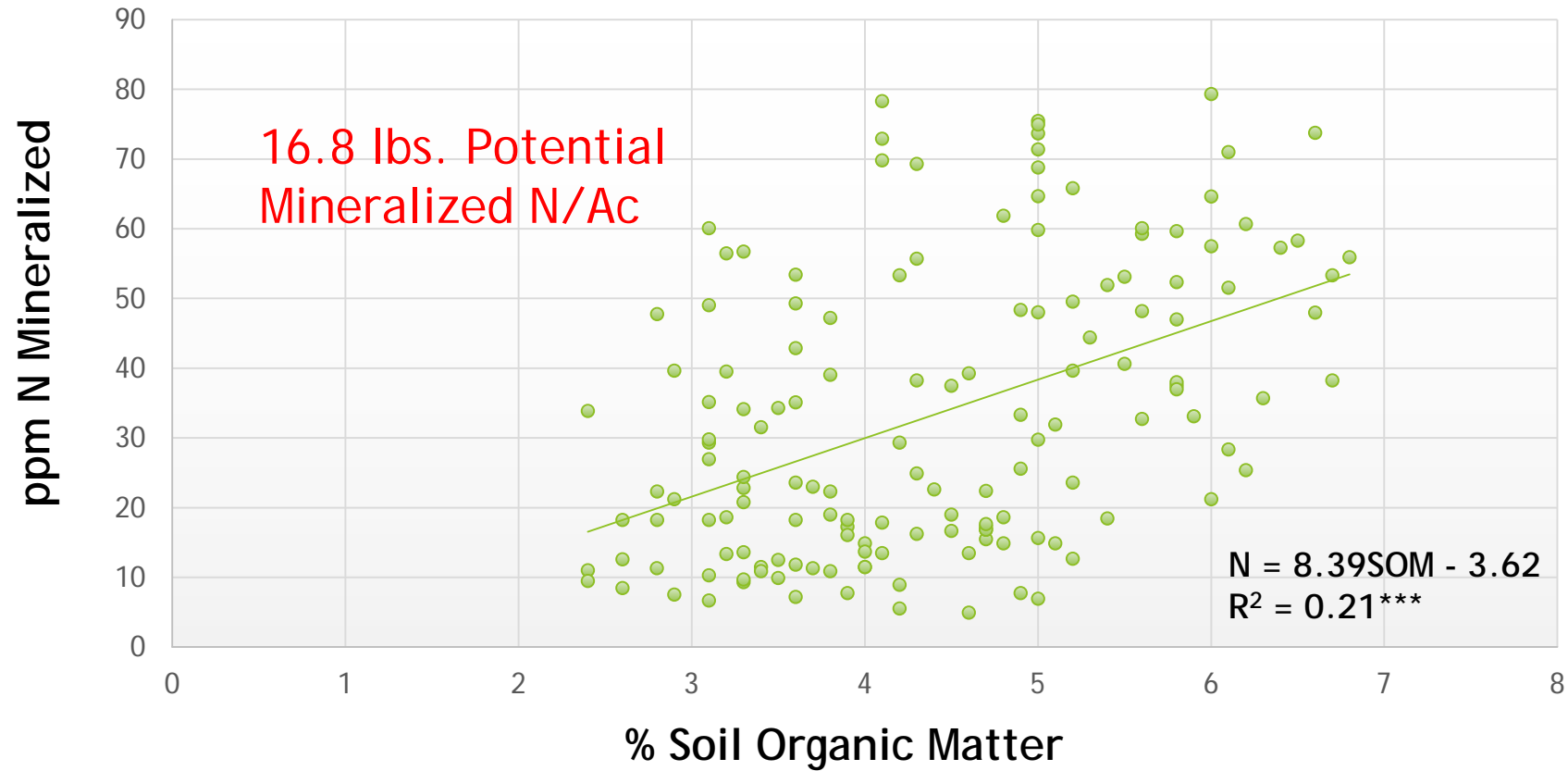
### Spring Wheat Mineral-N (2014 and 2015) - Control



### Soil Mineral-N (2014 and 2015) - Rotation

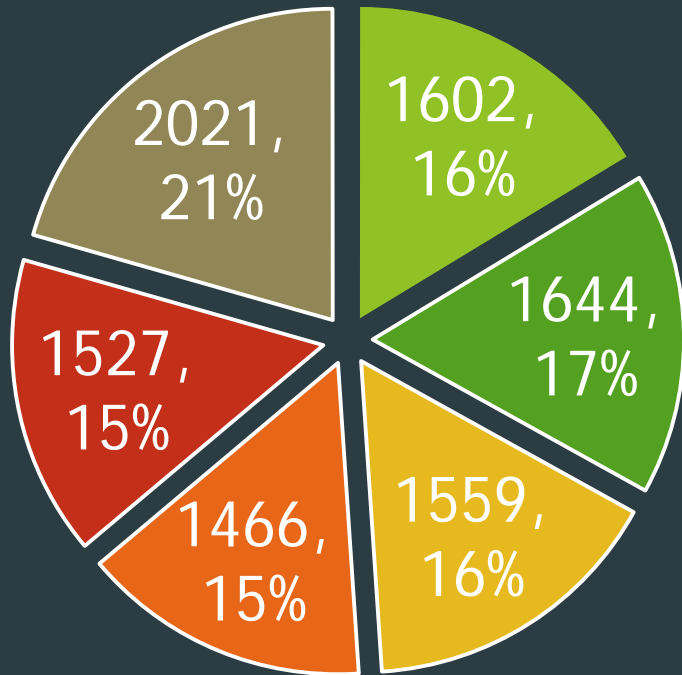


## 2014 and 2016 Potential Mineralizable Nitrogen



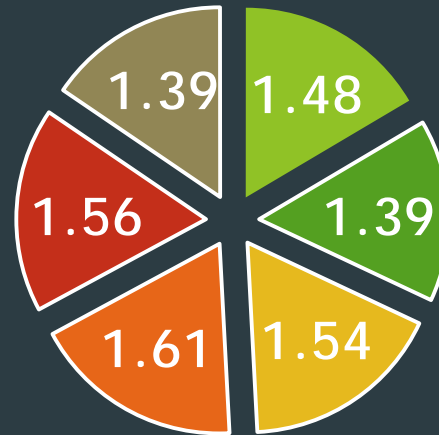
# Microbial ANALYSIS (WARD LAB) - (2017 Exceptional Drought)

PLFA - MICROBIAL BIOMASS  
(Abundance)



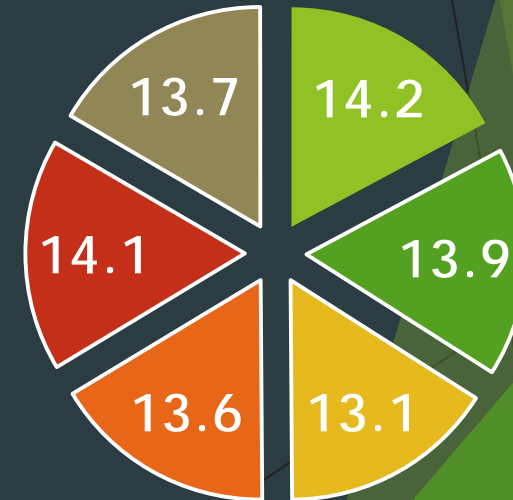
Nana Gram/  
Gram of Soil

FUNCTIONAL GROUP DIVERSITY  
INDEX  
(Microbial Community Structure)



- CORN
- PBLY
- SF
- SPWHT -C
- SPWHT -R
- THV-CCROP

SOIL HEALTH  
CALCULATION



ABOVE 7 AND INCREASE OVER TIME  
(RANGE 0-50)

# Haney N-P-K TEST, TRADITIONAL N/Ac, DIFFERENCE AND SAVINGS/Ac

	N-P-K * COST, \$/Ac	TRADITIONAL LBS N/Ac	HANEY LBS N/Ac	DIFFERENCE, LBS N/Ac	N SAVINGS, \$/Ac
CORN	235	69.5	118.4	48.8	\$31.29
PEA-BLY	154	30.4	77.4	47.0	\$30.06
SUNFLOWER	174	25.3	71.6	46.3	\$29.69
SP WHEAT-C	164	20.5	65.5	40.5	\$28.80
SP WHEAT-R	151	20.8	70.2	49.4	\$31.62
TRITICALE- H-VETCH, C-CROP	174	20.2	68.5	48.3	\$30.90
* Value of N-	P-K for next	crop			

Figure 5

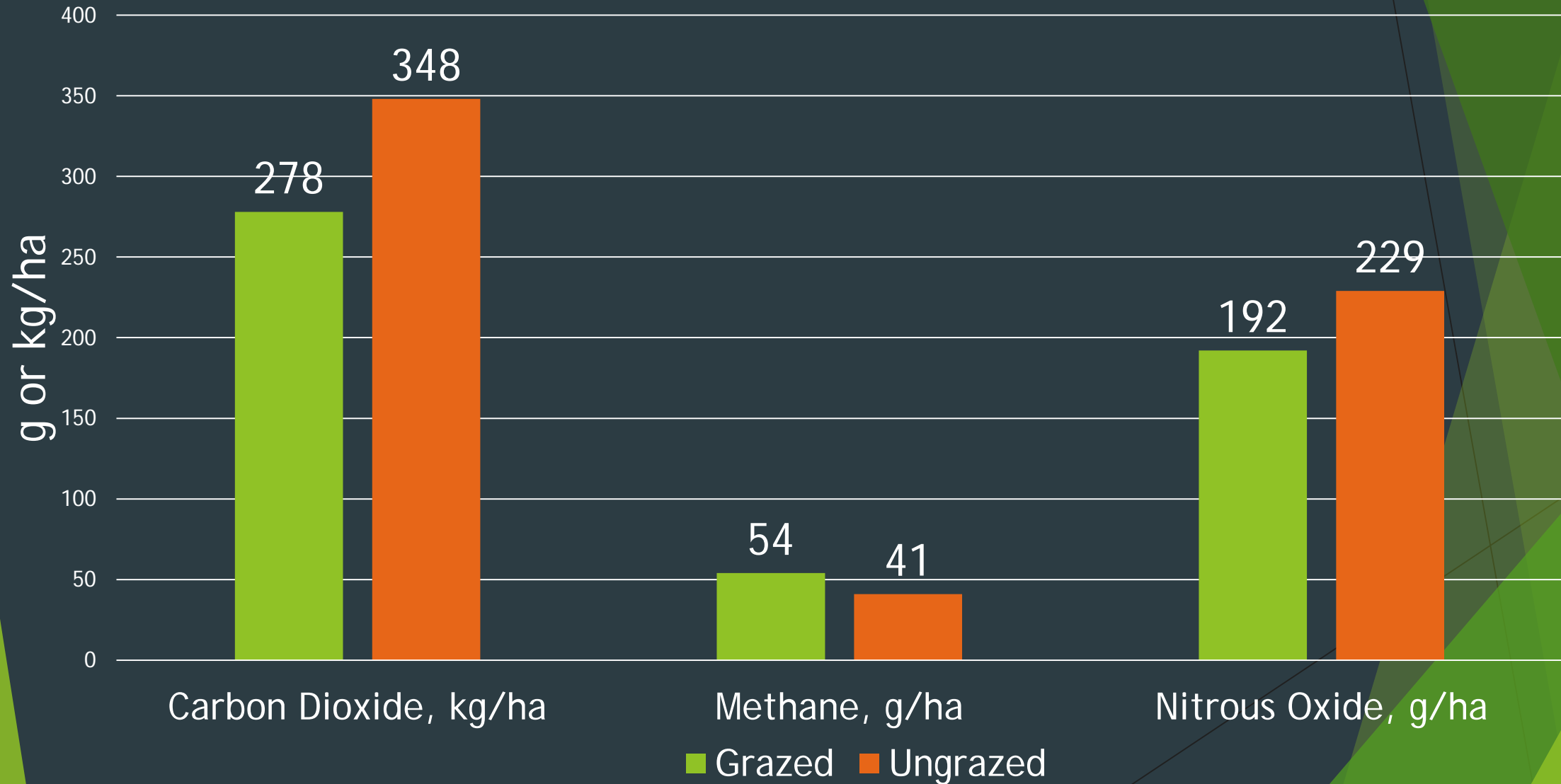
# Integrated System GHG Emissions



Carbon Dioxide  $\text{CO}_2$   
Methane  $\text{CH}_4$   
Nitrous Oxide  $\text{N}_2\text{O}$



