K-STATE Research and Extension

Forage Sampling, Analysis and What the Results Mean

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Animal Science Extension Agent Update

Eastern Kansas

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Knowledge for Life

What is Involved With Collecting a Forage Sample?

What is Involved With Collecting a Forage Sample?

- Time and dedication towards collecting a sample that represents the forage being tested!
- Testing apparatus – Many flavors available !



Developing a Sampling Protocol

The Sampling Protocol should describe:

- Method of forage collection
- Key forage species
- Key sampling areas
- During transition periods, sampling should occur every 2 weeks
- Monthly during forage dormancy

When Do You Sample?

Forages should be sampled as close to the time of feeding or sale as possible

Definition of a Forage Lot

- A forage lot consisting either of hay or silage is defined as forage taken from the same:
- Location
- Farm, or field

using the same cutting (within a 48-hour period) at the same stage of maturity; and is similar in the amount of grass, weeds, or rain damage.

Select Uniform Lots of Hay

	Hay field 1st cut		Hay field 2nd cut		
	Grass infested	Pure	Grass infested	Pure Rain Damage	Pure No Rain
Lot #	1	2	3	4	5

Segregate Each Lot as It Is Harvested and Stored

- When segregating by quality, a better job can be done nutritionally by feeding according to specific animal production requirements
  - i.e. Identity preservation
- This will greatly facilitate access so that it may be retrieved as needed

Sampling Different Bale Types

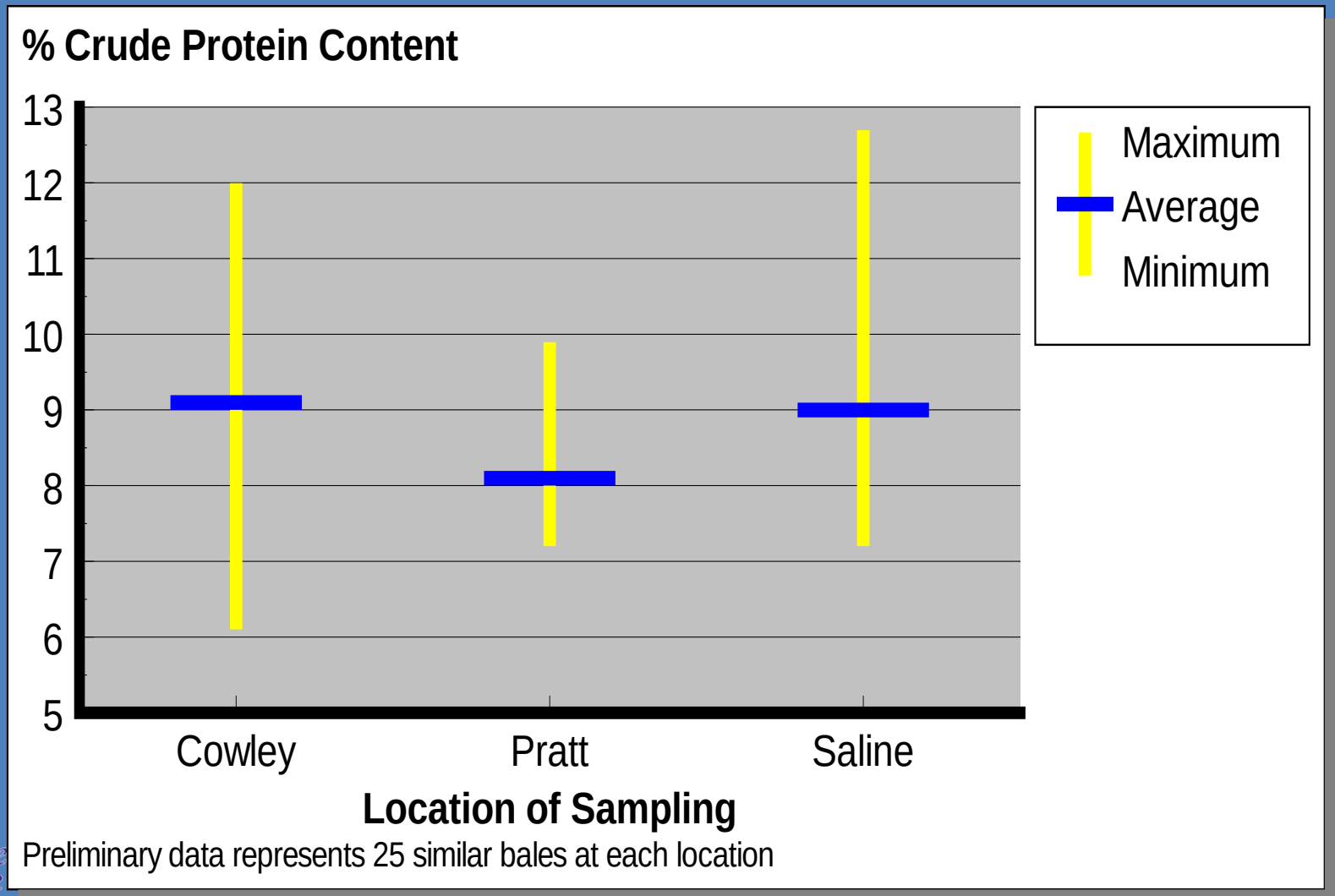
Large Round Bales

- Select a minimum of 10 bales from each lot to be sampled.
- Core sample at least two different locations on each side of bale
- Bales should be probed from the sides, not the ends.

Table 1. Recommended Number of Large Round Bales to Subsample and Composite Based Upon Desired Degree of Precision and Confidence Interval for Crude Protein Content

Forage Type	Precision of Average Crude Protein Estimate, %	Confidence Interval		
		99%	95%	80%
1st Cutting Alfalfa	± 1	19	11	5
	± .5	76	44	19
3rd Cutting Alfalfa	± 1	12	7	3
	± .5	47	27	12
Prairie Hay	± 1	4	2	1
	± .5	15	9	4
Sorghum-Sudan Hay	± 1	7	4	2
	± .5	28	16	7

Variation in Crude Protein Content of Cane Hay - Preliminary Results



Preliminary data represents 25 similar bales at each location

Conventional Square Bales

- Randomly select 15 – 20 bales from each lot of hay.
- Insert probe into center end of each bale.
- Drill at least 18” deep in loose bales, 12 – 15” in tight bales.
- DO NOT submit a flake of hay or use the “Grab” sample

Silage and Haylage

- Sampling may be done at harvest but another should be conducted post-fermentation.
- To sample ensiled material from storage, collect a minimum 2-pound sample from various locations on the “face” of the silage pile.
- Dump contents on clean floor and subsample.
- Seal in a plastic bag and store immediately in a freezer.

