Forage analysis

Using it to design a supplementation program

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Over the next 35 - 40 minutes…

- Value of conducting a forage analysis
- Quantify some “generic” beef cow nutrient requirements
- Characteristics of supplemental feedstuffs
- Identifying the most economical supplement and designing a supplementation program that works for you

Nutritional management programs in the tri-state area

Protein/energy

Minerals/vitamins

Nutritional management

- Will your forages meet the nutrient requirements of your cattle?
  - If they won't, you're going to sacrifice performance
  - How do you know if you don't test them?

Forage analysis

- Begin with a forage analysis
  - TN Soil, Plant, and Pest Center
    - Beef Basic: $17.00
    - Beef Plus: $30.00

- Very few things can yield as much of a return on investment

- Shifts supplementation decisions from reactive to proactive

- Can (should) be used as the first step toward developing a supplementation program that complements your forage(s)

Forage analysis

Unit of measurement

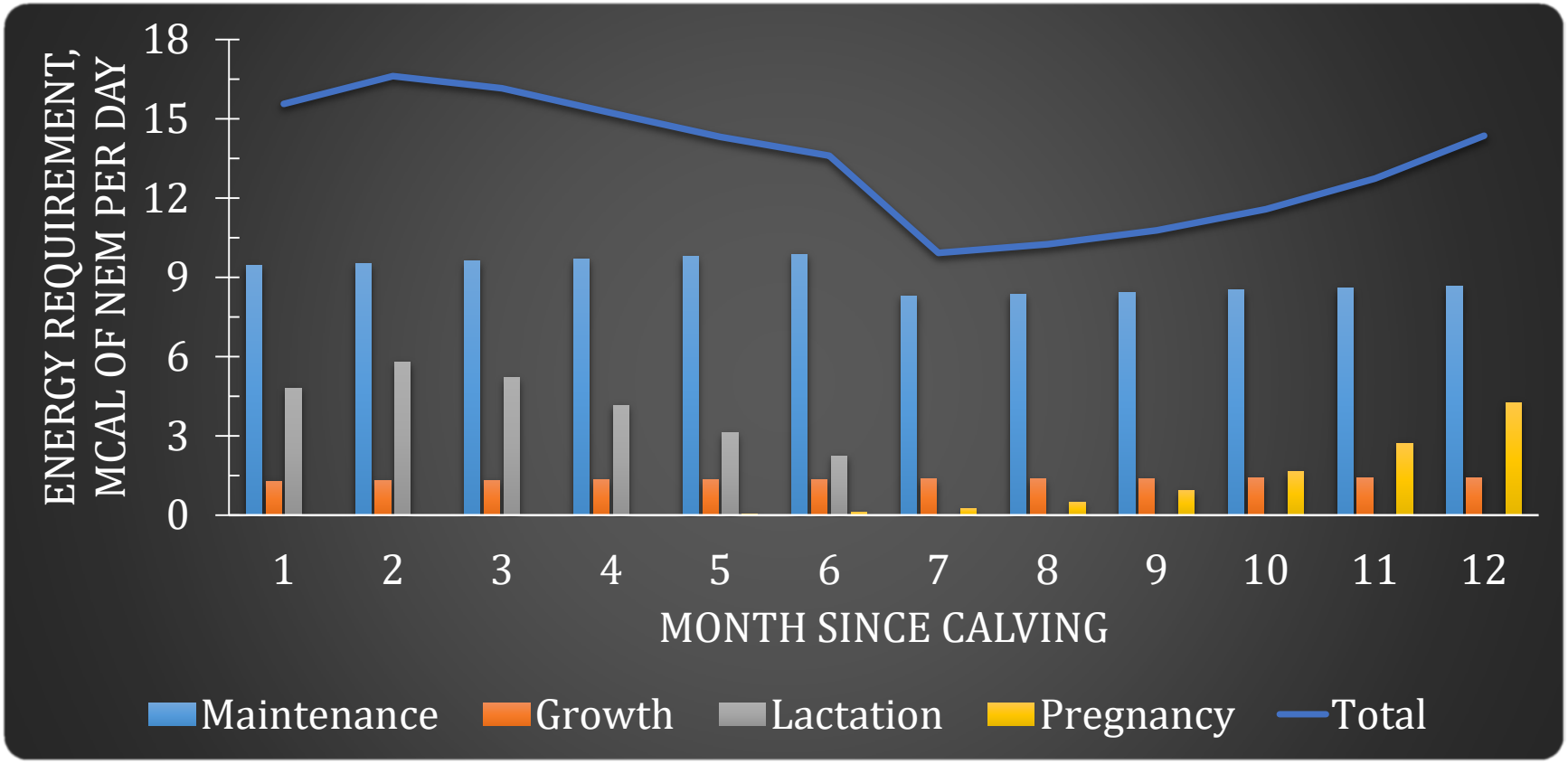
Nutrient value

Sample ID		[redacted]
County		[redacted]
Lab Number		[redacted]
Sample Type		[redacted]
Test Type		**Beef PLUS**
Moisture	%	27.21
Dry Matter (DM)	%	72.79
Relative Forage Quality (RFQ)	<90 - ≥140	155
Crude Protein (CP)	%	14.55
Acid Detergent Fiber (ADF)	%	38.39
Neutral Detergent Fiber (NDF)	%	65.24
Total Digestible Nutrients (TDN)	%	68
Net Energy Maintenance (NEm)	MCal/lb	0.71
Net Energy Gain (NEg)	MCal/lb	0.43
Lignin	%	3.73
Ash	%	10.30
Calcium (Ca)	%	0.47
Phosphorus (P)	%	0.22
Magnesium (Mg)	%	0.27
Potassium (K)	%	2.67
Copper (Cu)	ppm	7
Zinc (Zn)	ppm	25
Manganese (Mn)	ppm	64
Sulfur (S)	%	0.07

