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# Why should I sample feed/forage? How do I use the results?

2018 Kansas Forage and Grassland Conference

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## Why Test Forages?

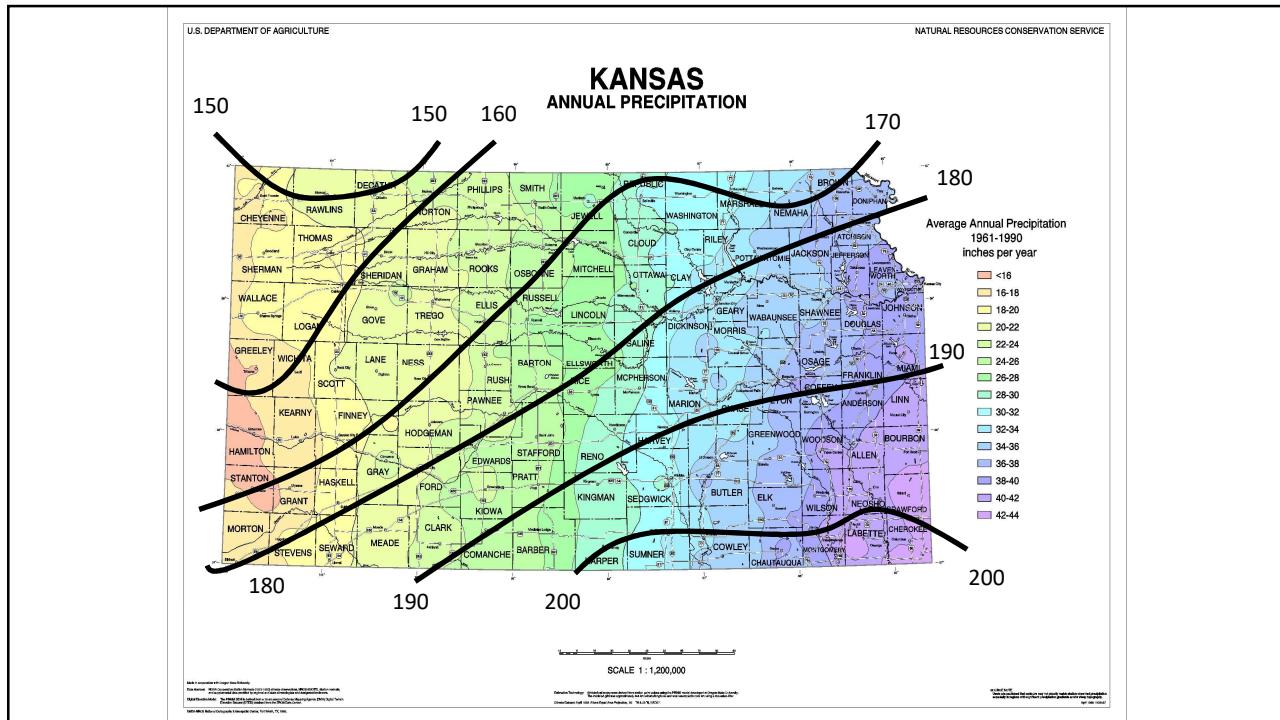
- Feed tests can help establish the dollar value of a forage
- Feed tests can establish the feeding value of your forages and help determine what feeds to feed or sell OR supplements to buy
- Feed tests are useful in evaluating production practices
  - Fertilization
  - Time of harvest
  - Method of harvest

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## Forage plants are the product of their environment

- Soil
- Weather – growing conditions
- Animals
- Disease

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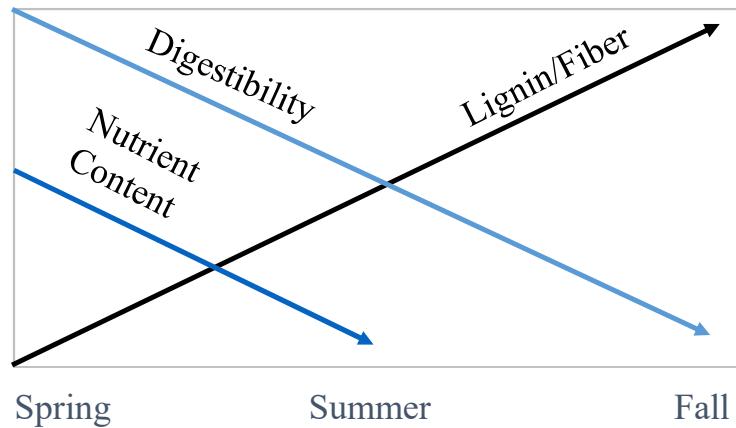
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## Forage Quality/Utilization