Forage Analysis

SDK Laboratories

1000 Corey Road
P.O. Box 886
Hutchinson, KS 67504-0886
620-665-5661
FAX: 620-665-0559
TOLL FREE: 877-464-0623
www.sdklabs.com

Sample # 45676
Sample: Forage Mike Becker Hoffman
Other ID: Wheat Straw & Soybeans

Date Received: 11/04/2011
Date Reported: 11/08/2011
Total Fee: 18.00

Kansas State University+
Attn: Dale Blasi
229 Weber Hall
Manhattan, Ks 66506

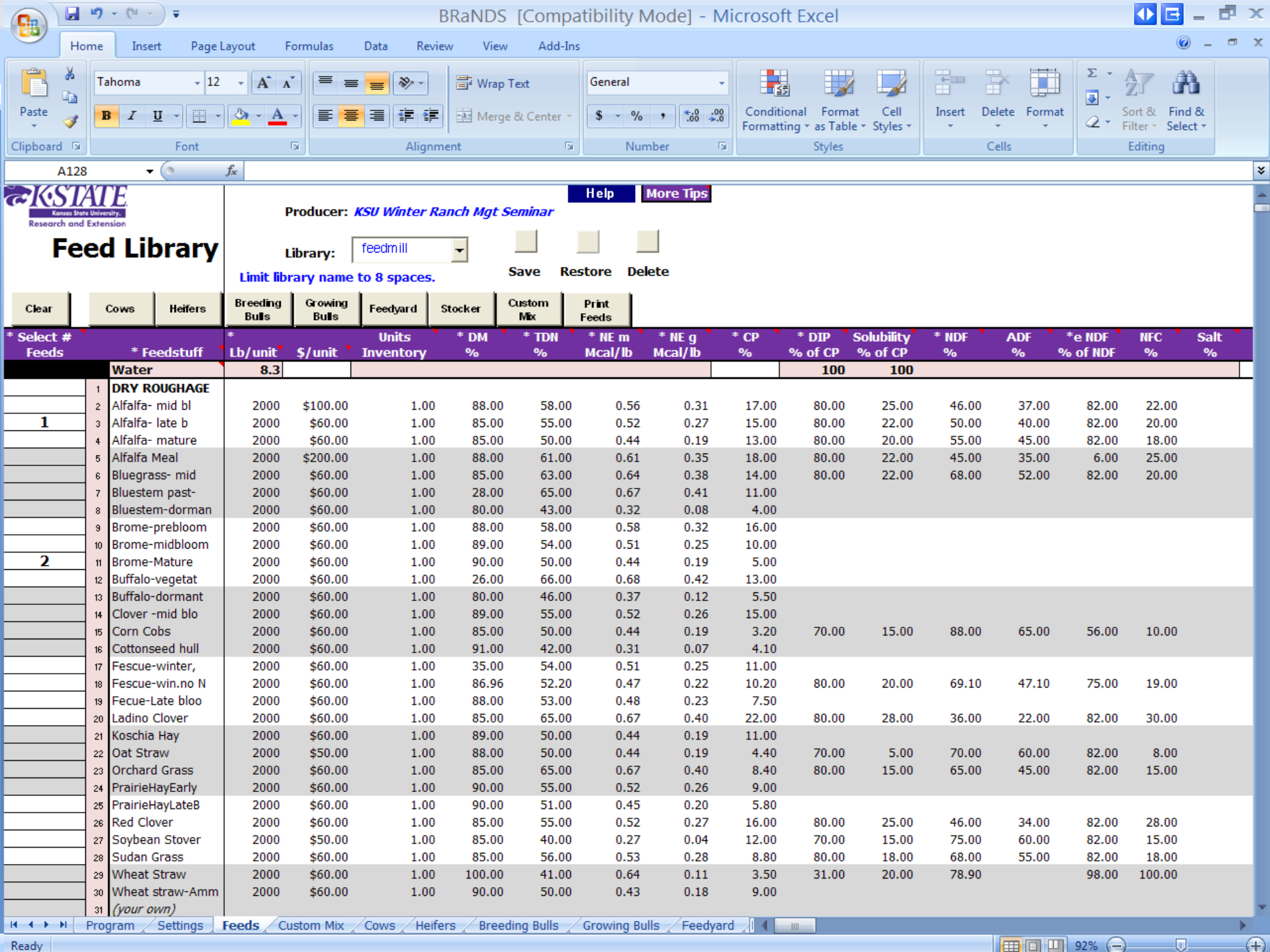
ANALYSIS

	Dry Basis	As Received	
Moisture		8.99	%
Dry Matter		91.01	%
Protein, Crude	11.50	10.47	%
ADF-Acid Detergent Fiber	40.32	36.70	%
NEL: Net Energy-Lactation	0.52	0.47	Mcal/lb
NEG: Net Energy-Gain	0.22	0.20	Mcal/lb
NEM: Net Energy-Maintenance	0.54	0.50	Mcal/lb
TDN: Total Digestible Nutrients	51.32	46.71	%
Calcium	1.64	1.49	%
Phosphorus	0.18	0.16	%

Net Energy of Native Range Calculated from ADF

- %TDN = 88.9 - (0.779 x ADF)
- ME (Mcal/kg) = (TDN% × 0.044) × 0.82
- NEm (Mcal/lb) = (1.37 × ME) – (.138 × ME^2) + (.0105 × ME^3) – 1.12 / 2.204
- NEg (Mcal/lb) = (1.42 × ME) – (.174 × ME^2) + (.0122 × ME^3) – 1.65 / 2.204

NRC (1996)