**All values reported on a 100% DM Basis*

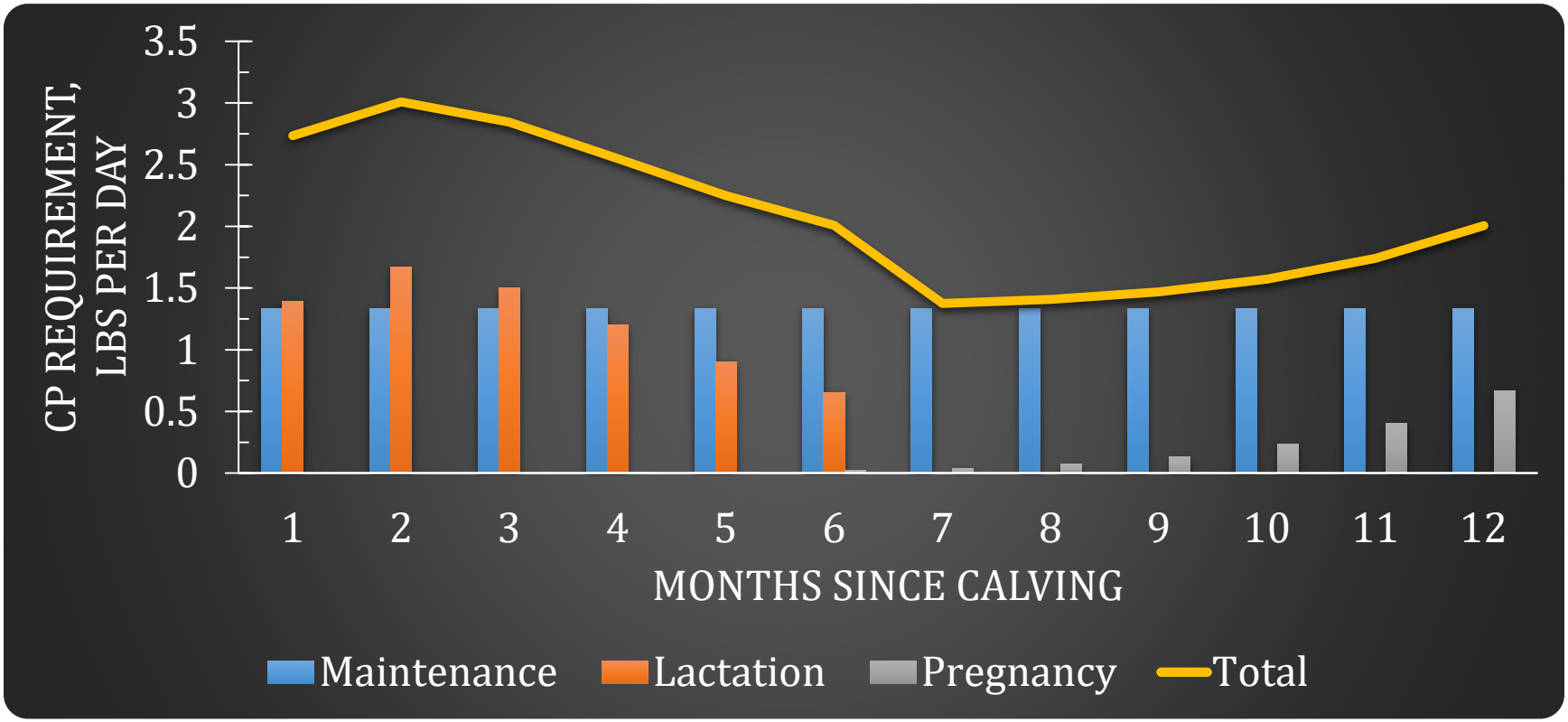
https://ag.tennessee.edu/spp/Pages/forage.aspx

Focus on cow requirements: energy



Calculated for a 3-yr old cow with a mature body weight of 1300 lbs
Adapted from the NRC, 2000

Focus on cow requirements: protein



Assumes that enough energy is present to not limit conversion of crude to metabolizable protein
Calculated for a 5-yr old cow with a mature body weight of 1300 lbs
Adapted from the NRC, 2000

Energy and protein

- Net energy for maintenance (NEm)
  - They must consume enough NEm to meet their requirements for maintenance before they can grow, lactate, reproduce, etc.
- Net energy for gain (NEg)
  - After they meet their NEm requirement, they need to consume enough NEg to drive the desired level of growth
- Crude protein (CP)
  - After they meet their NEm and NEg requirements, they need to consume enough CP to support that level of growth or production