# Total Grazed and Ungrazed Gas Emissions





# Cover Crop Seedling Survival After Winter Rye (Allelopathy Effect - Bowman, ND )



Flea Beetles  
Damaged  
Brassicas



Dikon Radish

Dwarf Essex Rape

Purple Top Turnip

Traill soybean

Common Vetch

Common pea

Forage Millet

German Millet

Triticale

Flax

Oats

Hays Barley

Sorghum-Sudangrass

# Yearling Steer Grazing

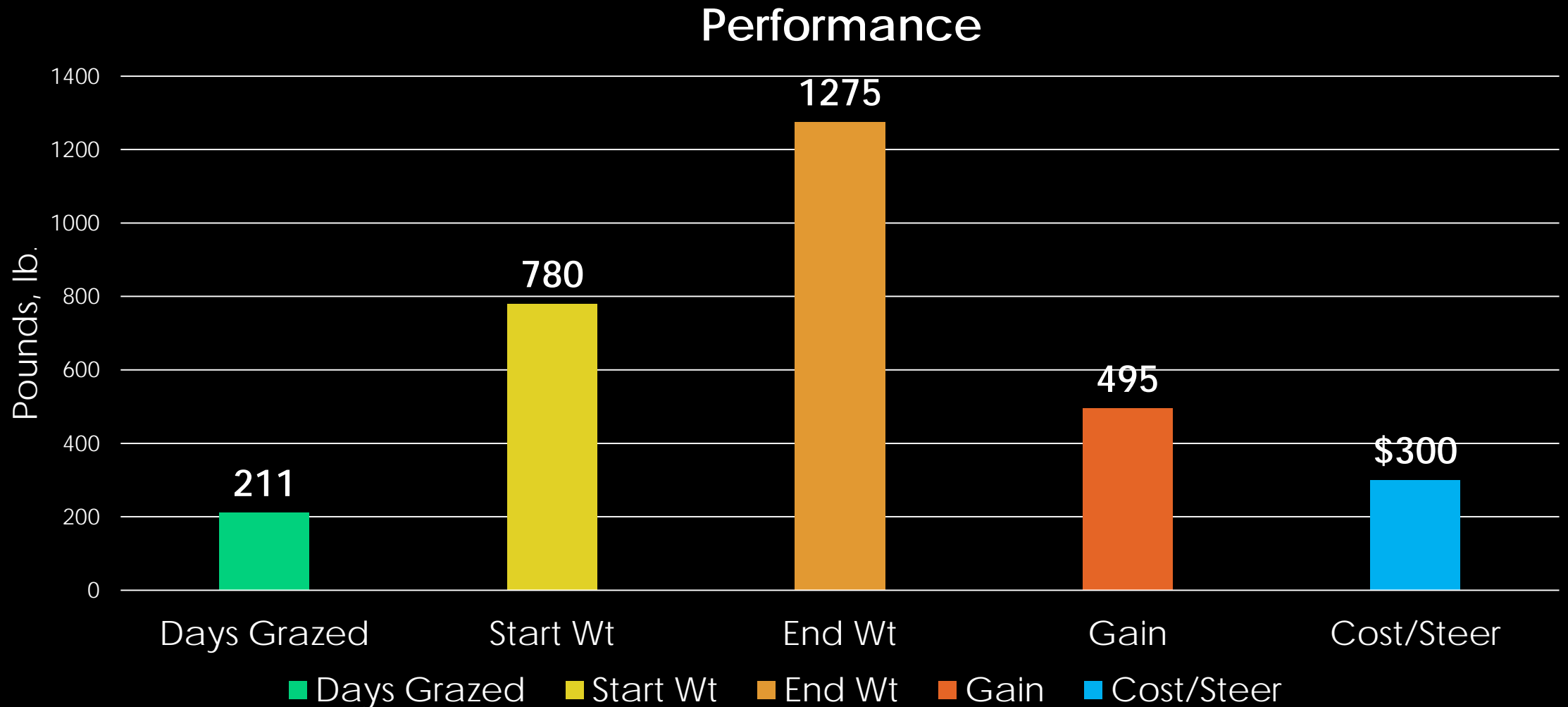


08.18.2013

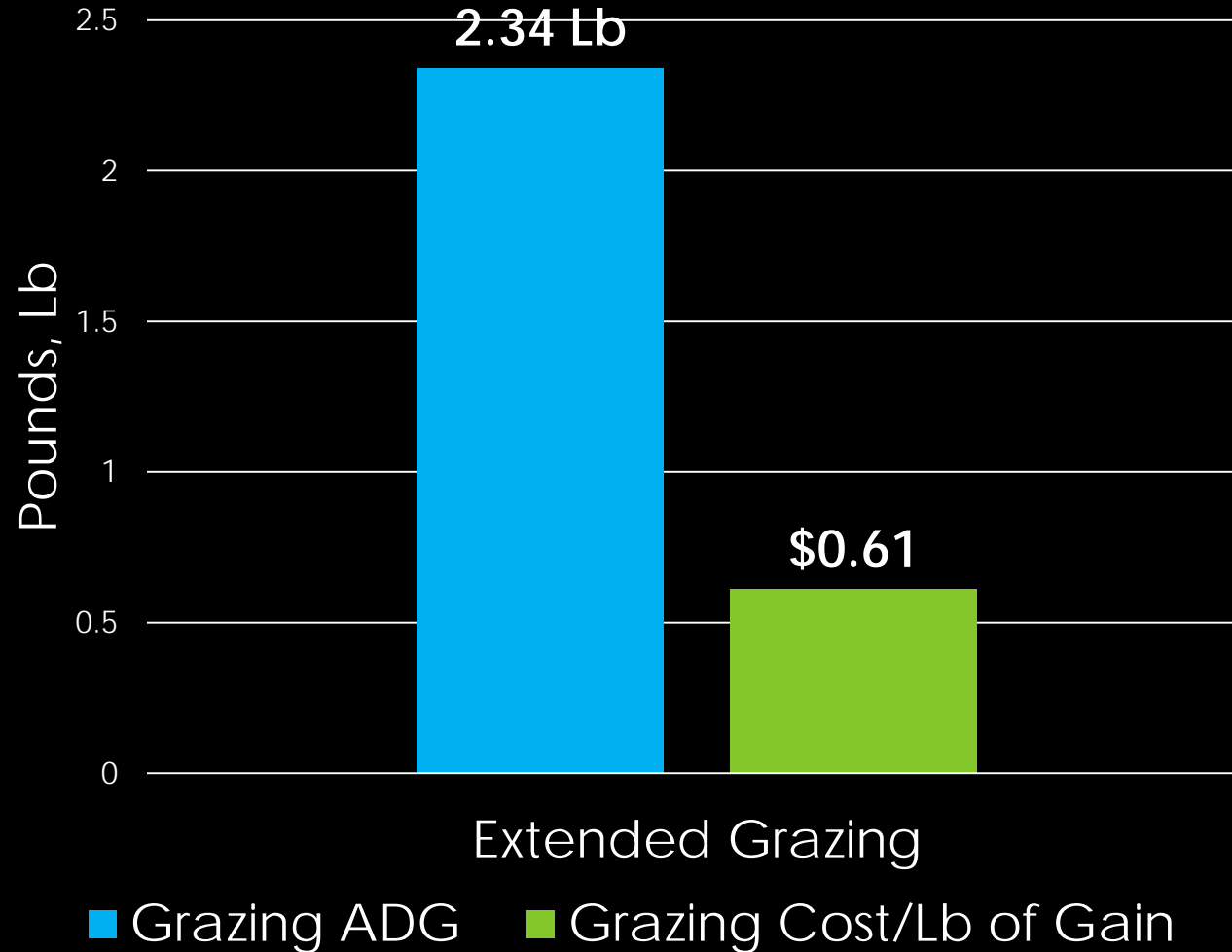
# GRAZING SEQUENCE COST/STEER



# YEARLING STOCKER GRAZING PERFORMANCE



# GAIN & GRAZING COST/LB OF GAIN



# YEARLING STOCKER ANNUAL FORAGE GRAZING NET RETURN

	\$
Annual Cow Cost	602
Backgrounding Cost	153
Grazing Cost/Steer	285
Total Cost	1040
End Grazing Steer Value (1275# @ \$125/cwt)	1593
Grazing Net Return/Steer*	553
Net Return/Ac (8.24 Ac/Str)	70
*(As of 1-16-2019)	