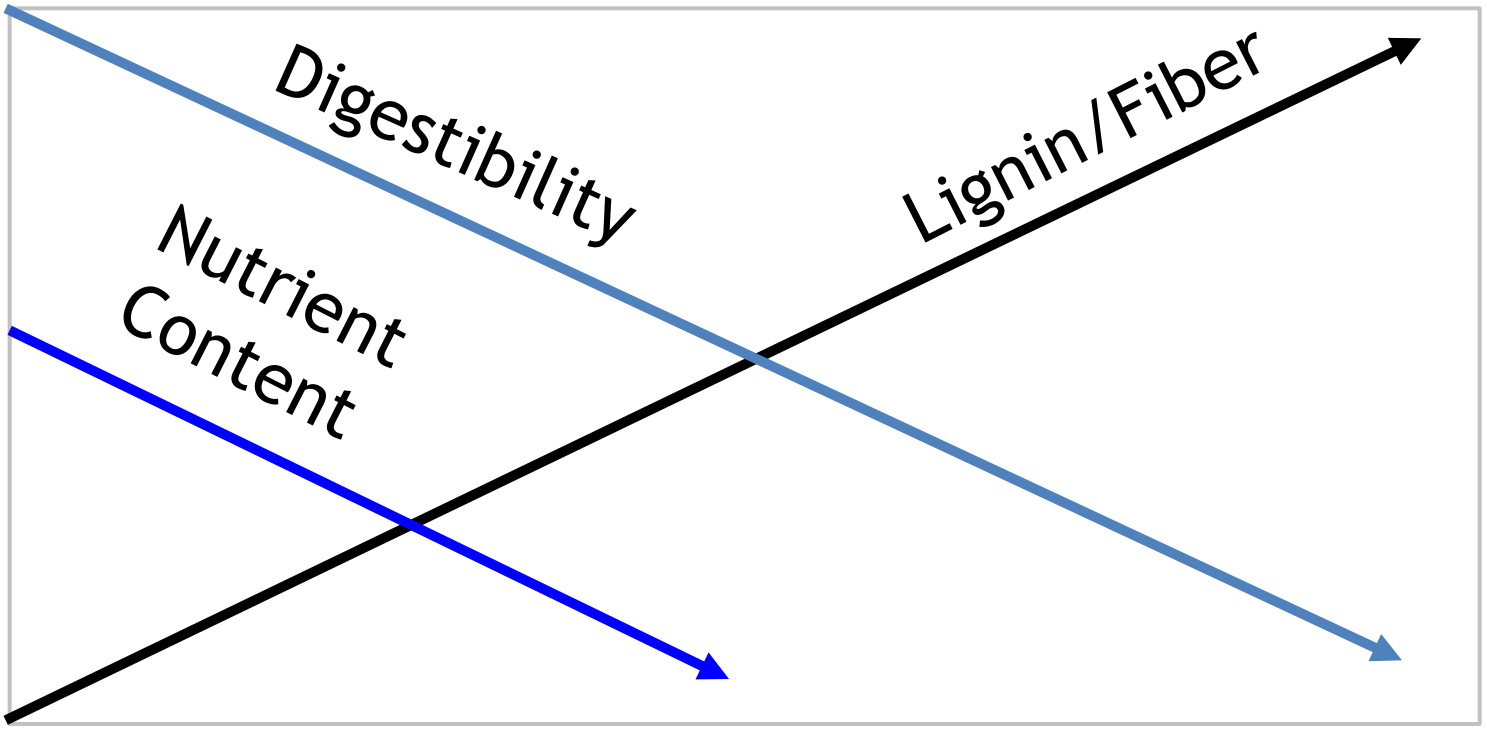
* Select # Feeds		* Feedstuff	* Lb/unit	$/unit	Units Inventory	* DM %	* TDN %	* NE m Mcal/lb	* NE g Mcal/lb	* CP %	* DIP % of CP	Solubility % of CP	* NDF %	ADF %	*e NDF % of NDF	NFC %	Salt %
		Water	8.3								100	100					
	1	DRY ROUGHAGE															
	2	Alfalfa- mid bl	2000	$100.00	1.00	88.00	58.00	0.56	0.31	17.00	80.00	25.00	46.00	37.00	82.00	22.00	
1	3	Alfalfa- late b	2000	$60.00	1.00	85.00	55.00	0.52	0.27	15.00	80.00	22.00	50.00	40.00	82.00	20.00	
	4	Alfalfa- mature	2000	$60.00	1.00	85.00	50.00	0.44	0.19	13.00	80.00	20.00	55.00	45.00	82.00	18.00	
	5	Alfalfa Meal	2000	$200.00	1.00	88.00	61.00	0.61	0.35	18.00	80.00	22.00	45.00	35.00	6.00	25.00	
	6	Bluegrass- mid	2000	$60.00	1.00	85.00	63.00	0.64	0.38	14.00	80.00	22.00	68.00	52.00	82.00	20.00	
	7	Bluestem past-	2000	$60.00	1.00	28.00	65.00	0.67	0.41	11.00							
	8	Bluestem-dorman	2000	$60.00	1.00	80.00	43.00	0.32	0.08	4.00							
	9	Brome-prebloom	2000	$60.00	1.00	88.00	58.00	0.58	0.32	16.00							
	10	Brome-midbloom	2000	$60.00	1.00	89.00	54.00	0.51	0.25	10.00							
2	11	Brome-Mature	2000	$60.00	1.00	90.00	50.00	0.44	0.19	5.00							
	12	Buffalo-vegetat	2000	$60.00	1.00	26.00	66.00	0.68	0.42	13.00							
	13	Buffalo-dormant	2000	$60.00	1.00	80.00	46.00	0.37	0.12	5.50							
	14	Clover -mid blo	2000	$60.00	1.00	89.00	55.00	0.52	0.26	15.00							
	15	Corn Cobs	2000	$60.00	1.00	85.00	50.00	0.44	0.19	3.20	70.00	15.00	88.00	65.00	56.00	10.00	
	16	Cottonseed hull	2000	$60.00	1.00	91.00	42.00	0.31	0.07	4.10							
	17	Fescue-winter,	2000	$60.00	1.00	35.00	54.00	0.51	0.25	11.00							
	18	Fescue-win.no N	2000	$60.00	1.00	86.96	52.20	0.47	0.22	10.20	80.00	20.00	69.10	47.10	75.00	19.00	
	19	Fecue-Late bloo	2000	$60.00	1.00	88.00	53.00	0.48	0.23	7.50							
	20	Ladino Clover	2000	$60.00	1.00	85.00	65.00	0.67	0.40	22.00	80.00	28.00	36.00	22.00	82.00	30.00	
	21	Koschia Hay	2000	$60.00	1.00	89.00	50.00	0.44	0.19	11.00							
	22	Oat Straw	2000	$50.00	1.00	88.00	50.00	0.44	0.19	4.40	70.00	5.00	70.00	60.00	82.00	8.00	
	23	Orchard Grass	2000	$60.00	1.00	85.00	65.00	0.67	0.40	8.40	80.00	15.00	65.00	45.00	82.00	15.00	
	24	PrairieHayEarly	2000	$60.00	1.00	90.00	55.00	0.52	0.26	9.00							
	25	PrairieHayLateB	2000	$60.00	1.00	90.00	51.00	0.45	0.20	5.80							
	26	Red Clover	2000	$60.00	1.00	85.00	55.00	0.52	0.27	16.00	80.00	25.00	46.00	34.00	82.00	28.00	
	27	Soybean Stover	2000	$50.00	1.00	85.00	40.00	0.27	0.04	12.00	70.00	15.00	75.00	60.00	82.00	15.00	
	28	Sudan Grass	2000	$60.00	1.00	85.00	56.00	0.53	0.28	8.80	80.00	18.00	68.00	55.00	82.00	18.00	
	29	Wheat Straw	2000	$60.00	1.00	100.00	41.00	0.64	0.11	3.50	31.00	20.00	78.90		98.00	100.00	
	30	Wheat straw-Amm	2000	$60.00	1.00	90.00	50.00	0.43	0.18	9.00							
	31	*(your own)*															

What do the Results of a Forage Test Mean?

Effective Supplementation Programs

- Must have an estimate of:
  - Feed value of basal forage
  - Quantity of forage an animal can consume
  - Nutritional needs of the animal

Growth vs. Quality



Nutrient Availability of Forage Components

Forage Fraction	Component	Nutrient Availability
Cell Contents	Soluble sugars	Complete
	Pectin	Complete
	Soluble Protein	High
	Lipids	High
Cell Wall Elements	Hemicellulose	Partial
	Cellulose	Partial
	Lignin	Indigestible
	Silica	Indigestible

(Van Soest, 1983)