When requirements aren't met…

- You sacrifice…
  - Growth performance
  - Reproduction (longevity)
  - Health and wellbeing
  - Carcass quality

Photo courtesy of Progressive Cattlemen Magazine

- Both direct and indirect effects
  - Direct → the cattle whose requirements aren't being met
  - Indirect → their offspring (fetal programming)

Nutrient restriction during gestation

- Generally results in nutrient deprivation of the developing calf → fetal programming

- Leads to restricted postnatal performance
  - Reduction in colostrum production and quality
    - Impaired immune function and calf health
  - Insufficient thermoregulation
  - Reductions in growth performance, efficiency and carcass traits
  - Reduction in reproductive performance of dams and calves

(Reviewed by Funston et al., 2010)

Supplementing females during gestation

- What about birth weight and dystocia (calving difficulty)?
  - What if I told you that you can't make a calf's birthweight heavier than it's genetic potential?
  - Starving a developing calf will decrease birth weight slightly, but will not decrease the incidence of calving difficulty!
    - But all the negative consequences of fetal programming come along with it
    - And they're harder to get bred back!
  - Don't be afraid to feed her to meet her requirements
    - Just don't make her obese

Effects of late gestational supplementation to meet maintenance requirements on calf performance and subsequent maternal performance as first-calf heifers[1]

Measurement	Treatment		Statistical significance
	Supplemented[2]	Non-supplemented	
Calf performance	--	--	--
Birth weight, lbs	79	77	Not different
Weaning weight, lbs	498	481	Different
Maternal performance	--	--	--
Pregnancy rate, %	93	80	Different
Calved in first 21 d, %	77	49	Different
Calf birth weight, lbs	73	73	Not different
Unassisted births, %	78	64	Not different

[1]Extrapolated from Martin et al., 2007

[2]Cows were supplemented with 0.4 lb of CP and 0.75 lb of TDN per d during the last trimester of gestation

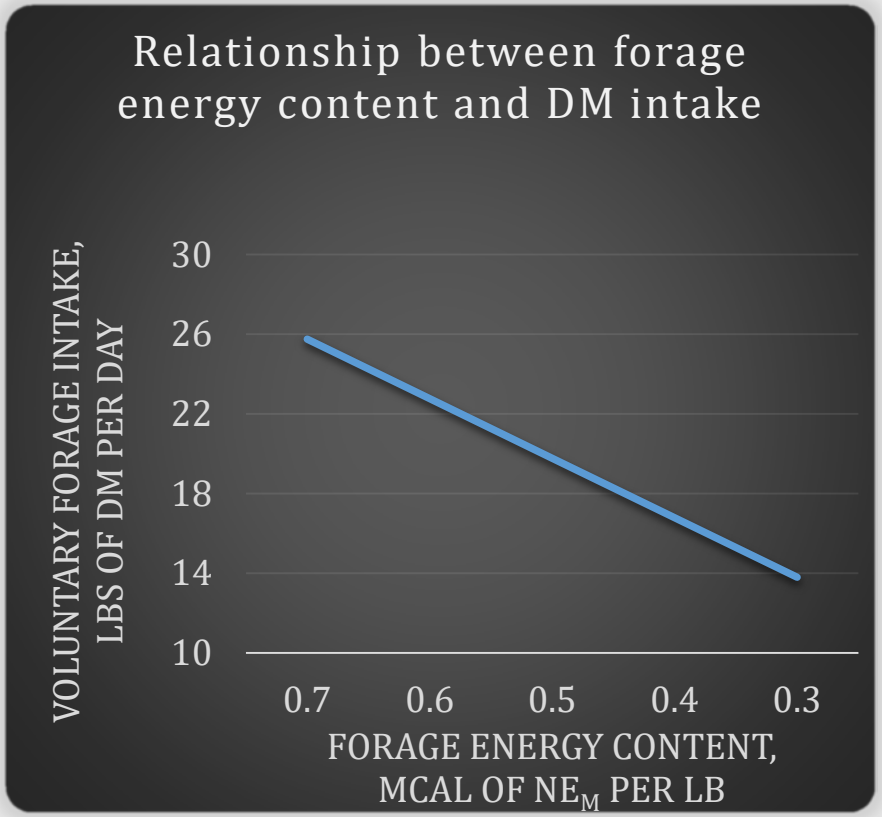
Effects of late gestational supplementation above maintenance requirements on calf performance [1]

Measurement	Treatment		Statistical significance
	Supplemented[2]	Non-supplemented	
Calf performance	--	--	--
Birth weight, lbs	84.4	83.2	Not different
Unadjusted weaning weight, lbs	640	640	Not different
Adjusted 205-d weaning weight, lbs	612	618	Not different
Weight per d of age, lbs	2.6	2.6	Not different

[1]Work conducted at Blount, Holston, Highland-Rim, Middle TN, and Plateau RECs and included 515 cows
[2]Supplemented with 5 lbs of distiller's dried grains w/ solubles per d, 3 d per week

Can they eat enough?