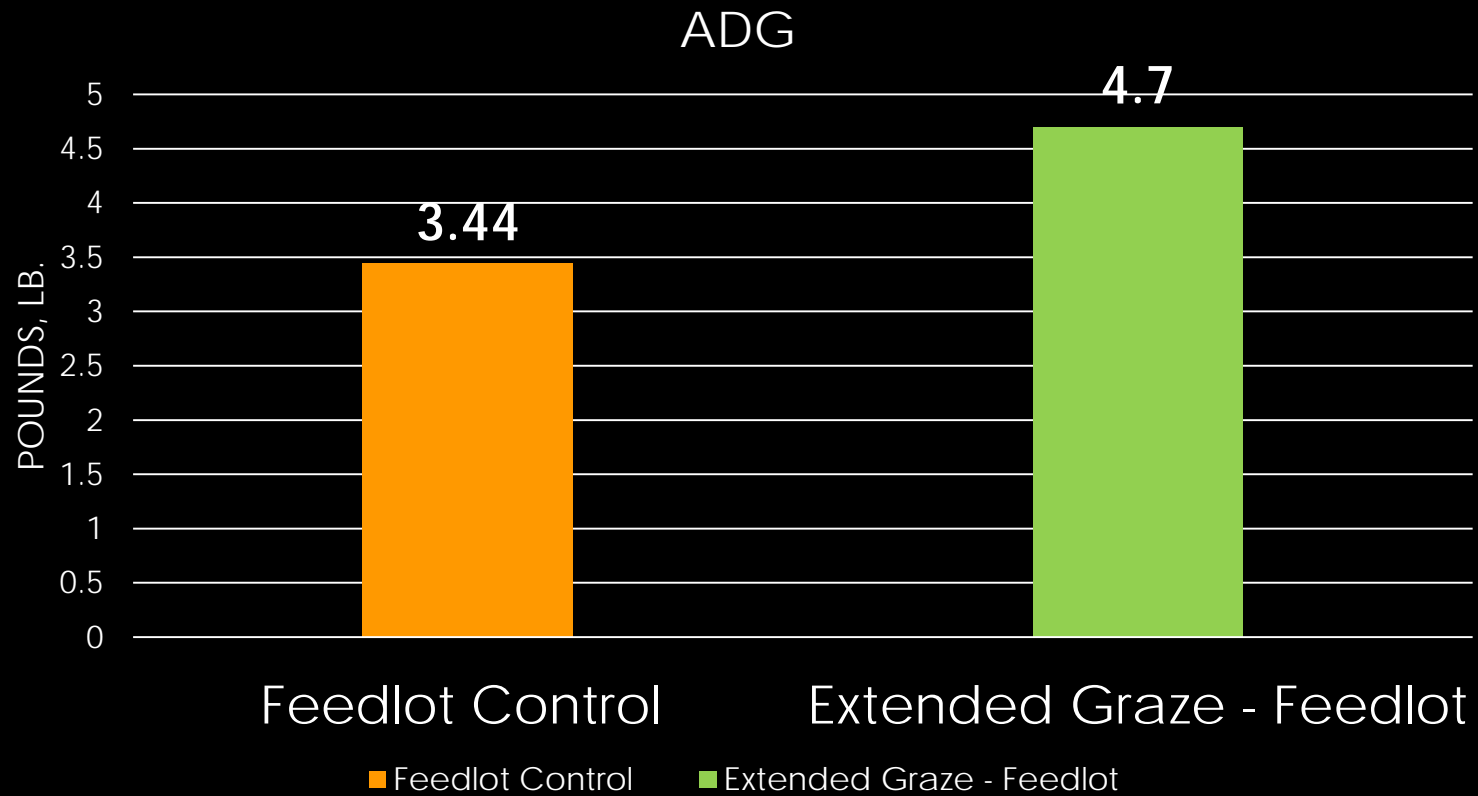


# Stocker Retained Ownership – From End Grazing to Slaughter



**Feedlot Days On Feed :**  
**Control – 211, Graze - 82**

# YEARLING STEER FEEDLOT ADG (82 DAYS ON FEED)



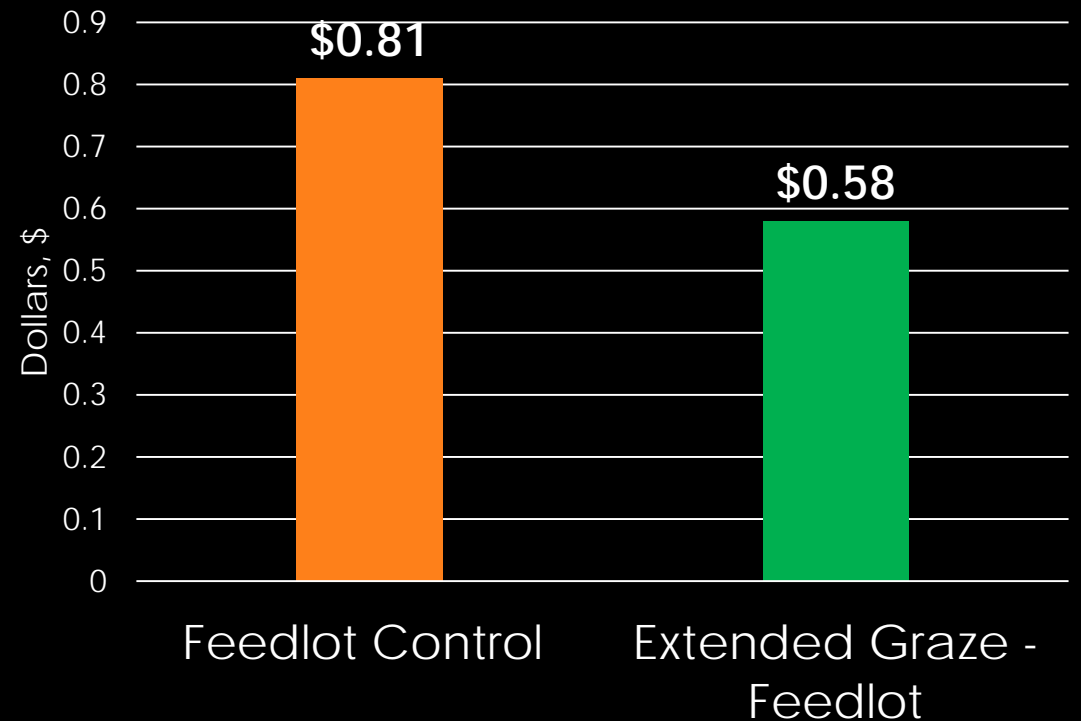


# YEARLING STOCKER FEEDLOT PERFORMANCE

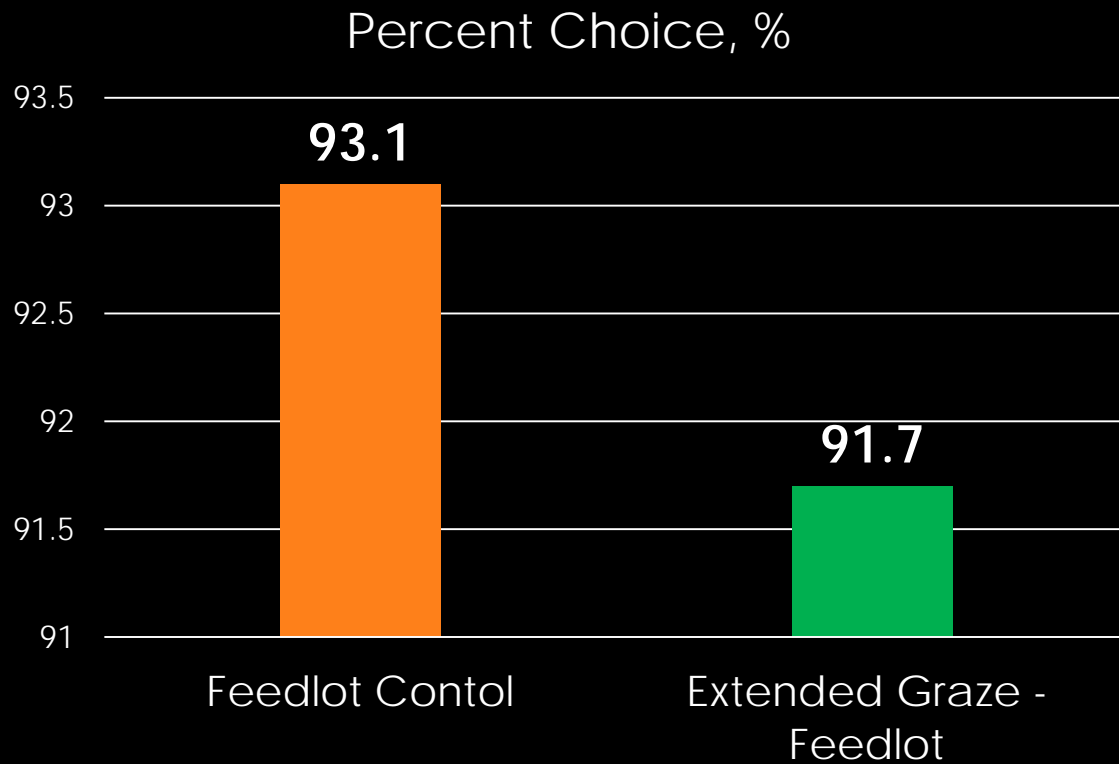
## Feedlot Feed Intake & Efficiency



## Cost/Lb of Gain



# YEARLING STOCKER QUALITY GRADE

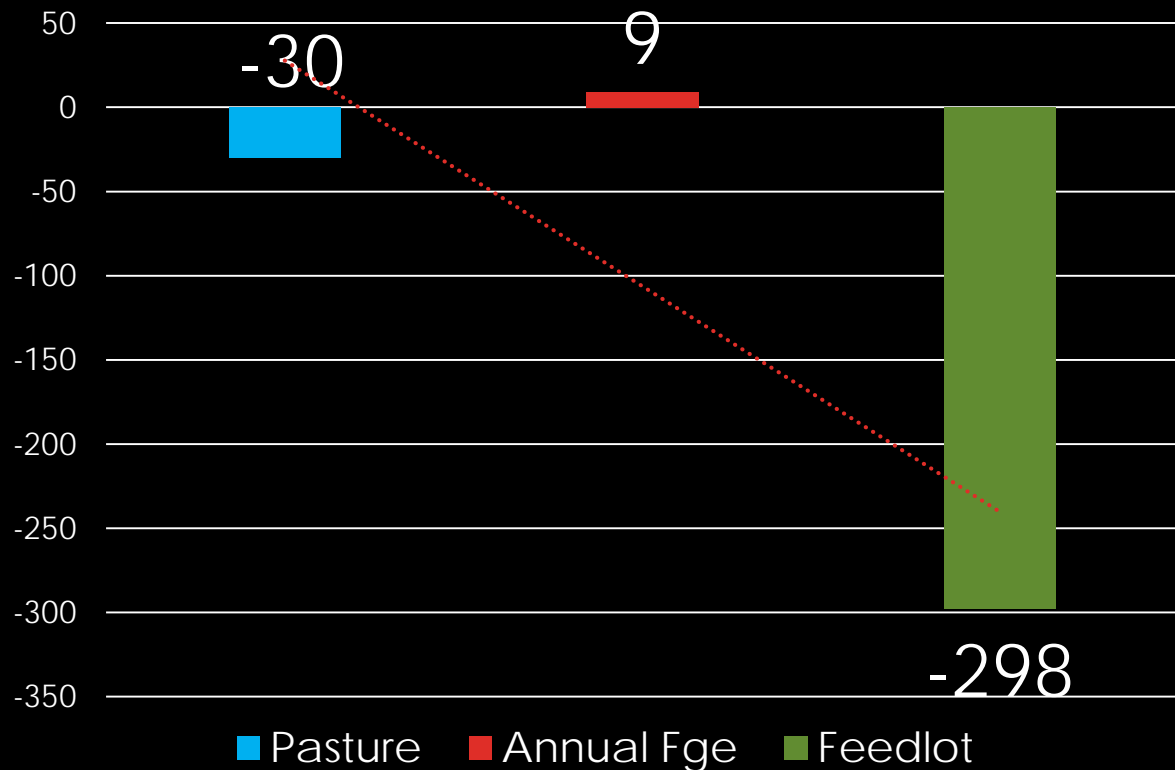


(P = 0.11)