- Pre-harvest
  - Stage of maturity
- Harvest
  - Height of cut
  - Baling moisture
- Post-harvest
  - Storage
  - Method of feeding

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# Growth vs. Quality



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Factors that accelerate the maturation process

- Temperature
- Light
- Water

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## Influence of Water

- A water deficiency minimizes the development of the plant, thereby retarding maturity.
  - Therefore:
- This equals increased digestibility while DM yields are reduced.

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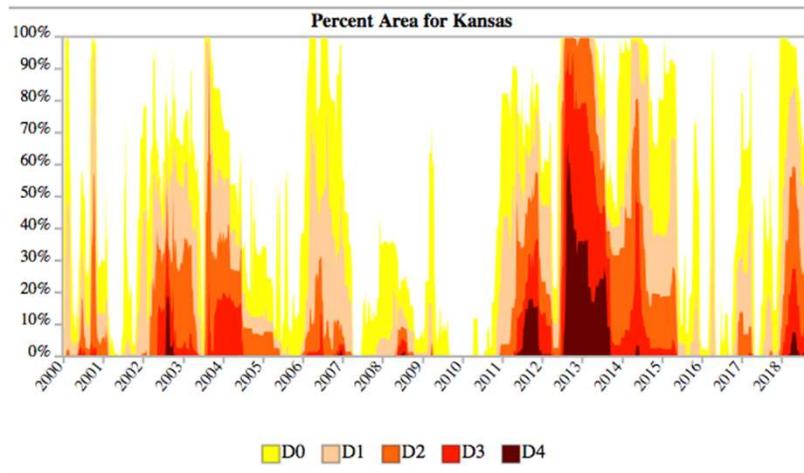
## Kansas Drought\*

- 1 out of 5 years in eastern Kansas
- 1 out of 3 years in western Kansas

\* Years with less than two-thirds average annual precipitation

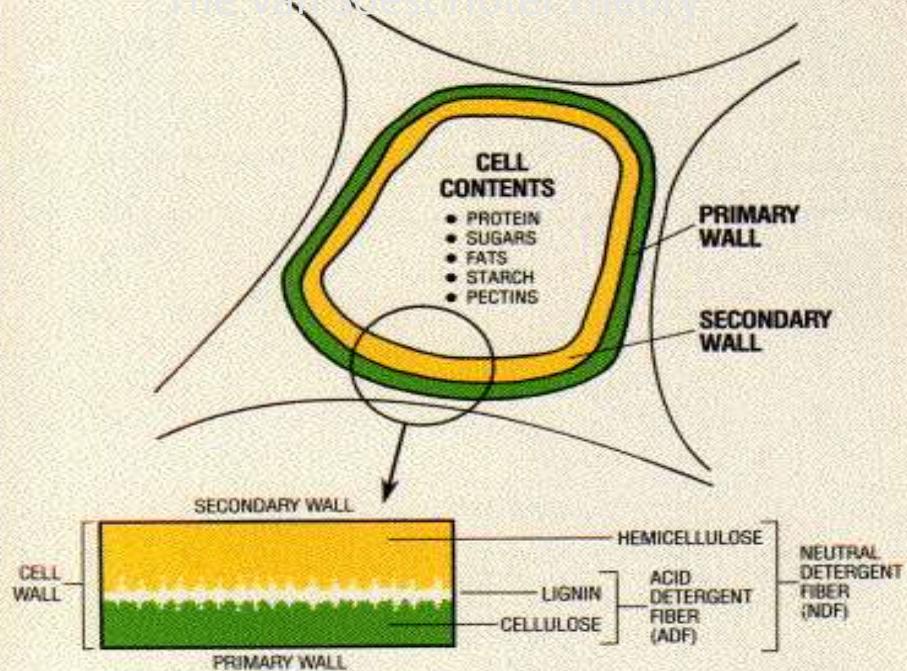
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## Drought in Kansas