- Energy content is the primary indicator of voluntary forage intake
  - Net energy for maintenance (NE_m)
- If forage has a low NE_m content, they may not be able to eat enough to meet their requirements
  - Voluntary intake decreases as energy content decreases



Adapted from the NRC, 2000
Calculated for a 1300 lb cow

Selecting the right supplement

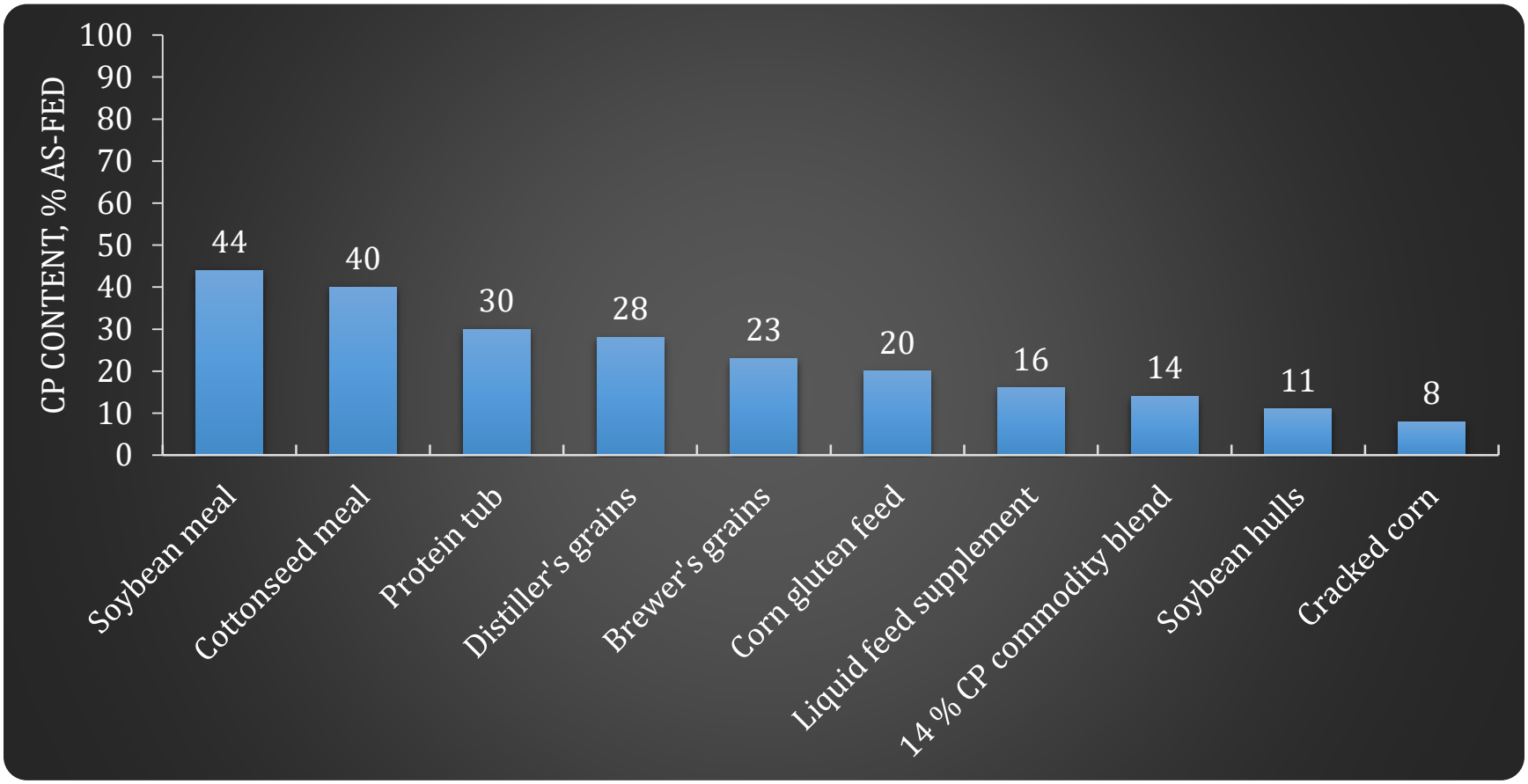
- If your goal is to use supplements to fill a nutrient void…
  - Select supplemental feeds that complement your forage
    - Low protein forage → supplement that is high in protein
    - Low energy forage → supplement that is high in energy

Selecting the right supplement

- If that goal includes maximizing profitability…
  - Evaluate the value of your options
    - **<u>Cost per unit of nutrient</u>** rather than only retail cost
  - Select the most economical option