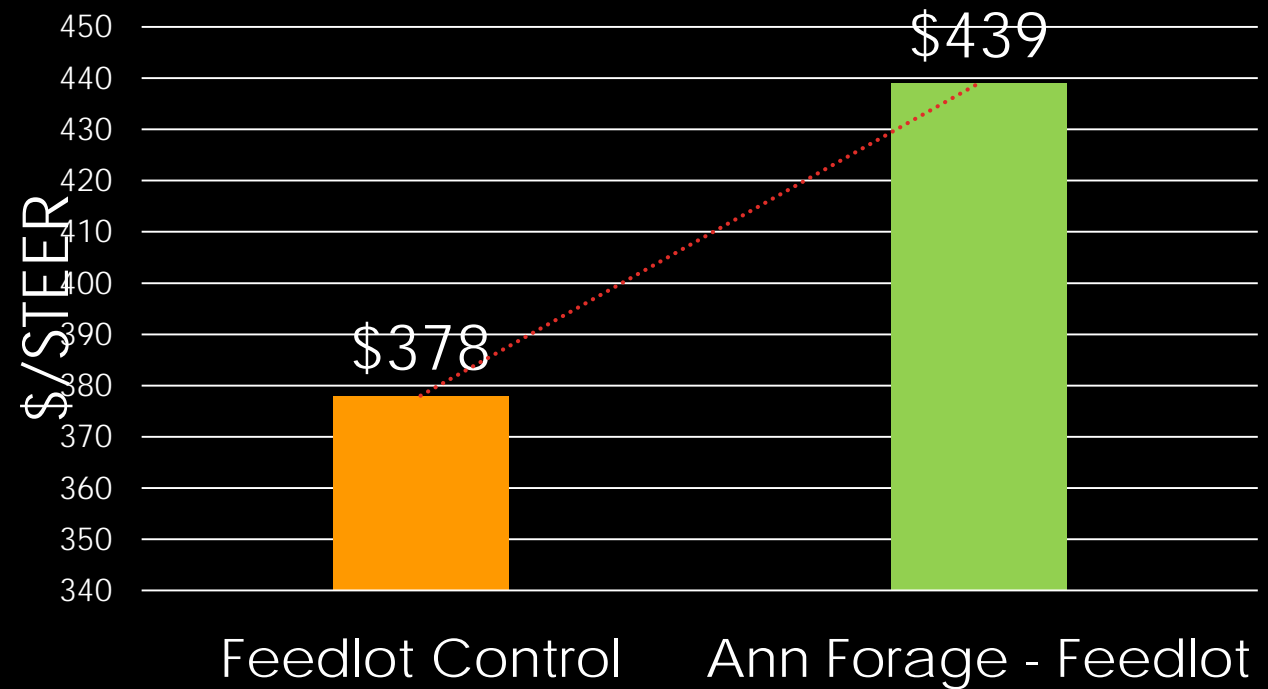


# RETAINED OWNERSHIP FINISHING NET RETURN

## Experiment 1

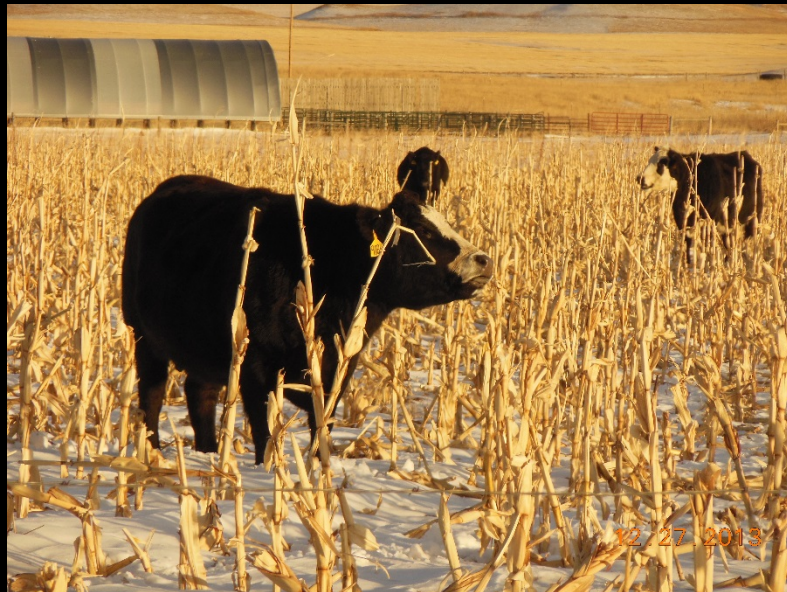


## Experiment 2

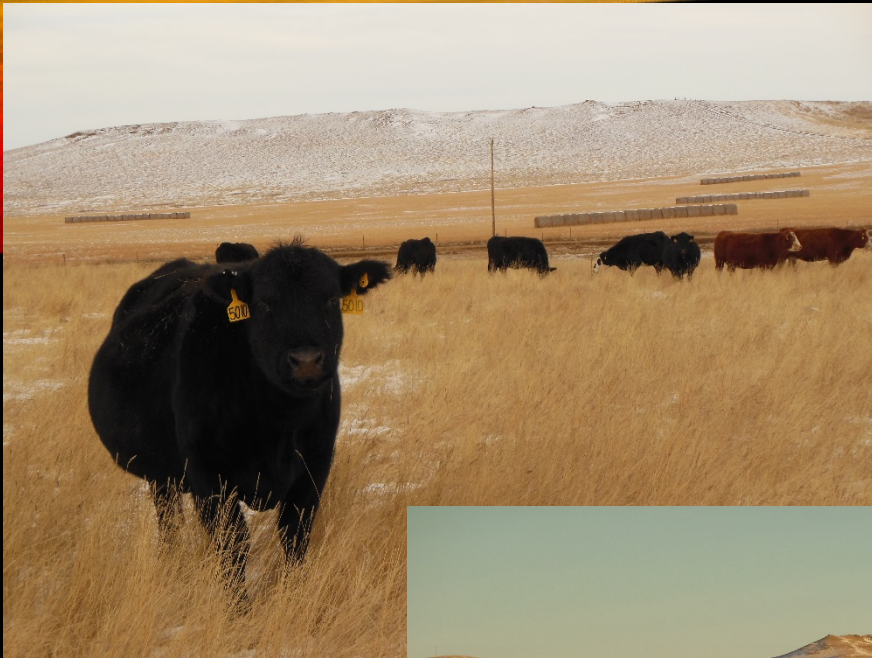


# COWS: EXTENDED GRAZING SEASON

- Cover Crop
- Corn and Sunflower Residue



# Cows: Extended Grazing Season



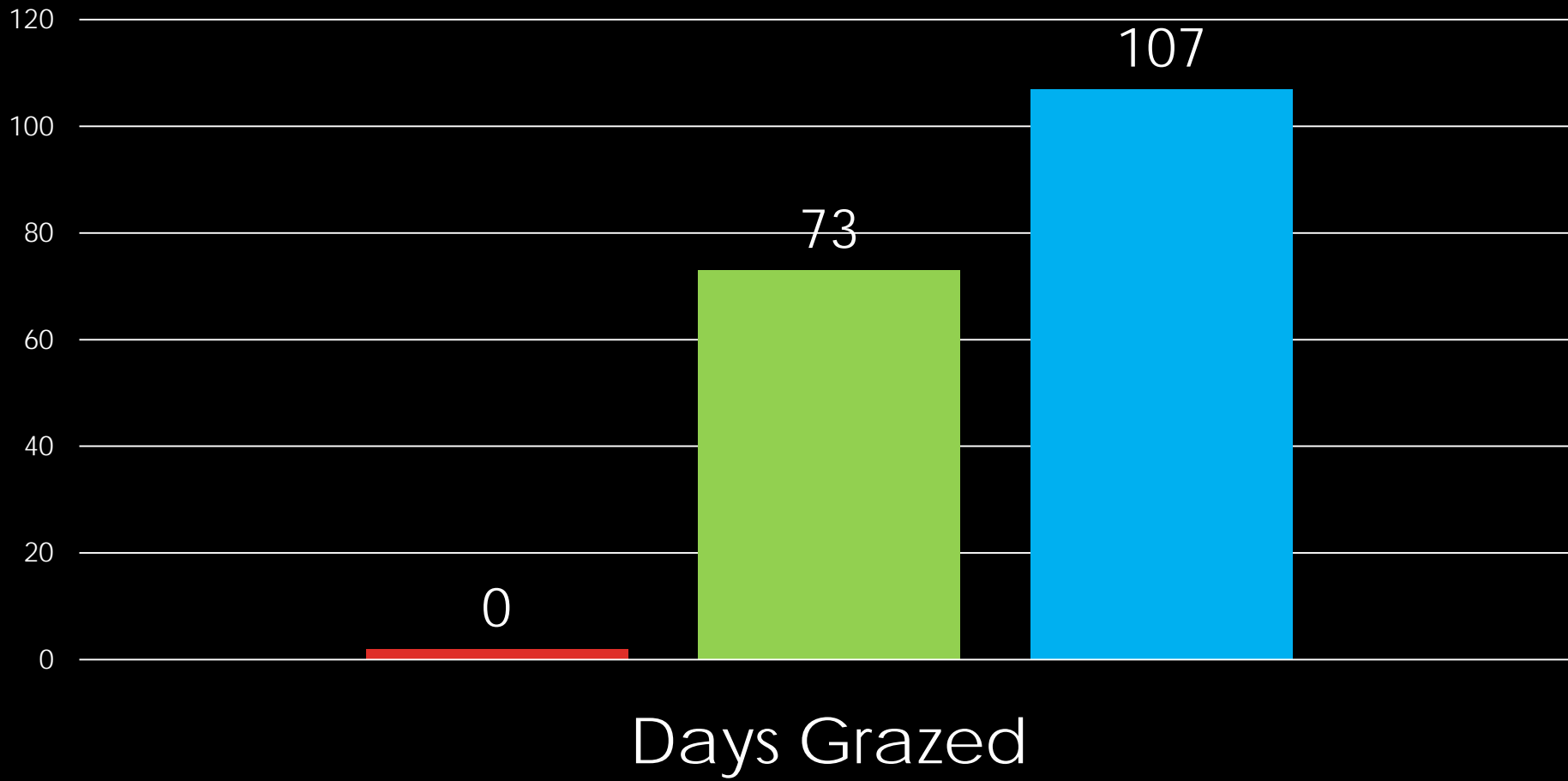
- ▶ Stockpiled tame pasture
- ▶ Corn stalk residue

# COVER CROP MIX AND COST

Crops	#/Acre	\$/#	Cost/ Ac, \$
Sunflower	2	4.50	9.00
Everleaf Oat - 114	20	0.37	7.40
Flex Winter Pea	20	0.40	8.00
Hairy Vetch	5	1.75	8.75
Winfred Forage Rape	1	3.50	3.50
Ethiopian Cabbage	1	4.00	4.00
Hunter Leaf Turnip	1	3.50	3.50
Cost/Ac			44.15
Farming Cost & Property Tax/Ac			23.85
Cover Crop Cost/Ac			68.00
Cover Crop Grazing Cost/Cow, \$			<b>36.55</b>