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## The Vassiljev Model Theory



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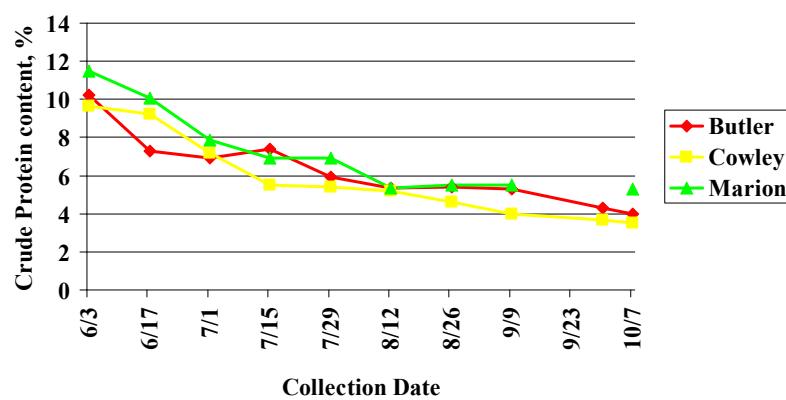
### Influence of Environmental Factors Upon Composition and Digestibility of Forages<sup>a</sup>

Item	Temp.	Light	Nitrogen	Water	Predation
Yield	+	+	+	+	-
Nitrate	-	-	+	+	+
Cell Wall	+	-	±	+	-
Lignin	+	-	+	+	-
Digestibility	-	+	±	-	+

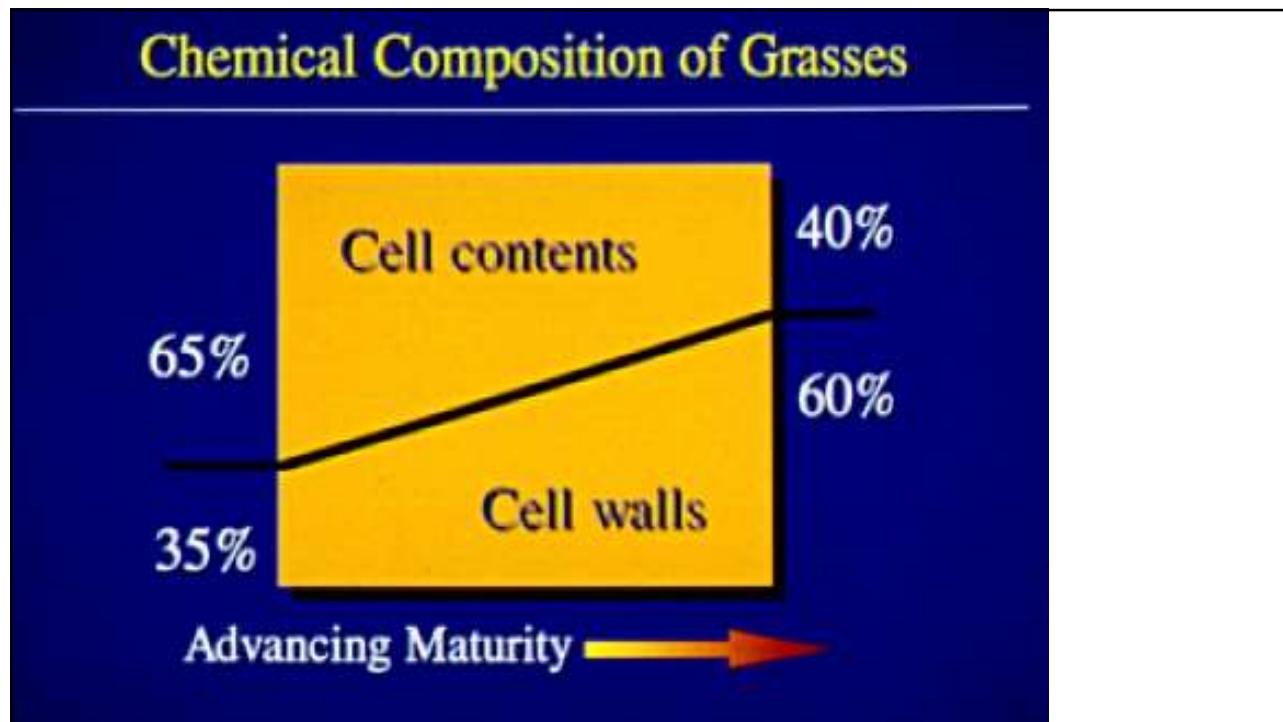
<sup>a</sup> Van Soest et al., 1978.