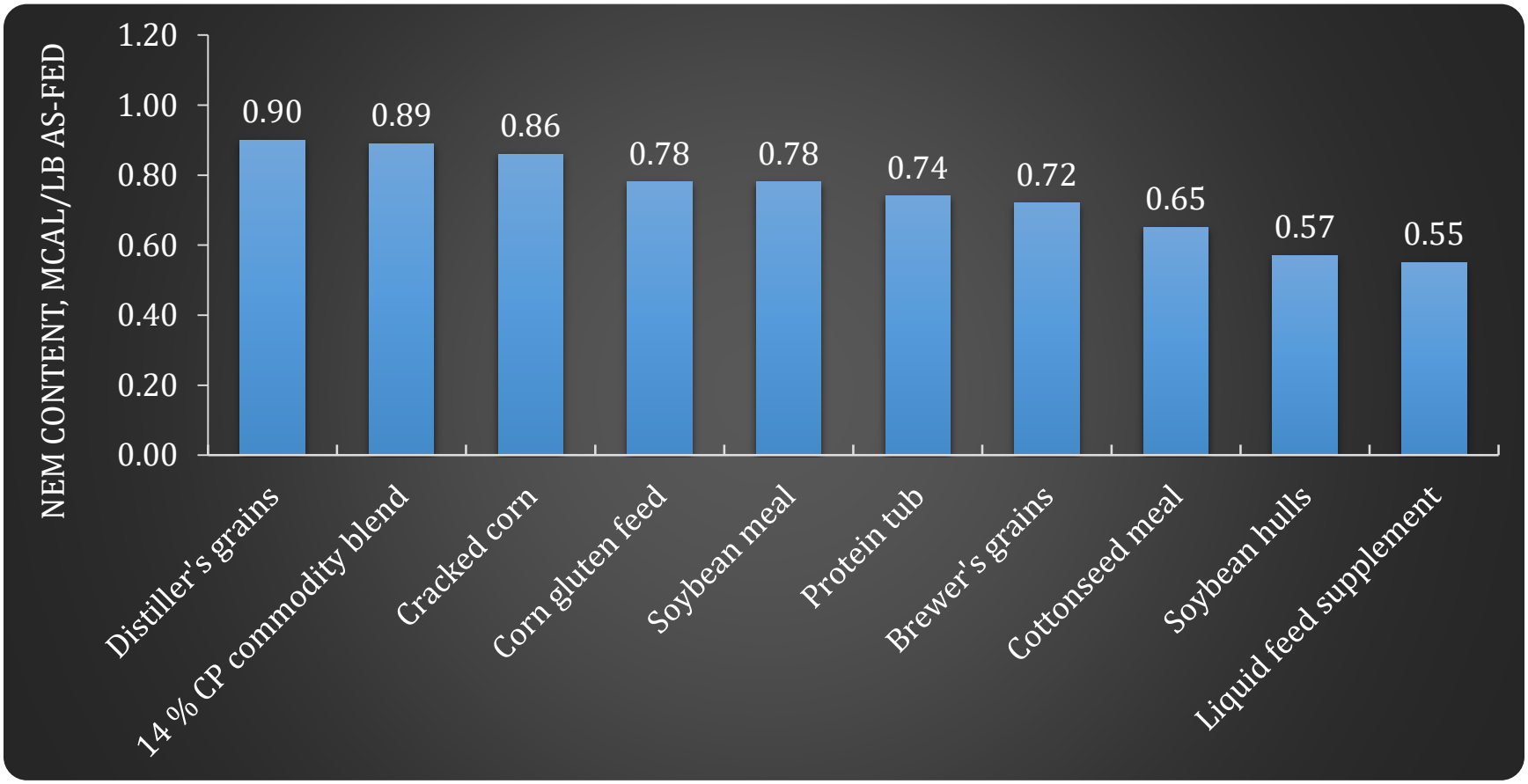
$$\text{Cost per unit of nutrient} = \frac{Cost\ per\ lb\ of\ feed}{amount\ of\ nutrient\ per\ lb\ of\ feed}$$