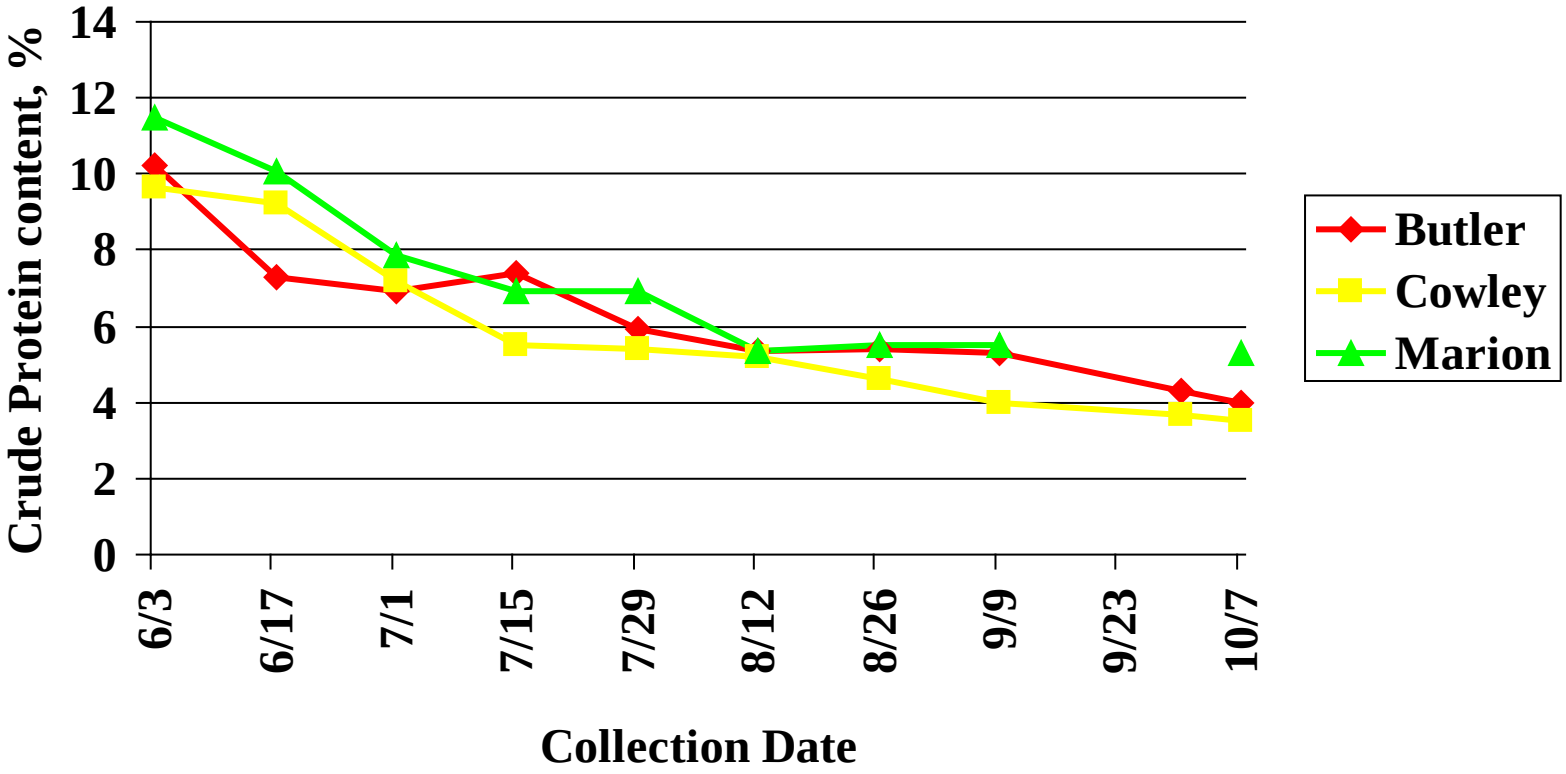
Forage Dry Matter Intake

- Function of:
  - Fermentation rate
  - Rate of particle size reduction
  - Rate of particle passage rate

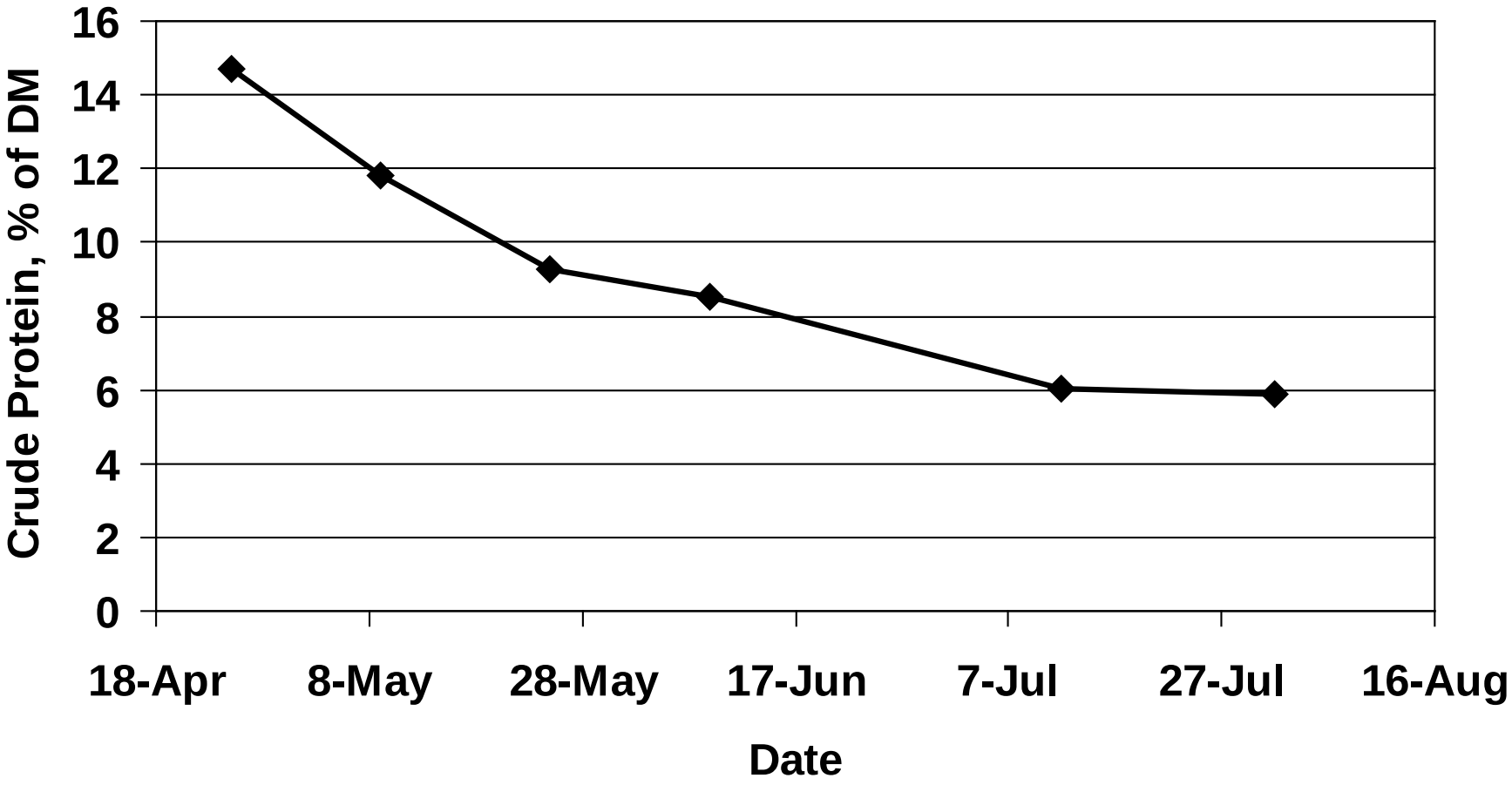
Forage Quality and Cattle Intake

Forage Quality	Dry Matter Intake (% of body weight)
High	2.5 to 3.0%
Medium	2.0%
Poor	1.0 to 1.5%