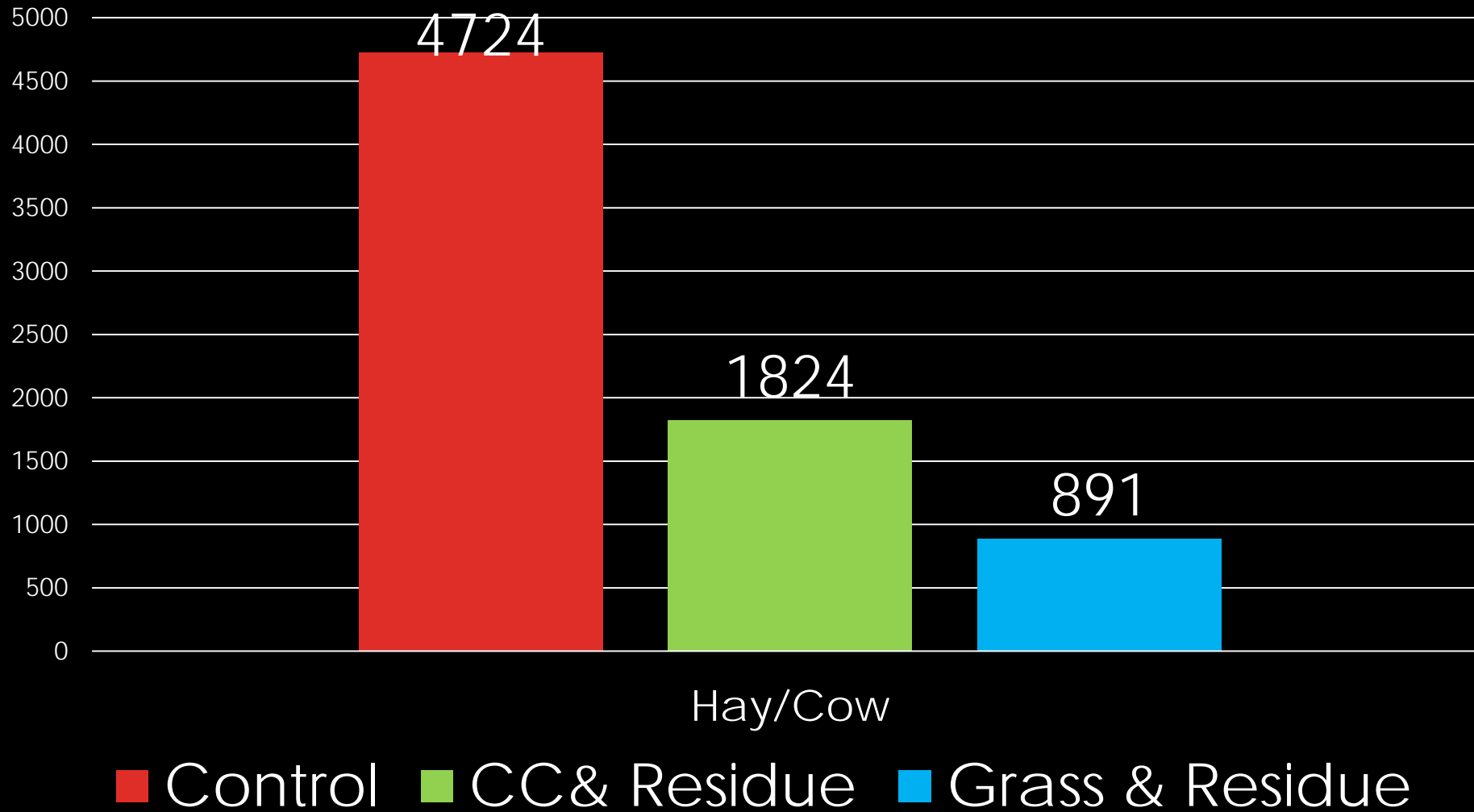


# DAYS OF WINTER GRAZING



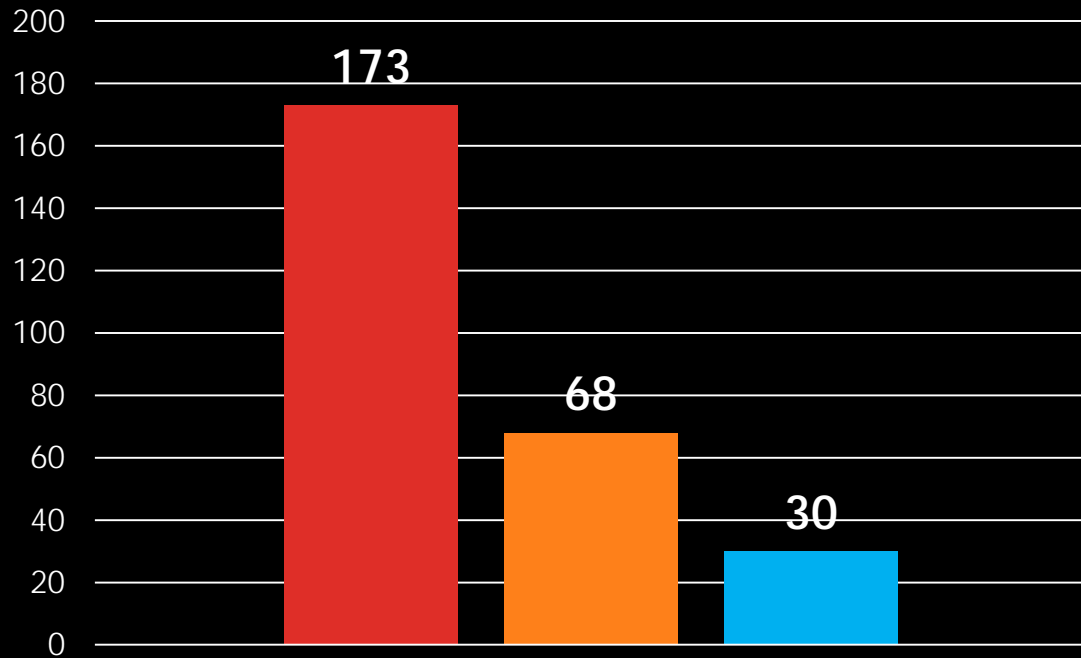
■ Control ■ CC & Residue ■ Grass & Residue

# WINTER HAY FED PER COW



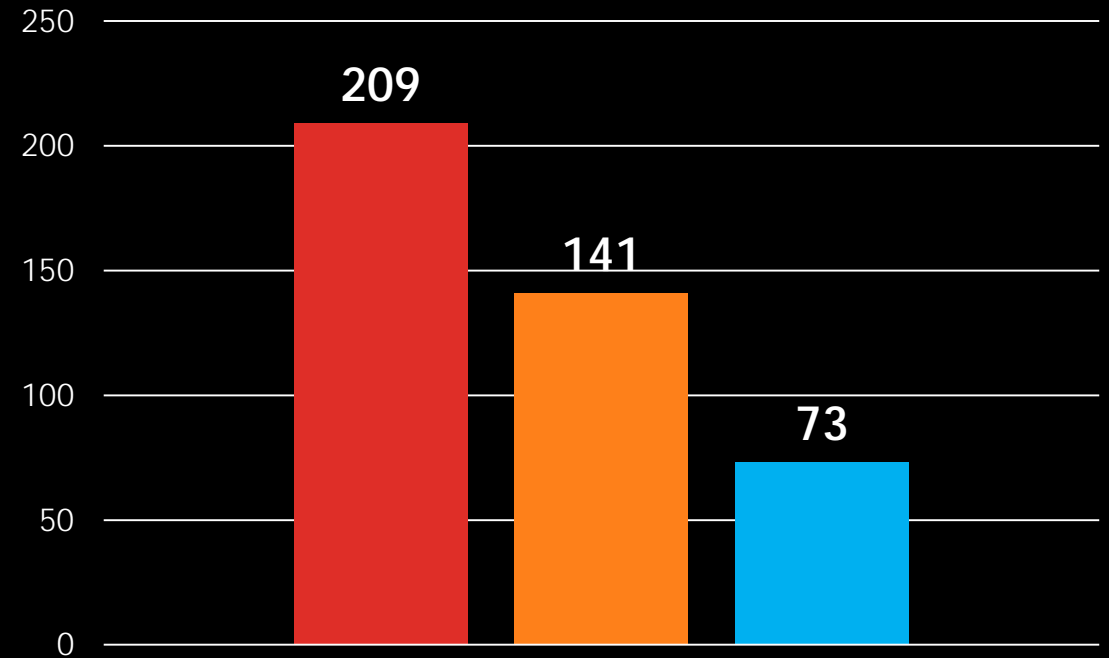


## Hay Cost/Cow, \$



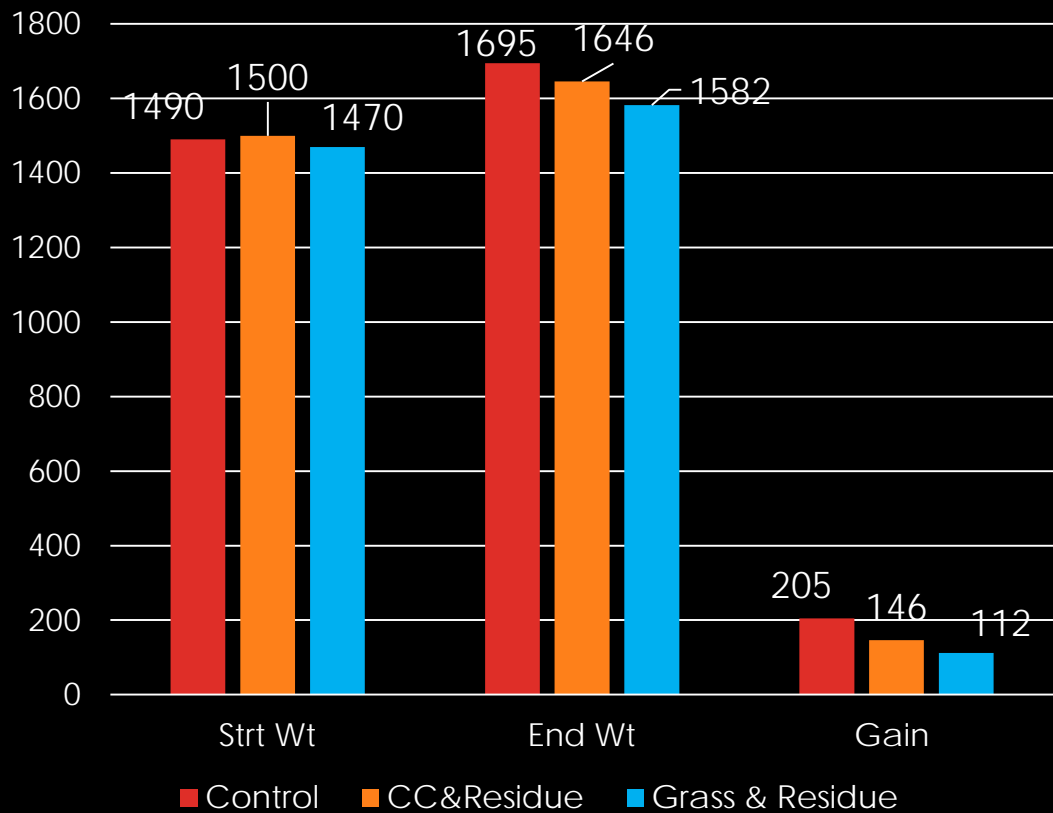
■ Control      ■ CC & Residue  
■ Grass & Residue