Supplement nutrient composition



NRC, 2000

Supplement nutrient composition



NRC, 2000

Supplement cost per unit of nutrient

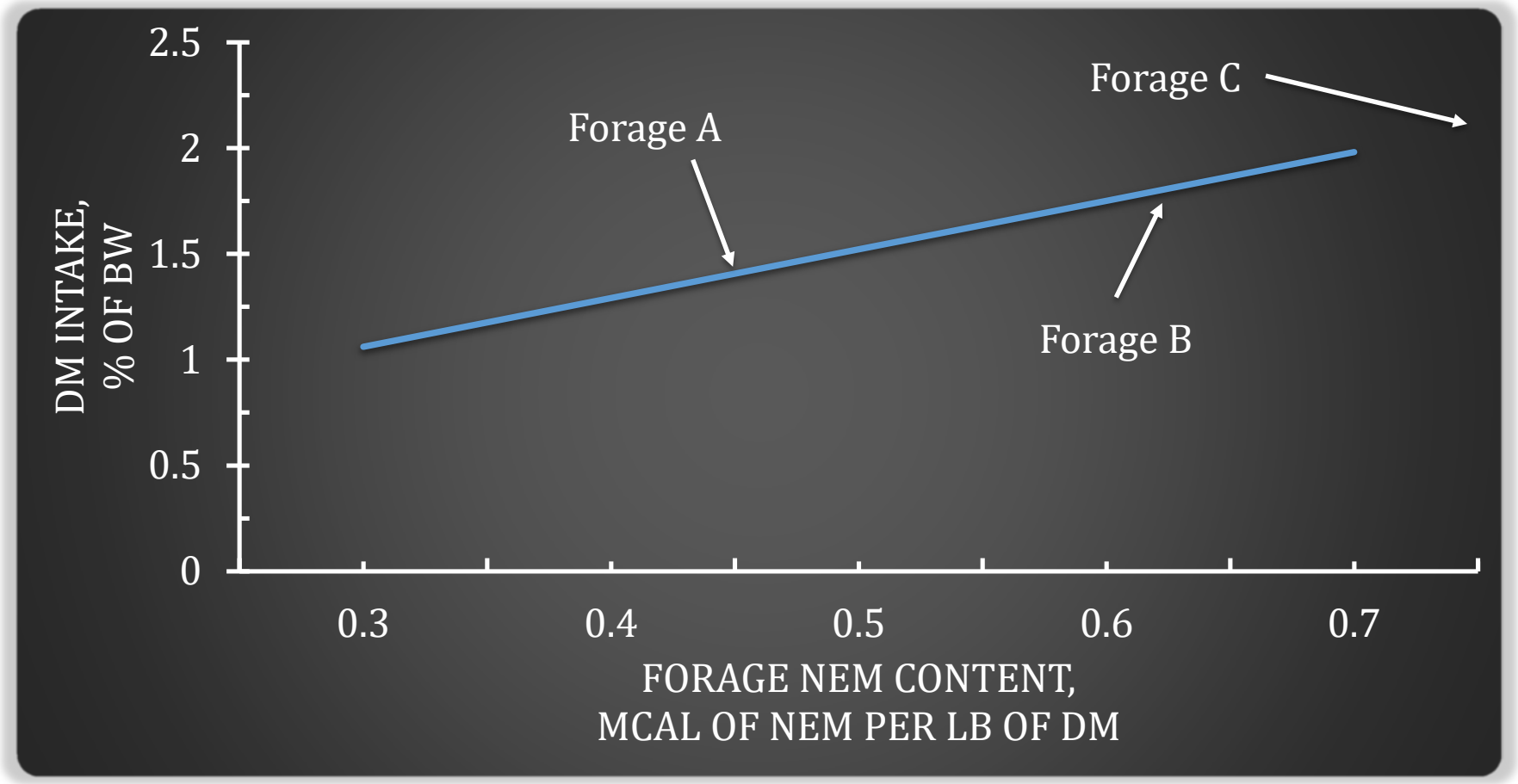
Feedstuff	Retail cost ($/ton)	Retail cost ($/lb)	Cost of CP ($/lb)	Cost of NEm ($/mcal)
Brewer's grains	210.00	0.11	0.45	0.15
Corn gluten feed	170.00	0.09	0.42	0.11
Cottonseed meal	325.00	0.16	0.41	0.25
Cracked corn	185.00	0.09	1.20	0.11
Distiller's grains	185.00	0.09	0.33	0.10
Soybean meal	400.00	0.20	0.46	0.26
Soybean hulls	115.00	0.06	0.52	0.10
14 % CP commodity blend	235.00	0.12	0.84	0.17
Protein tub	600.00	0.30	1.00	0.41
Liquid feed supplement	210.00	0.11	0.66	0.19

Real-world scenario

- Let's compare the ability of three forages to meet the nutrient requirements of a 1300 lb cow

Forage example	TDN (% of DM)	NEm (Mcal/lb of DM)	CP (% of DM)
A	50	0.45	8.2
B	60	0.61	9.8
C	70	0.76	11.4