% Crude Protein Content of Native Grass Hay by Harvest Date, 1997

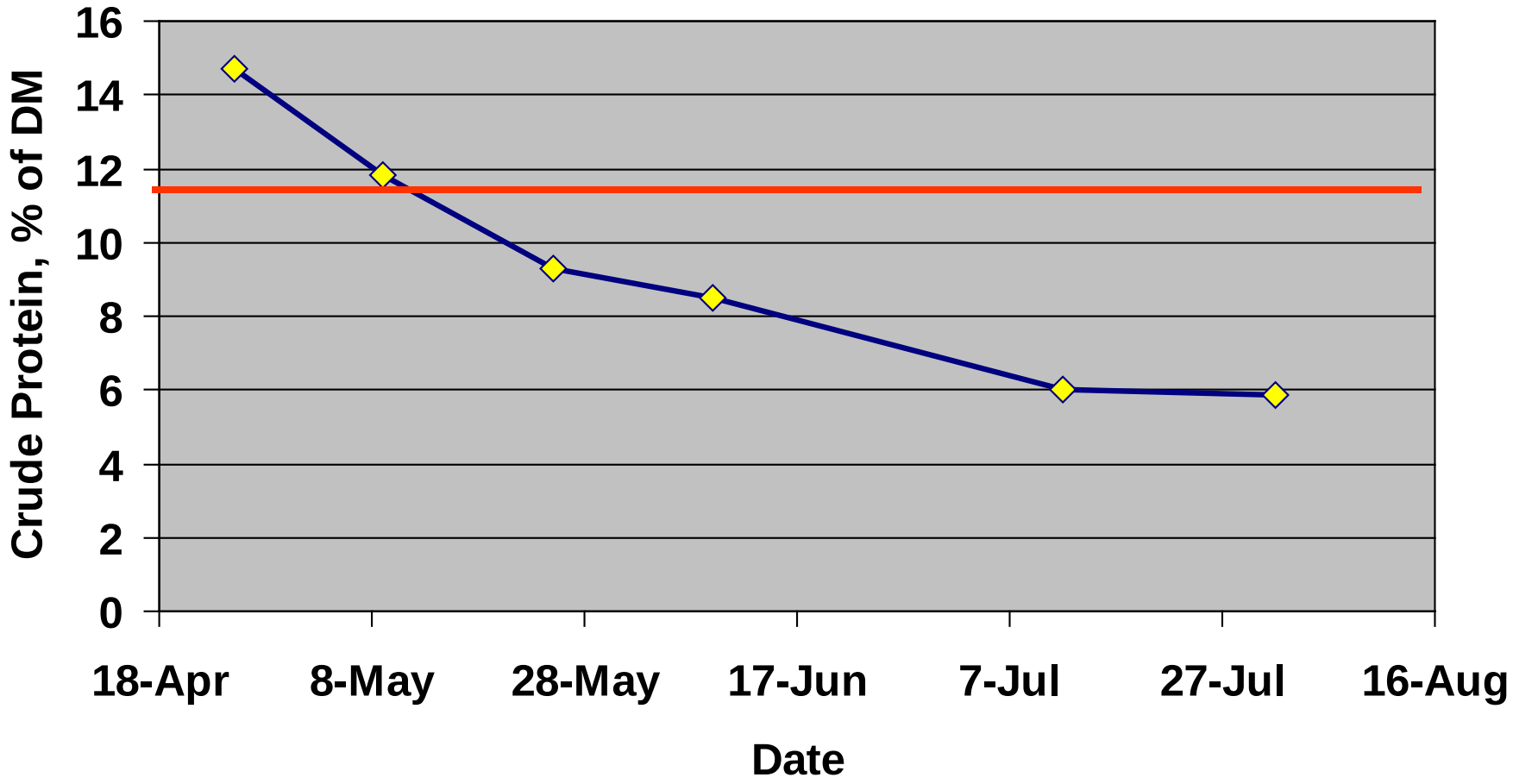


Crude Protein of Native Range



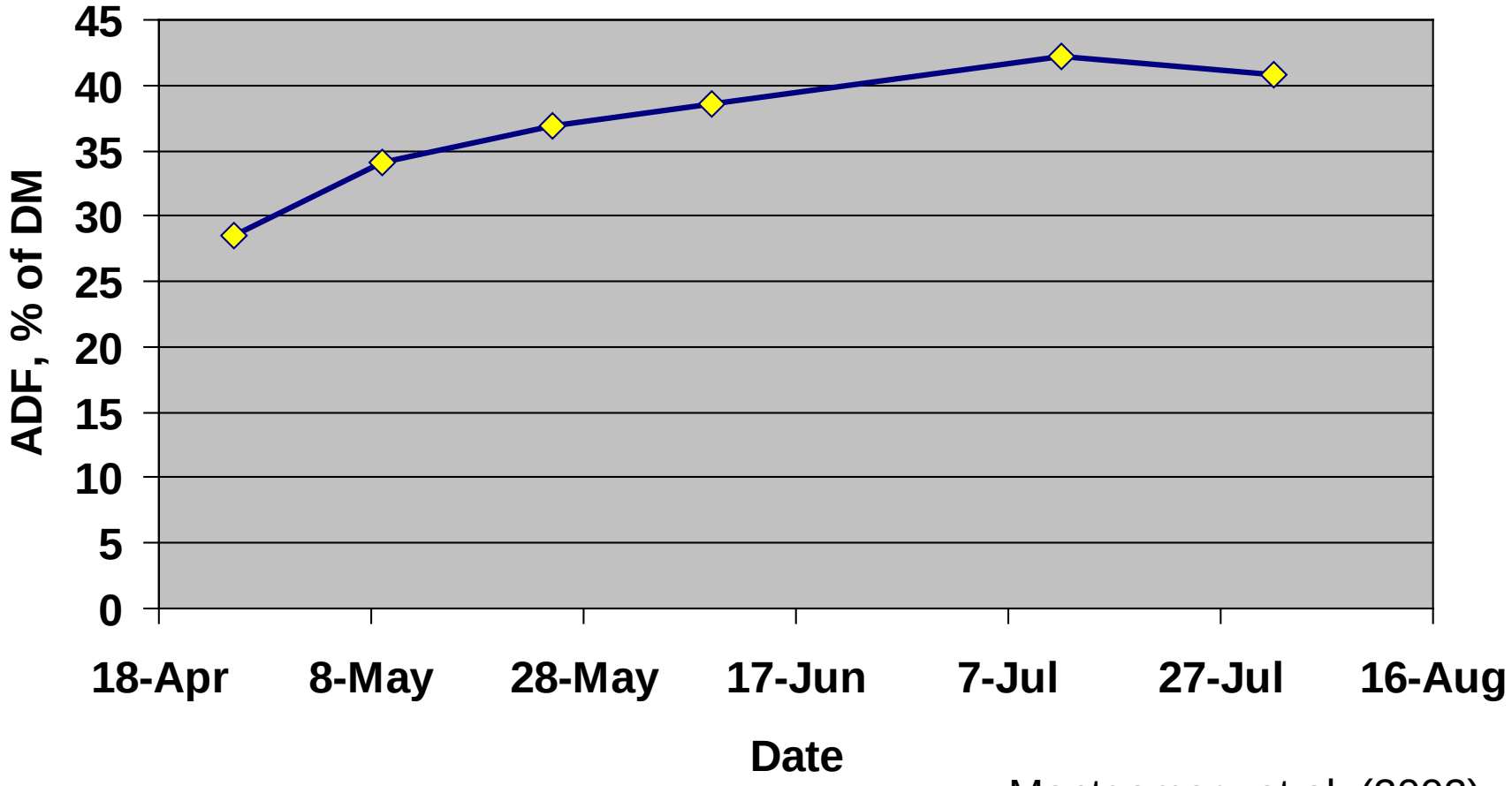
Montgomery et al. (2002)