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



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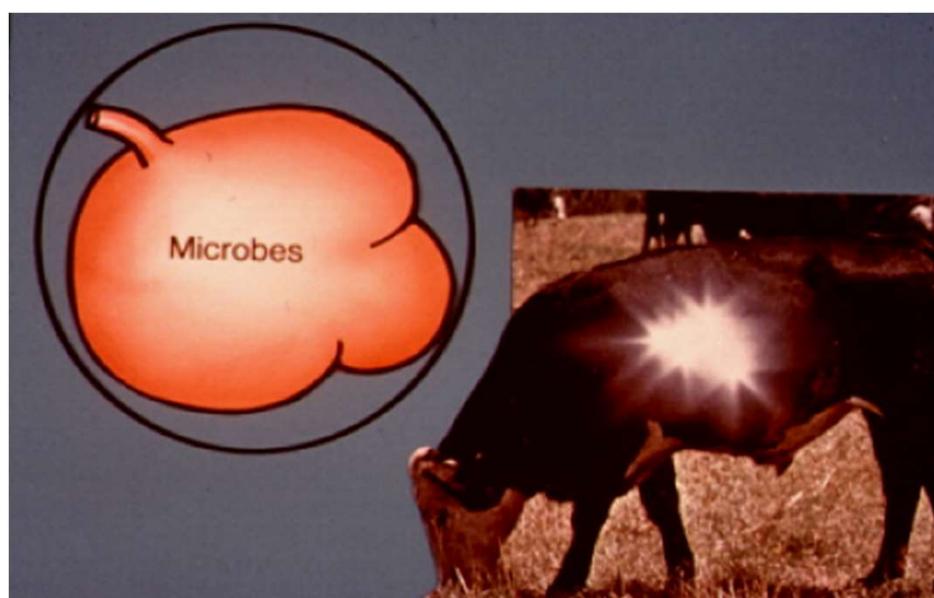
### Nutrient Availability of Forage Components (Van Soest, 1983)

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

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## Forage Dry Matter Intake

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

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Forage Intake of Beef Cows as Affected by Stage of Production, Forage Quality and Supplement Type<sup>a</sup>

Stage of production & supplementation strategy	Forage Quality		
	Low	Medium	High
<i>Dry, pregnant cow</i>		<i>Intake expressed on % body wt, dry matter basis</i>	
Unsupplemented	1.5	2.0	2.5
Protein supplementation	1.8	2.2	2.5
Energy supplementation	1.5	2.0	2.5
<i>Lactating cow</i>			
Unsupplemented	2.0	2.3	2.7
Protein supplementation	2.2	2.5	2.7
Energy supplementation	2.0	2.3	2.7

<sup>a</sup>Adapted from Hibberd and Thrift, 1992

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## Harvest Losses

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- Respiration losses
- Mechanical losses
- Heat damage

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## Weathering Damage of Large Round Bales

- Most damage occurs in the outer 12 inches of the bale
  - 50% of the hay in a bale with a radius of 30 inches is in the outer 9 inches of the bale
  - Proper core-sampling procedures must be adjusted to consider this change



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## Hay Composition in Different Depths of Unprotected Large Round Bales

<u>Sampling interval, in</u>	<u>% of DM</u>	DM, %	IVDDM	NDF	ADF
0-3		56.4	43.0	59.5	46.7
3-6		75.5	50.2	58.1	45.1
6-9		81.0	52.1	58.0	45.2
9-12		82.4	53.0	56.2	43.3
12-30		83.9	55.0	53.5	41.5

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## Developing a Sampling Protocol

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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

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What is a forage lot ?

- A forage lot consists of forage harvested from one field:
  - at the same cutting and maturity within a 48-hour period
  - Usually contains fewer than 100 tons of hay.
- A forage lot should be similar for forage type, field (soil type), cutting date, maturity, variety, weed infestation, type of harvest equipment, weather during growth and harvest and storage conditions.