Predicted voluntary forage intake



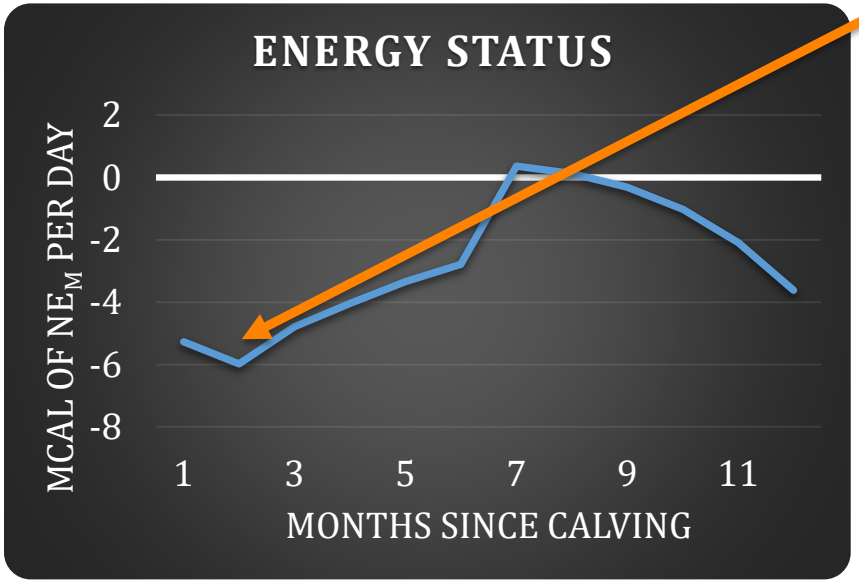
Adapted from the NRC, 2000

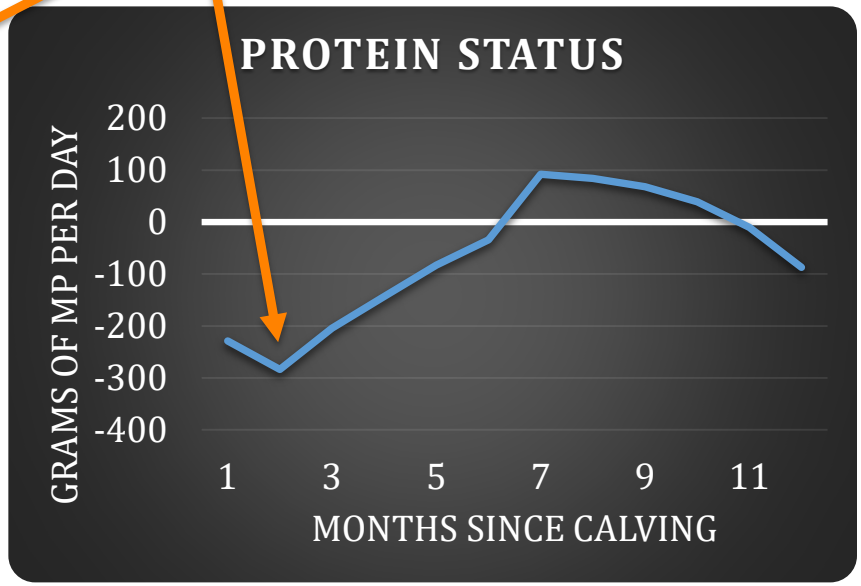
Forage A

4 lbs distiller's
3 lbs cracked corn

OR

6 lbs gluten
2 lbs cracked corn



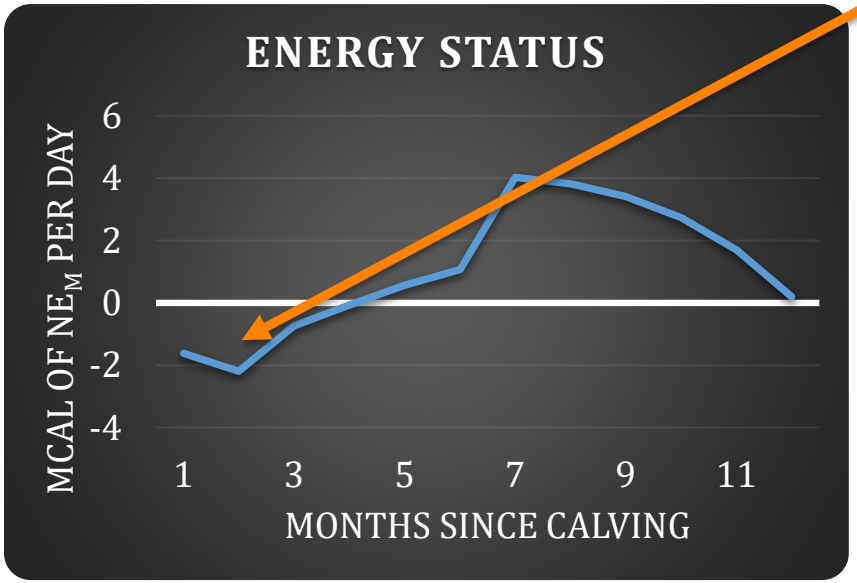


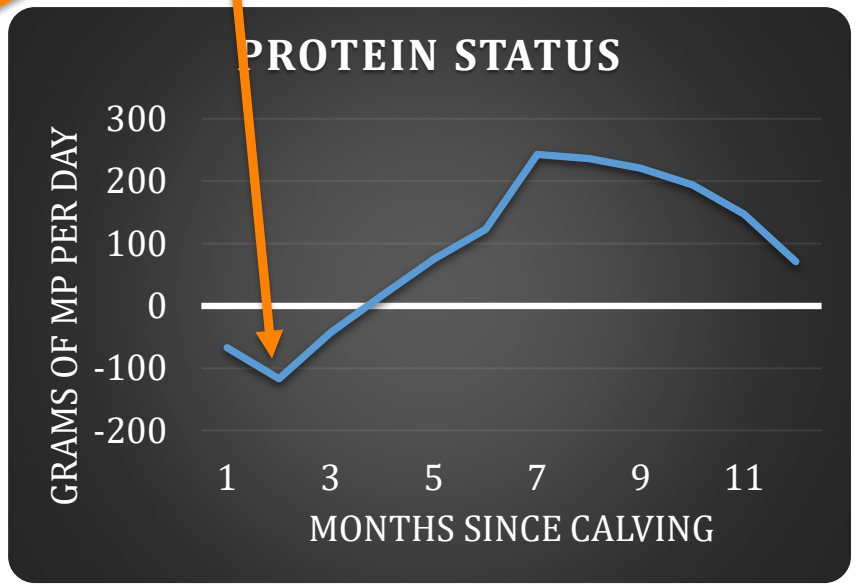
- TDN = 50 % of DM
- NE_m = 0.45 Mcal/lb of DM
- CP = 8.2 % of DM