Minimum Crude Protein to Support a 2.0 lb ADG



Montgomery et al. (2002)

% ADF of Native Range



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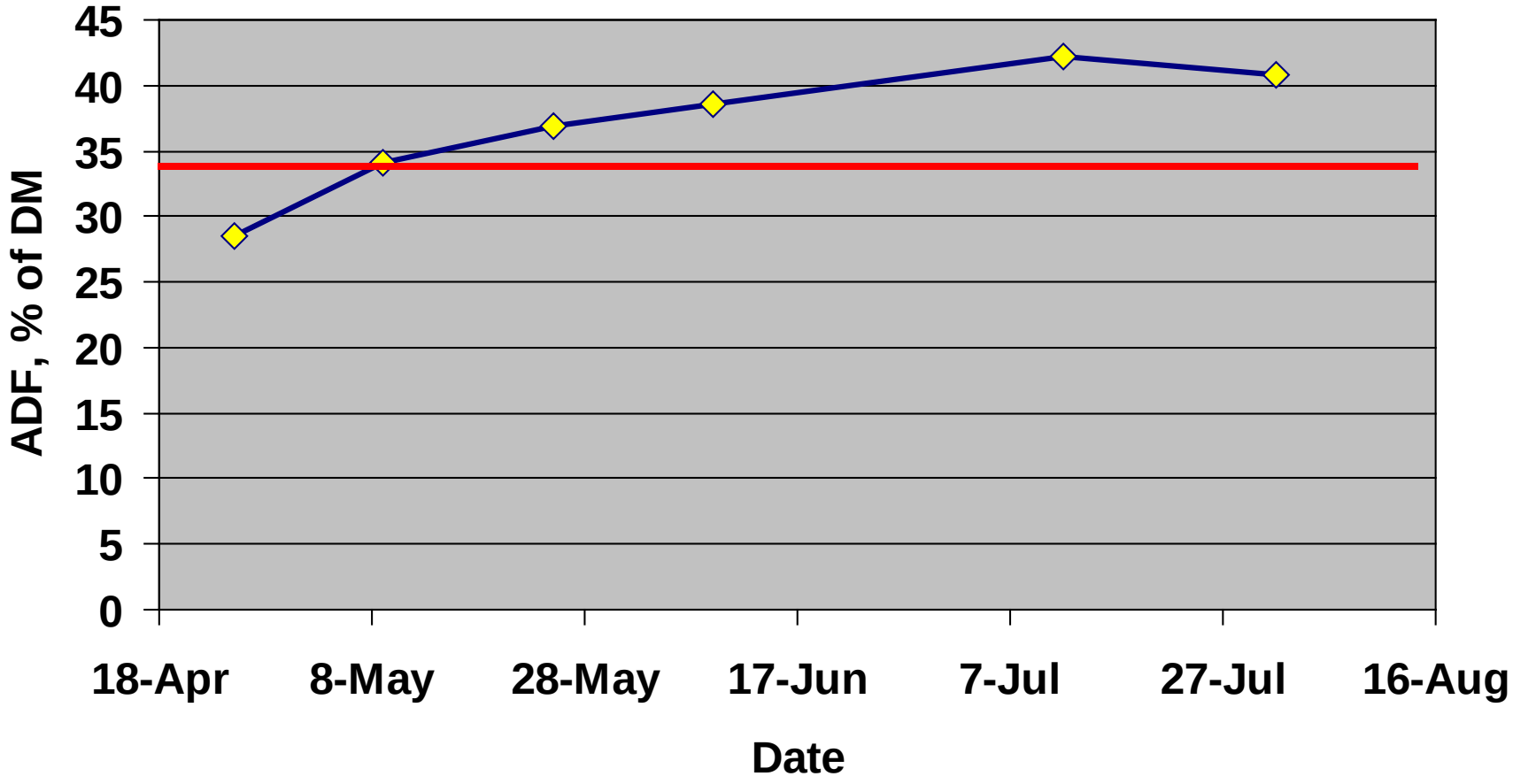
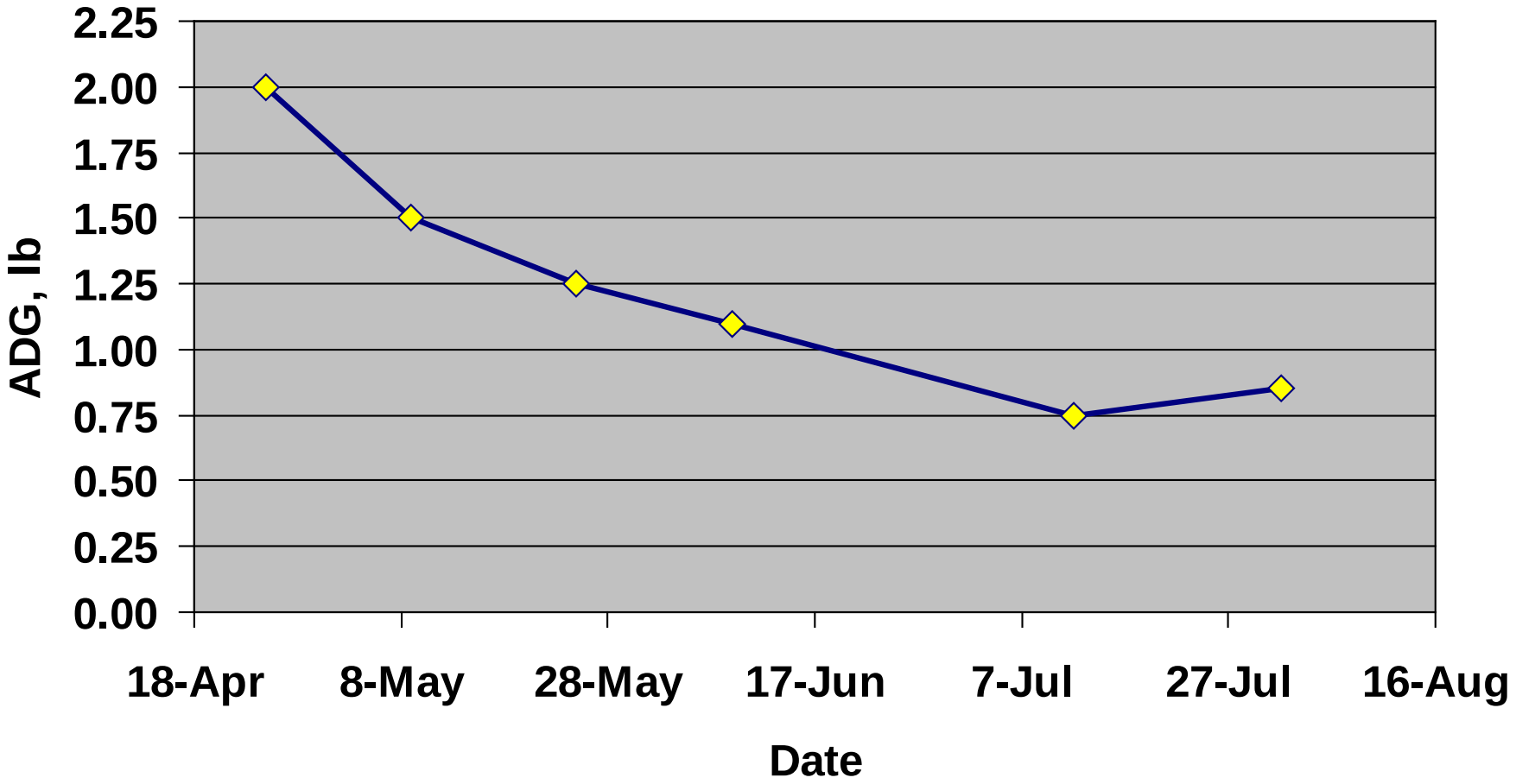