## Total Winter Feed Cost/Cow

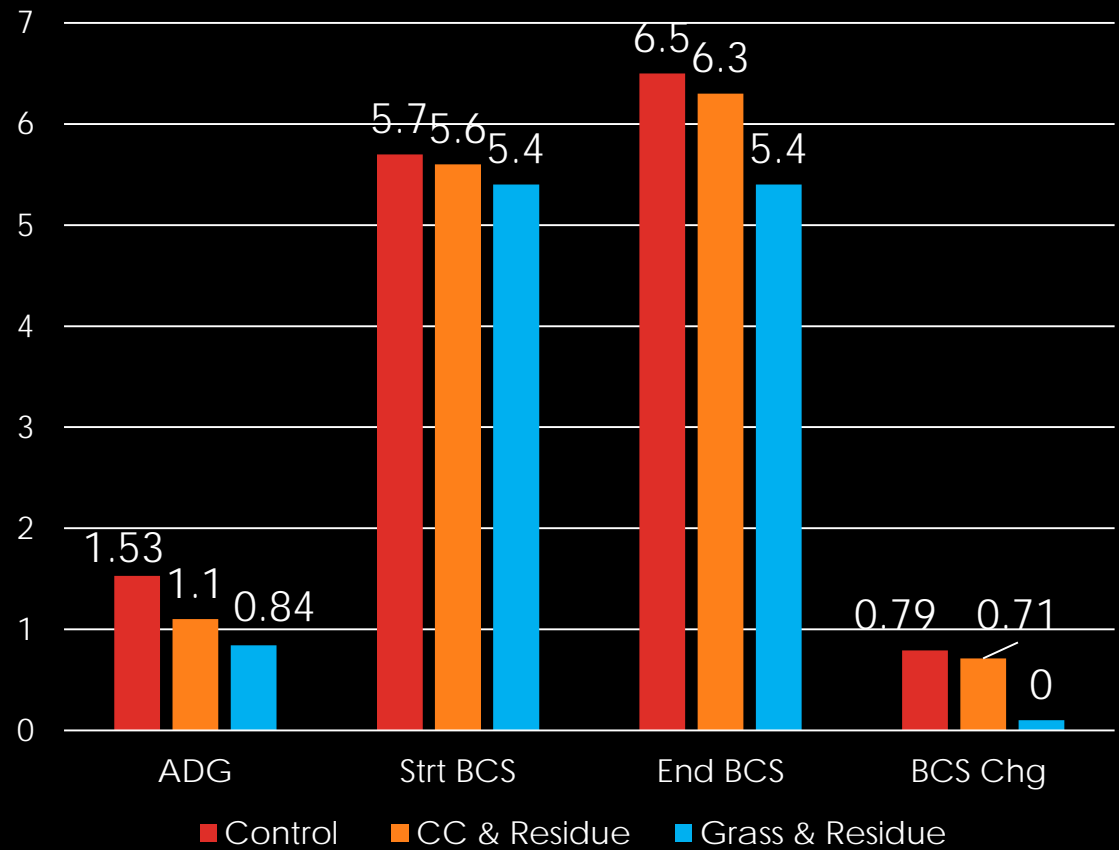


■ Control      ■ CC & Residue  
■ Grass & Residue

## Cow Wt. Gain, lb

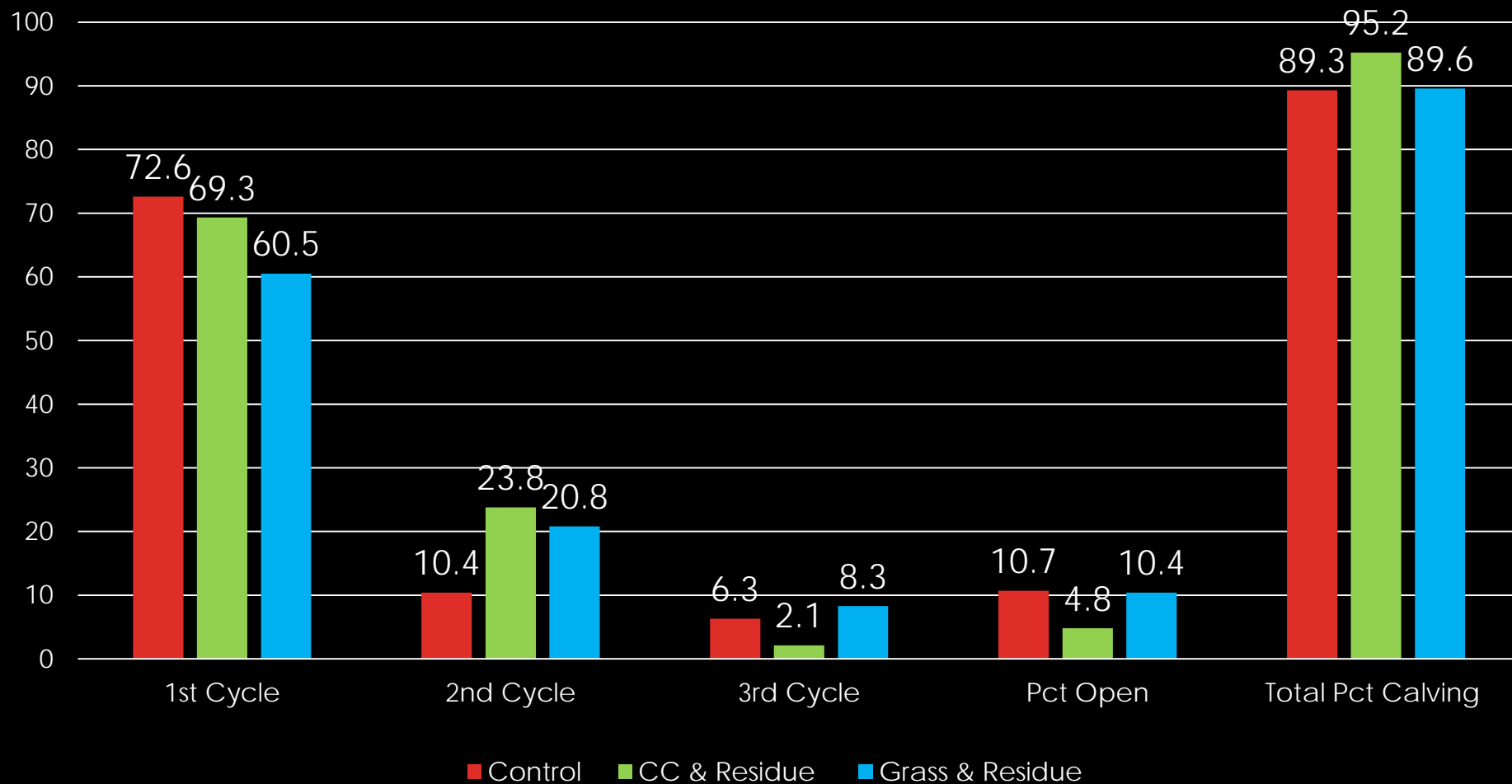


## BCS Change

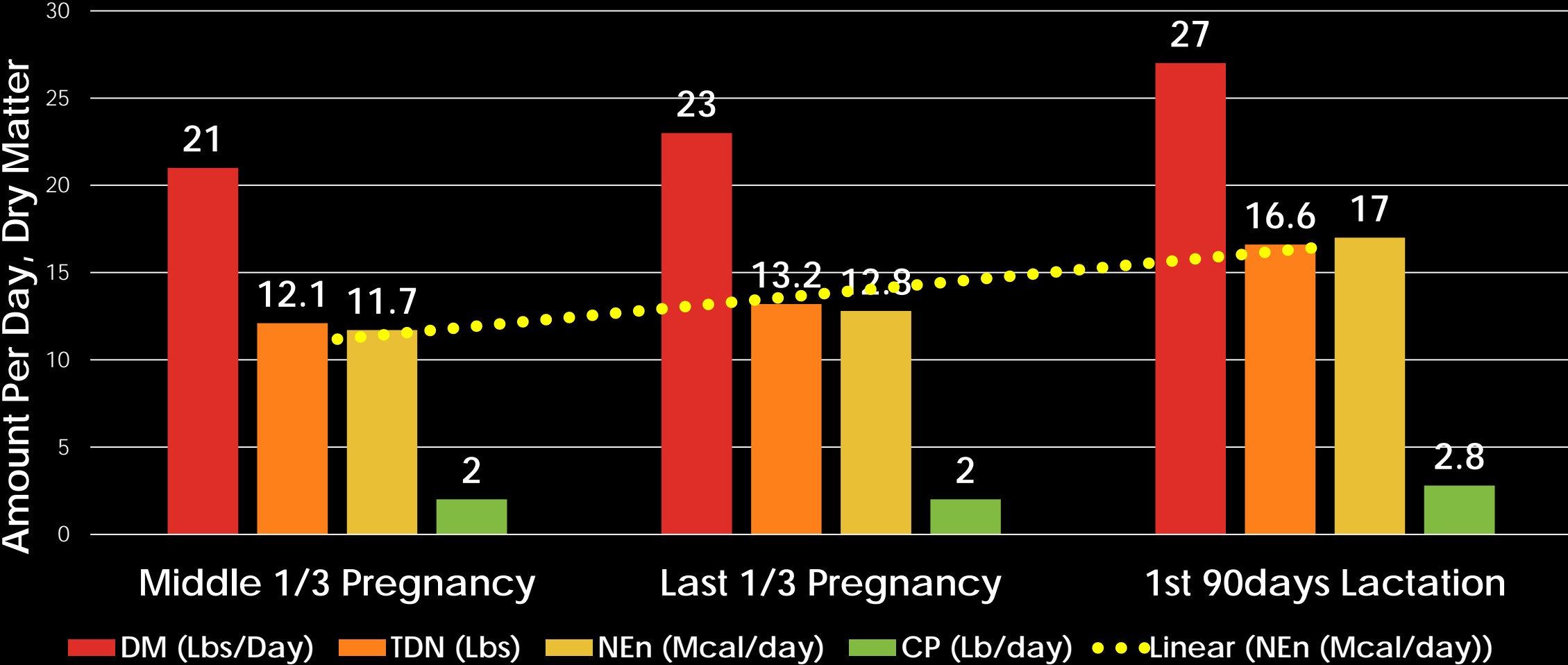


# REPRODUCTIVE PERFORMANCE

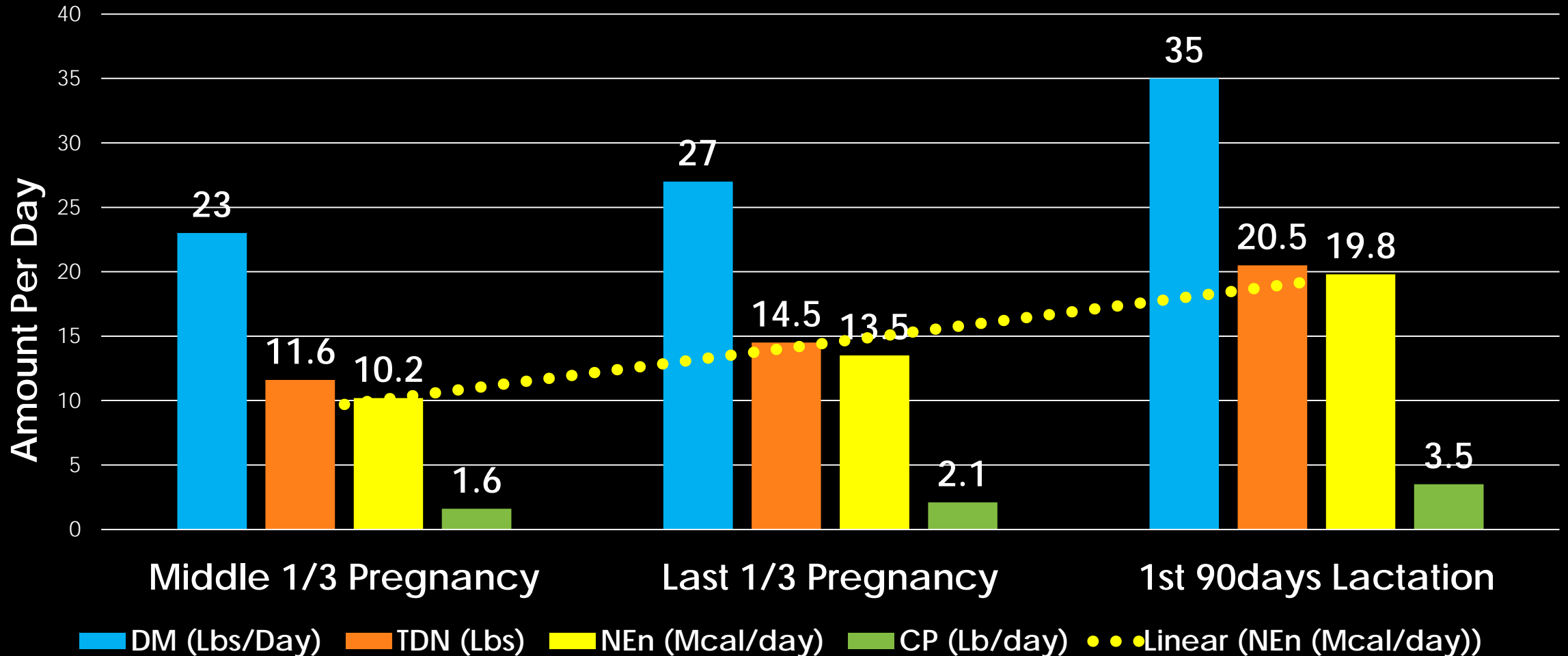
## Breeding Cycle Calving Percent



# DRY MATTER NUTRIENT REQUIREMENTS: 1100 LB HEIFER



# DRY