MP = metabolizable protein, or protein that is absorbed

Forage B

3 lbs distiller's OR **3 lbs gluten** OR **3 lbs cracked corn**



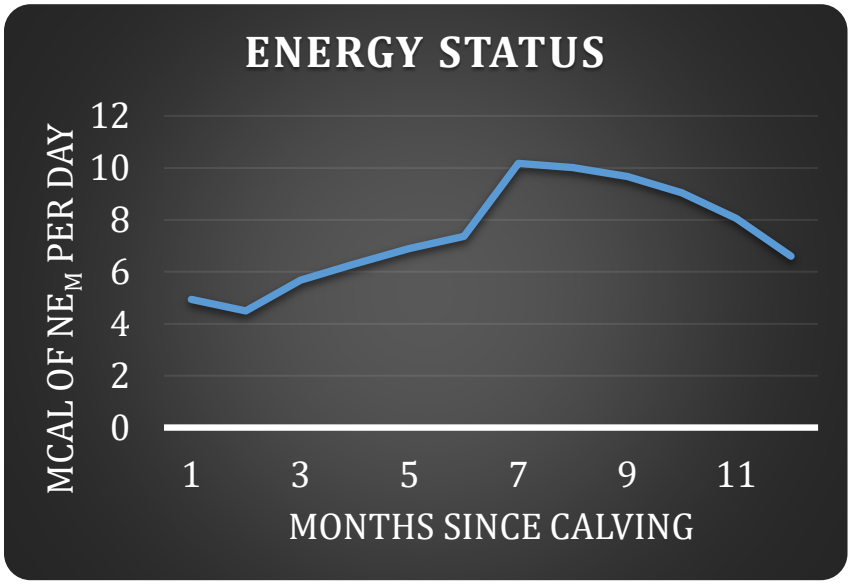


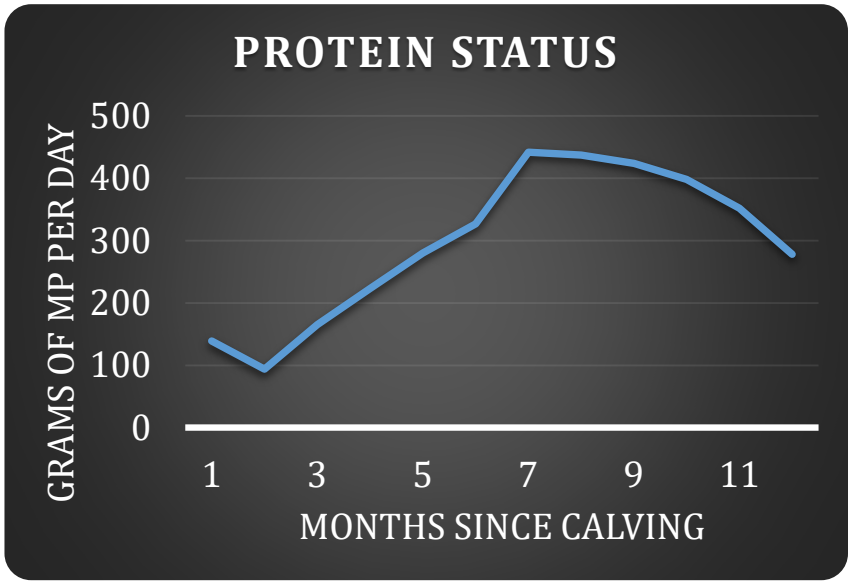
- TDN = 60 % of DM
- NE_m = 0.61 Mcal/lb of DM
- CP = 9.8 % of DM

MP = metabolizable protein, or protein that is absorbed

Forage C

She doesn't need any supplemental energy or protein!





- TDN = 70 % of DM
- NE_m = 0.76 Mcal/lb of DM
- CP = 11.4 % of DM

MP = metabolizable protein, or protein that is absorbed

Mineral supplementation

- Which mineral supplement is the right choice?
- Should I be feeding the same mineral supplement year-round?
- Forage analysis is the only way to answer these questions

Ensiled feeds

- Forage analysis can also be used to screen for ensiled feed safety issues
  - Clostridia
  - Listeria
- pH is currently the best indicator of silage safety
  - Corn silage → pH > 4.5 should be tested prior to feeding
  - Haylage → pH > 5 should be tested prior to feeding
- Screen via forage analysis PRIOR TO feeding
  - If pH is too high, test for clostridia and listeria

Take-home points

- Importance of a forage analysis cannot be overemphasized!
- Focus on meeting the nutrient requirements of your cattle in the most economical way possible
- Base supplementation decisions on nutrient needs and supplement value (cost per unit of nutrient) rather than retail cost

Closing thoughts

- Design a program that works for you
  - Just because it works for your neighbor, doesn't mean it'll work for you
  - Just because it's what you've done in the past, doesn't mean it's the best option
- Don't be afraid to supplement your cattle if they need it
  - View it as an investment, rather than an expense
  - Make economically responsible supplementation decisions
- When purchasing supplements…
  - You generally get what you pay for
  - Be skeptical of "fix-all" product claims

What's on the horizon?

- Decision-making tools
  - Cost per unit of nutrient calculator for supplemental feedstuffs
  - Cost per unit of nutrient calculator for different forms of the same supplemental feedstuff

- Educational materials
  - How to conduct a forage analysis
  - Beef cattle nutrient requirements
  - Specific supplemental feedstuffs

Questions?