Montgomery et al. (2002)

Predicted ADG based on ADF



Montgomery et al. (2002)

METHODS TO ESTIMATE GRAZING ANIMAL DIET SELECTION

METHODS OF DETERMINING FORAGE

- HAND CLIPPING
  - Does not account for animal selectivity
  - Generally 2% higher CP, 3-5% higher digestibility
  - Forage availability also a factor
- CANNULATED ANIMALS
  - Esophageal / Ruminal
  - High maintenance/labor required

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- FECAL ANALYSIS

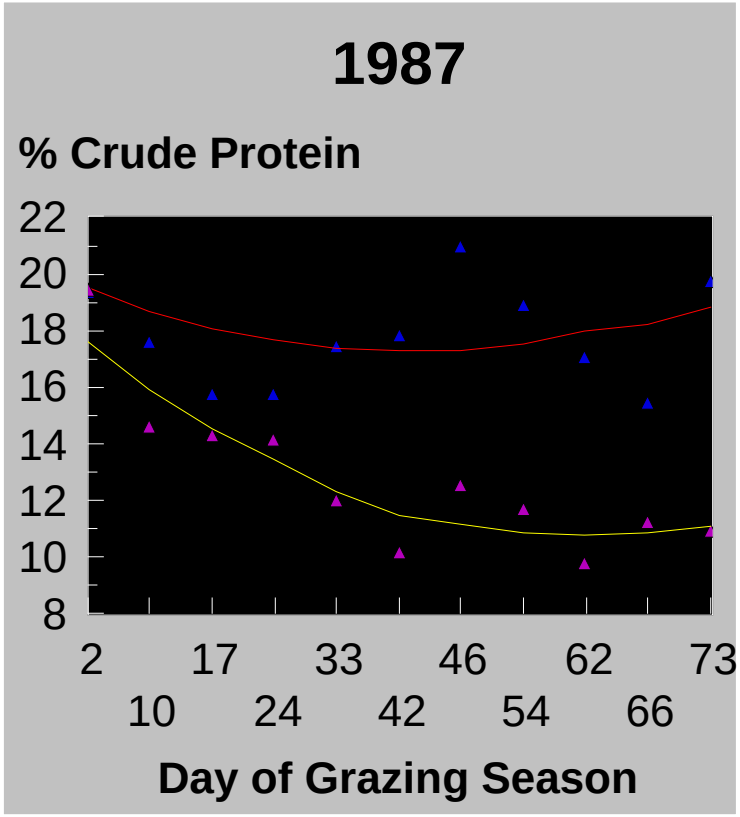
The Extent of Forage Selectivity of an Animal can vary by:

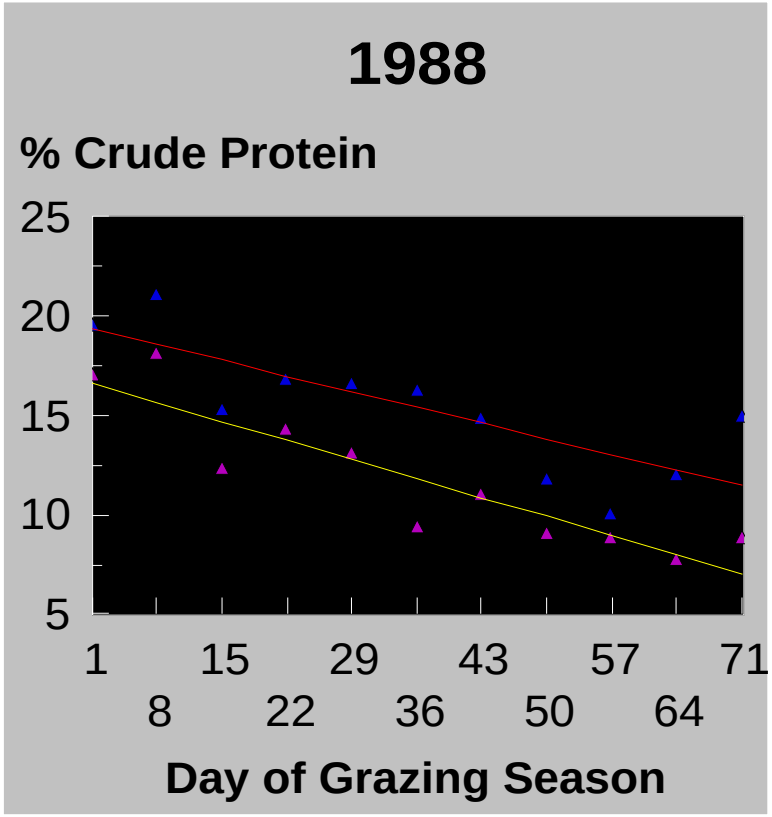
- Species of animal
- Available plants
- Stage of maturity
- Intensity of grazing
- Weather conditions

How Livestock Graze

- Consume the most palatable plant first
- Consume the most palatable plant part first
- Consume disproportionately more tall than short
- Graze convenient areas