MATTER NUTRIENT REQUIREMENTS: 1400 LB COW



# Dry Pregnant Cow 60 Days Before Calving

## ➤ Last Trimester

### ➤ **Critical Time** :

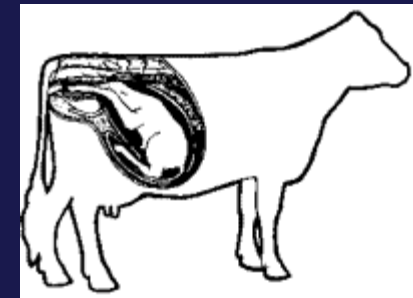
➤ Feeding the cow, this year's calf, and gearing up (BCS) for next years calf!

➤ Increasing nutrient demands due to Rapid Fetal Growth.

➤ 70 % of Total Fetal Growth

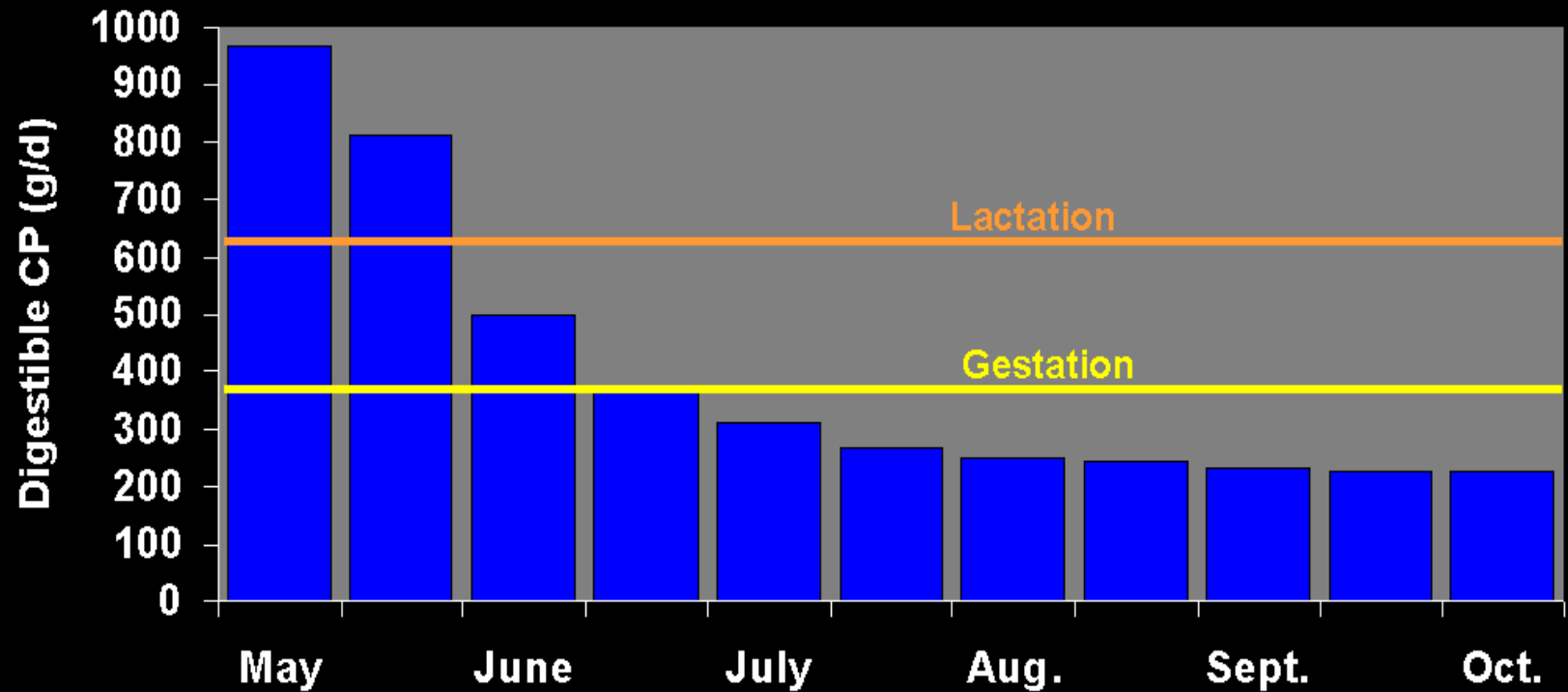
➤ Preparing for Lactation:

➤ Colostrum and Milk Protein Quality Increases



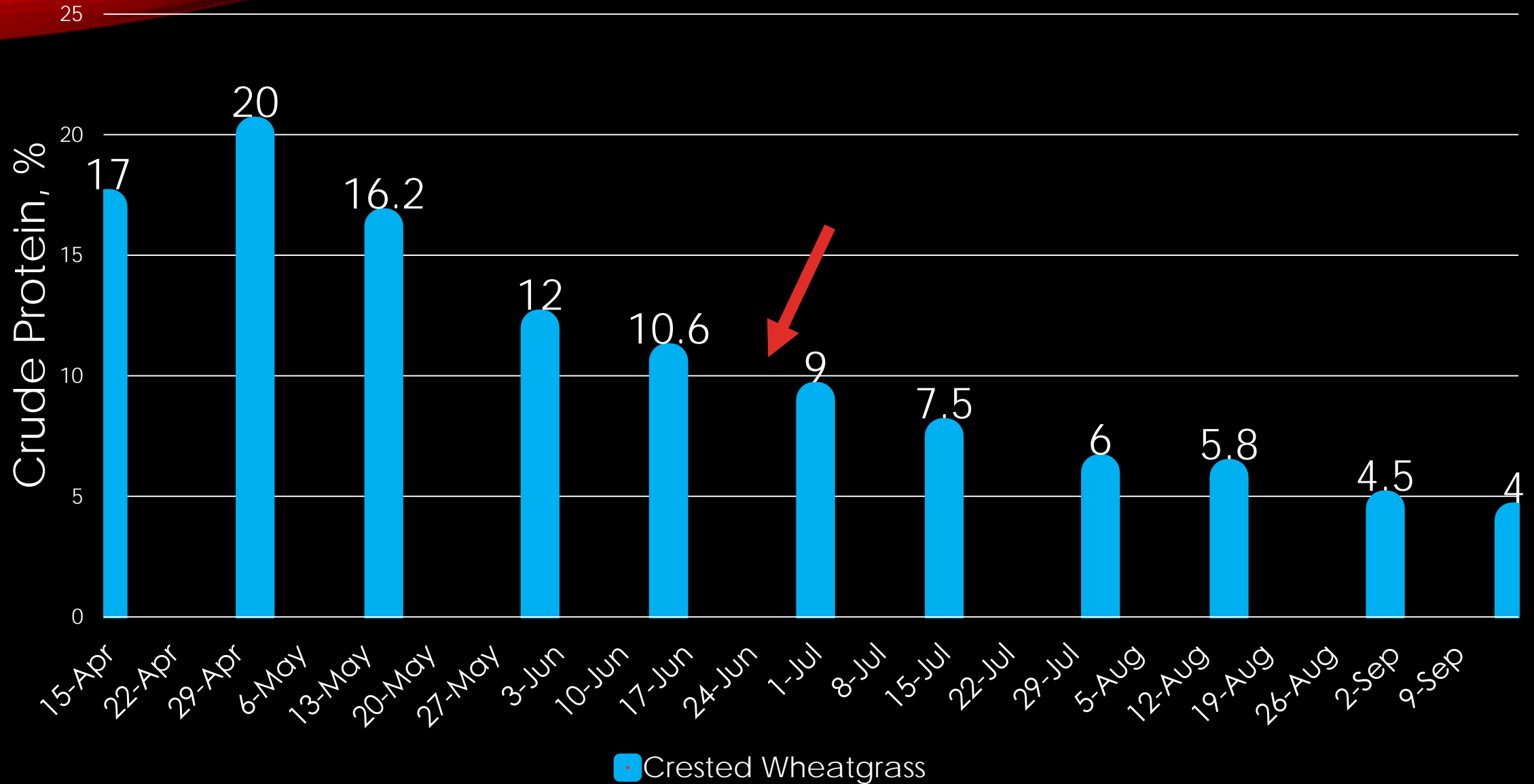
# RANGE CP VS COW DEMANDS

## Range Forage Digestible Protein and Protein Requirement of Beef Cows



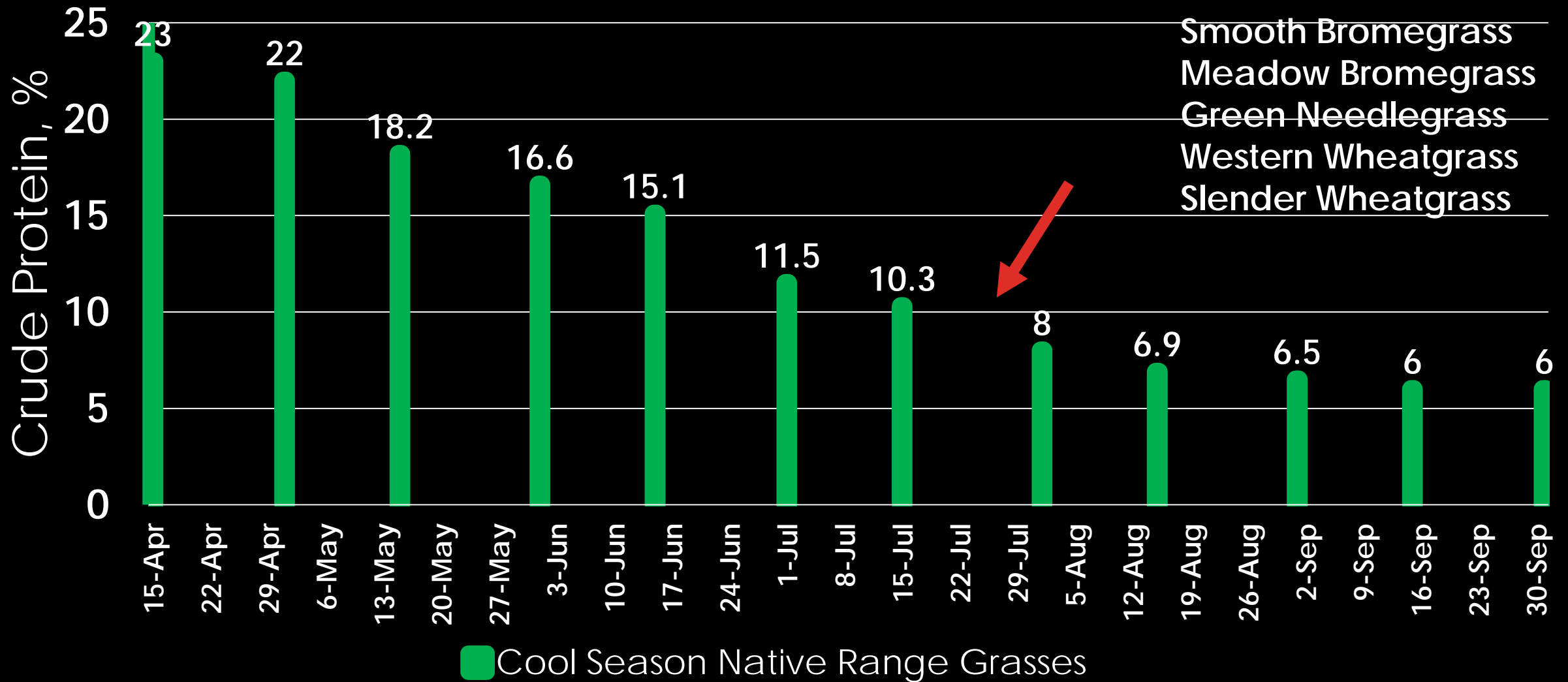
Adapted from Turner and DelCurto (1991)

# Crested Wheatgrass, CP

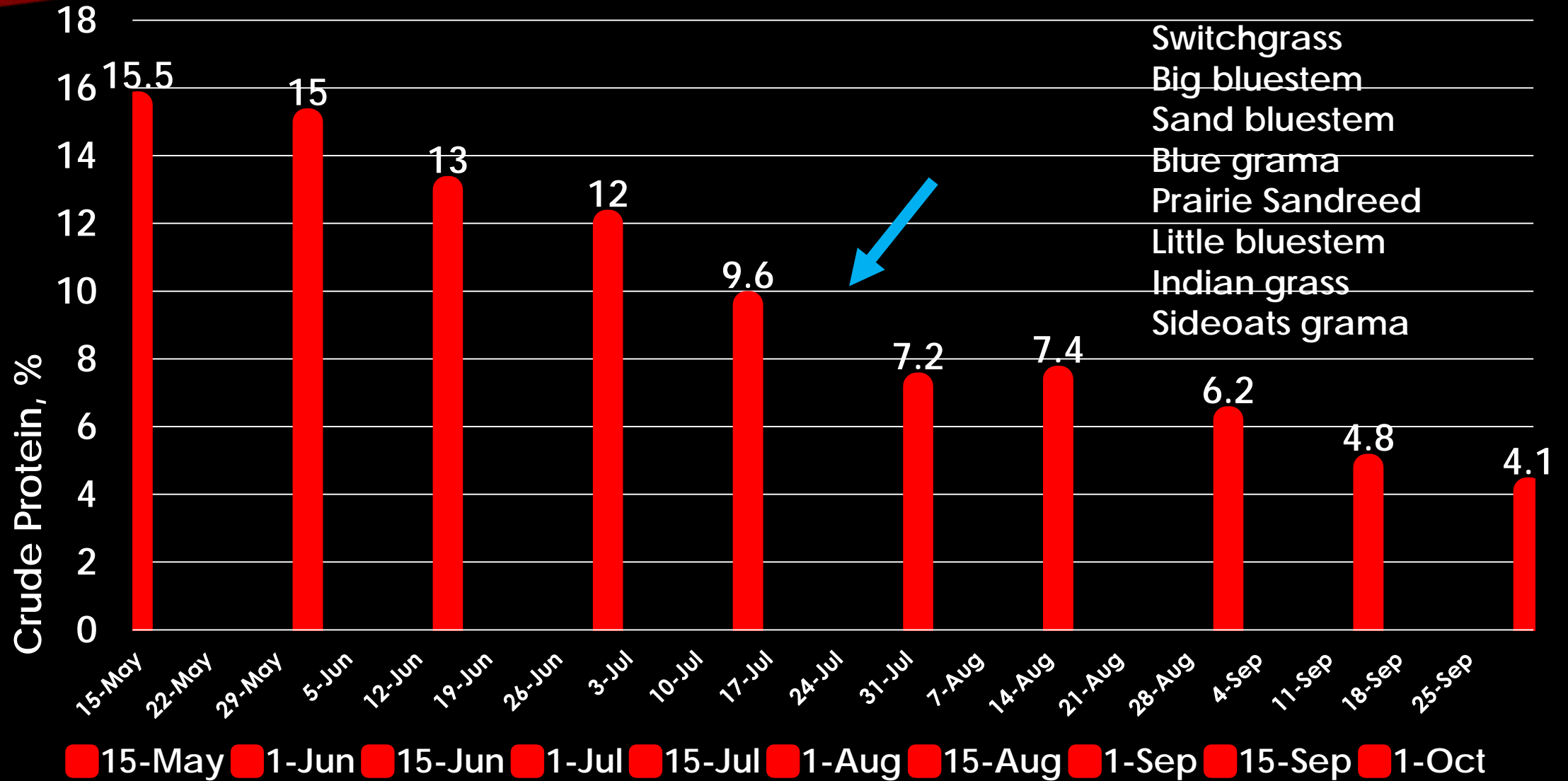




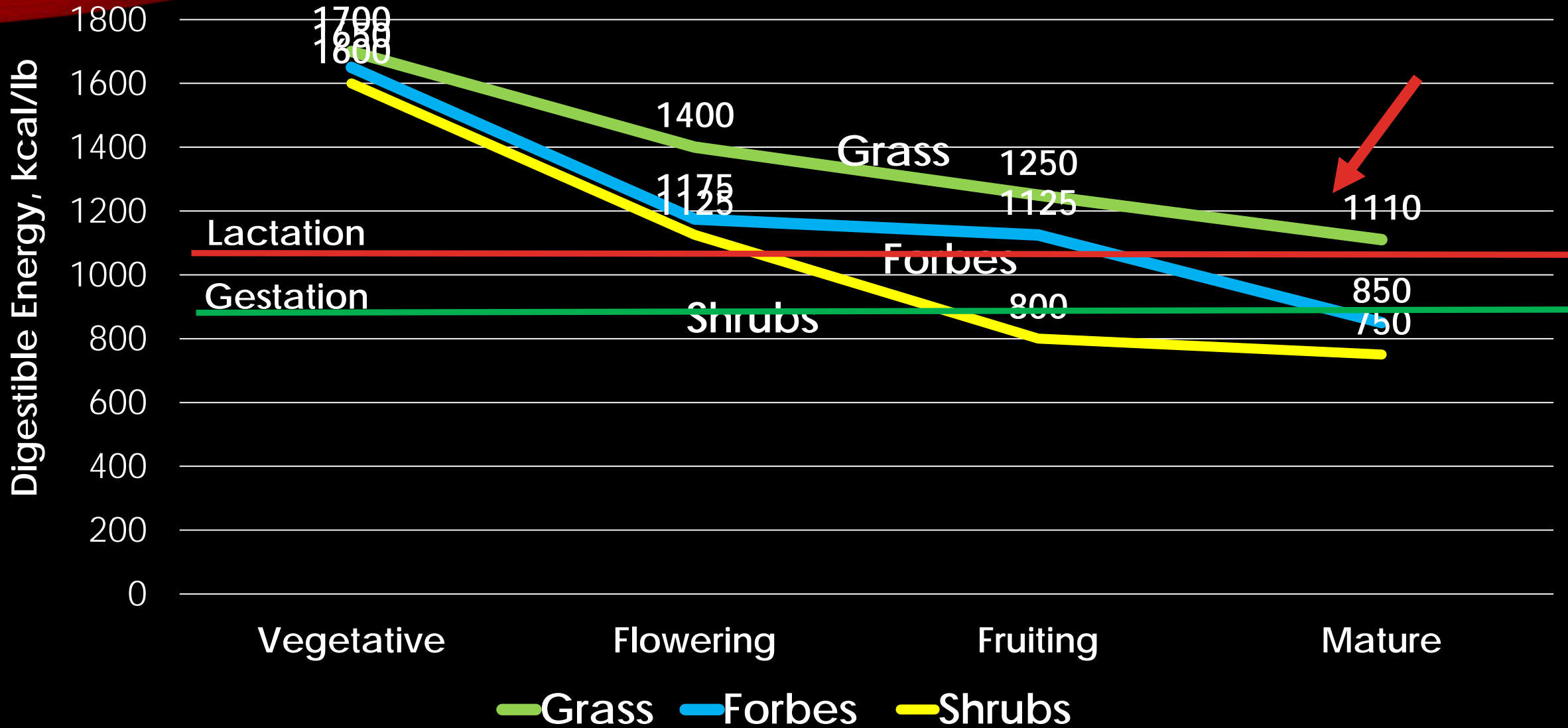
# Cool Season Native Range Grasses, CP



# Warm Season Native Range Grasses, CP



# Native Range Digestible Energy



# Native Range Digestible Protein, %



A photograph of a herd of sheep in a field. The sheep are scattered across a field of tall, dry, golden-brown grass. A wooden fence runs across the middle ground. In the background, there are rolling hills under a hazy, overcast sky. The overall scene is a rural, pastoral landscape.

**THANK YOU**

12.22.2014 12:05