Esophageal vs. hand-clipped samples of Smooth Bromegrass across season

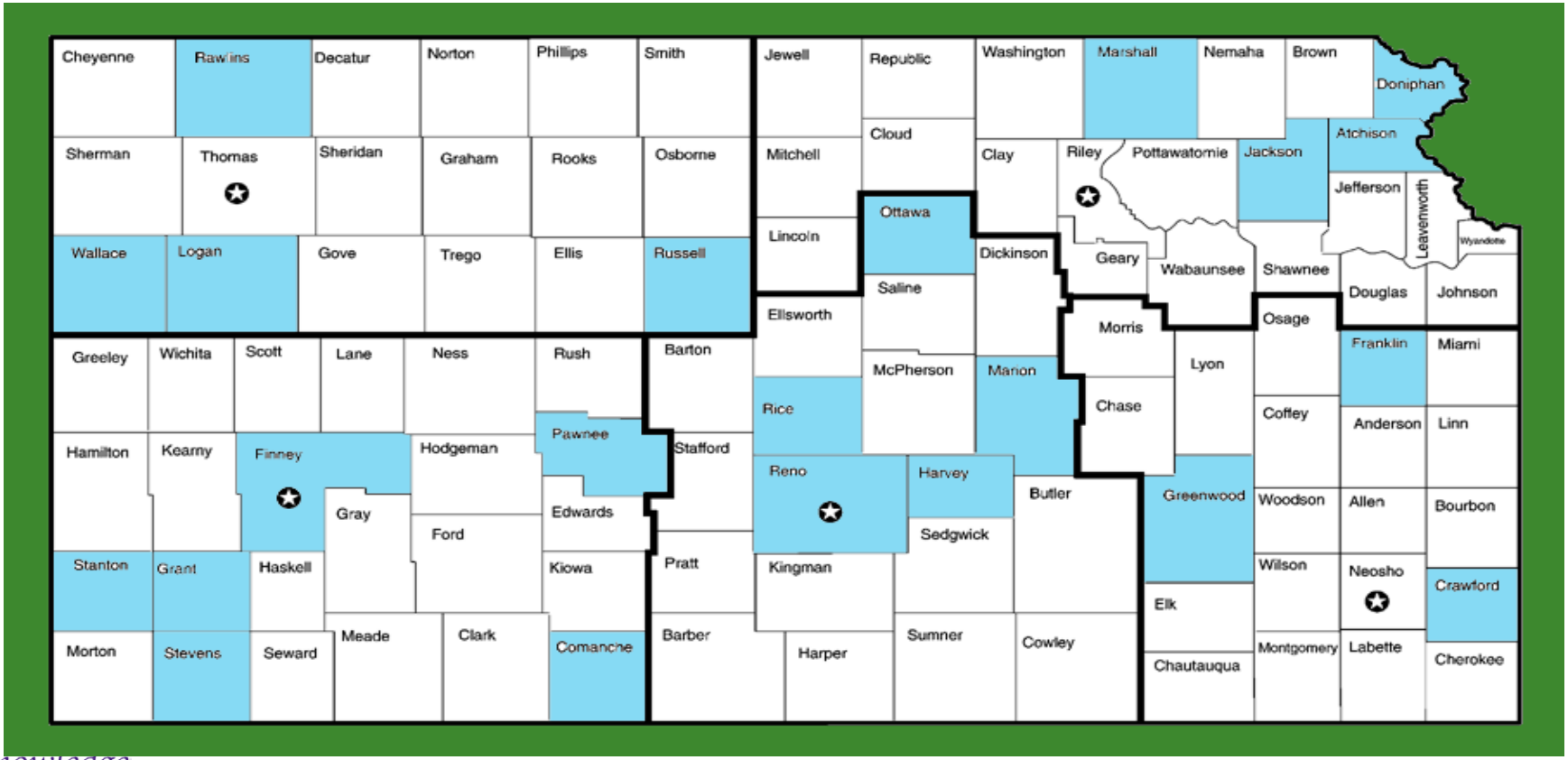




K-STATE Research and Extension

KSU Forage Task Force
Crop Residue Project

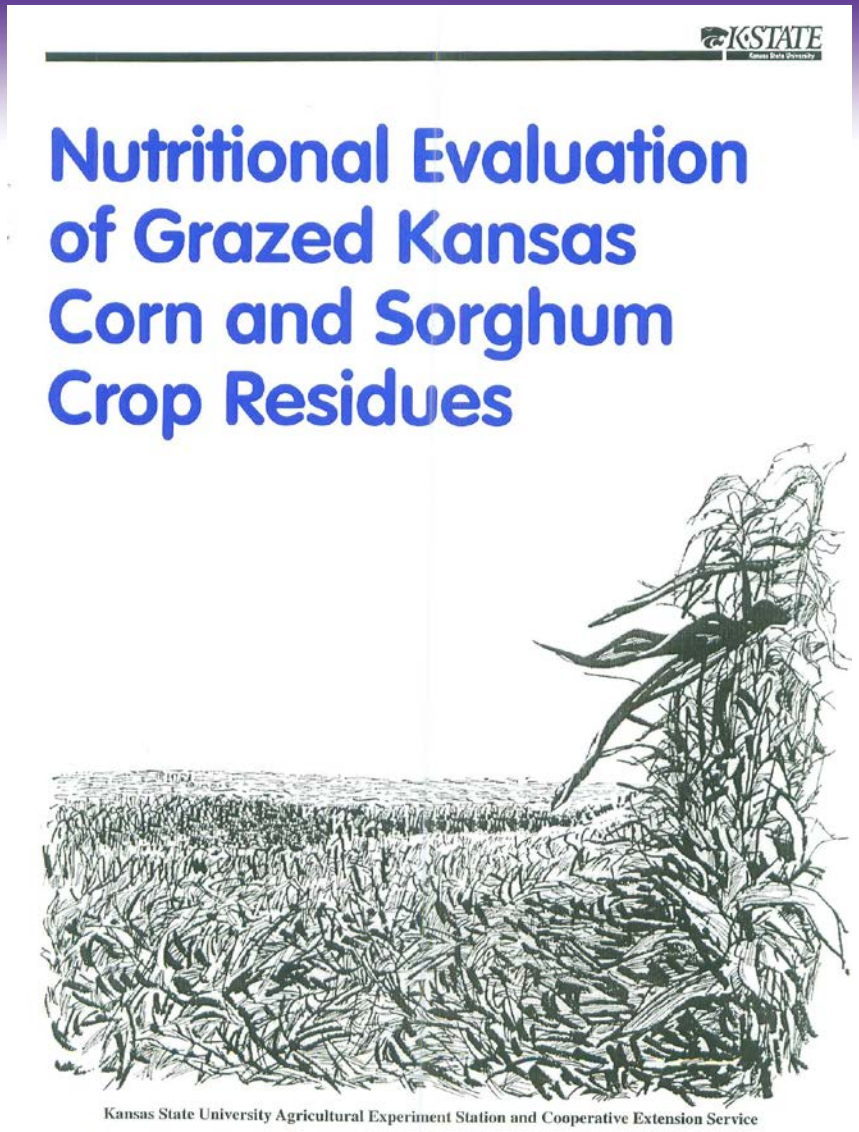
Counties that have participated in Crop Residue Study



Knowledge for Life

KSU Crop Residue Project Sampling Protocol

- Sample fields every two weeks during the grazing season
- At each sampling period, four replicates were collected from the grazed and ungrazed area.
- Each replicate shall consist of a 12 foot row



www.ksubeef.org

Summary Points

- The bigger the lot sampled, more samples will need to be collected.
- Collect many samples, mix well and subsample an aliquot .
- Choose sample sites carefully when sampling a silo, field or pasture.
- Sample silage as opposed to fresh.
- Send to lab as quickly as possible.

Wrap Up Comments

- The results returned to you from a forage testing laboratory are the best information available to predict animal performance.
- A good sample is one that represents the entire lot of feed that was sampled.

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