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## Select Uniform Lots of Hay

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

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## 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
- This will greatly facilitate access so that it may be retrieved as needed
- This is especially important step in a hay marketing operation.

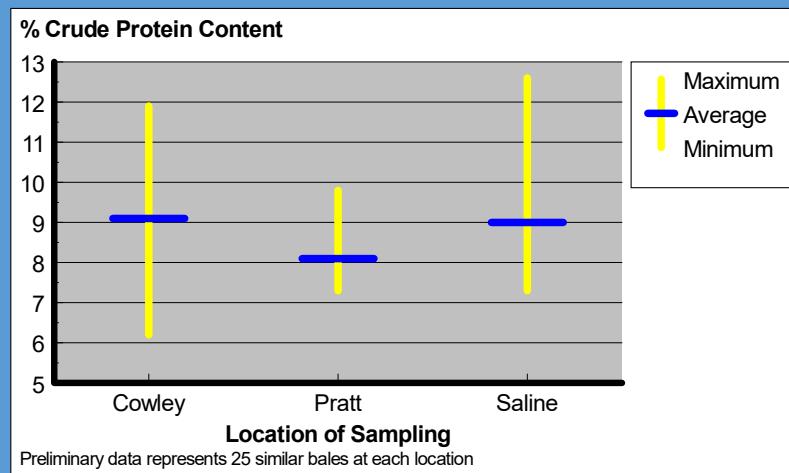
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## Where Does Variation Arise?

- Field Variation
  - Weed infestation
  - Soil and fertility differences
- Harvest Variation
  - Equipment/conditioner differences
  - Management philosophy
- Sampling Error
  - Location of bale
  - Location/depth of core sample

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## Variation in Crude Protein Content of Cane Hay - Preliminary Results



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## Nitrate Variation in Sudan Hay Bales From the Same Field – C. Garten 1989

- Nitrate content of 23 bales collected from the same field averaged 2,764 ppm but varied from 1,525 to 6,250 ppm on an as-fed basis
- Thus, the nitrate level in individual bales varied more than TWO – FOLD from the average.

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### Recommended Number of Large Round Bales to Sub-sample and Composite

Forage Type	Precision of average CP Estimate, %	Confidence Interval		
		99%	95%	80%
1 <sup>st</sup> alfalfa	±1	19	11	5
	±5	76	44	19
3 <sup>rd</sup> alfalfa	±1	12	7	3
	±5	47	27	12
Prairie hay	±1	4	2	1
	±5	15	9	4
Sudan hay	±1	7	4	2
	±5	28	16	7

Blasi, et al., 1995

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Bales should be probed from the sides,  
not the ends

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Do Not Submit a flake of hay or use the “grab” sample technique

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## When Do You Sample?

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

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## Sampling Silage

- Sampling silage at harvest will give one an idea about the feeding value prior to feeding.
- Because of fermentation changes, another sample should be tested when feeding begins.
- Multiple samples should be collected, combined and then sub-sampled from the total before submitting to a laboratory.

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## Collecting a feed sample

- The entire sample should be placed in a plastic bag and sealed to retain the moisture level at the time of sampling.
- The sample(s) should be labeled properly.
- The sample(s) should then be stored in a cool place until it is shipped to the laboratory.
- Send the sample(s) to the laboratory A.S.A.P. via UPS or USPS.

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## Methods of Feed/Forage Testing

- **Physical** – Sight, smell and touch are useful, although frequently misleading indicators of feed value.
- **Chemical** – When representative feed samples are tested chemically, accurate predictions of animal performance usually can be made.
- **NIR Spectroscopy** – Rapid, low-cost computerized method with questionable reliability

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## Net Energy of Native Range Calculated from ADF

- $\%TDN = 88.9 - (0.779 \times ADF)$
- $ME \text{ (Mcal/kg)} = (TDN\% \times 0.044) \times 0.82$
- $NE_m \text{ (Mcal/lb)} = (1.37 \times ME) - (.138 \times ME^2) + (.0105 \times ME^3) - 1.12 / 2.204$
- $NE_g \text{ (Mcal/lb)} = (1.42 \times ME) - (.174 \times ME^2) + (.0122 \times ME^3) - 1.65 / 2.204$

NRC (1996)

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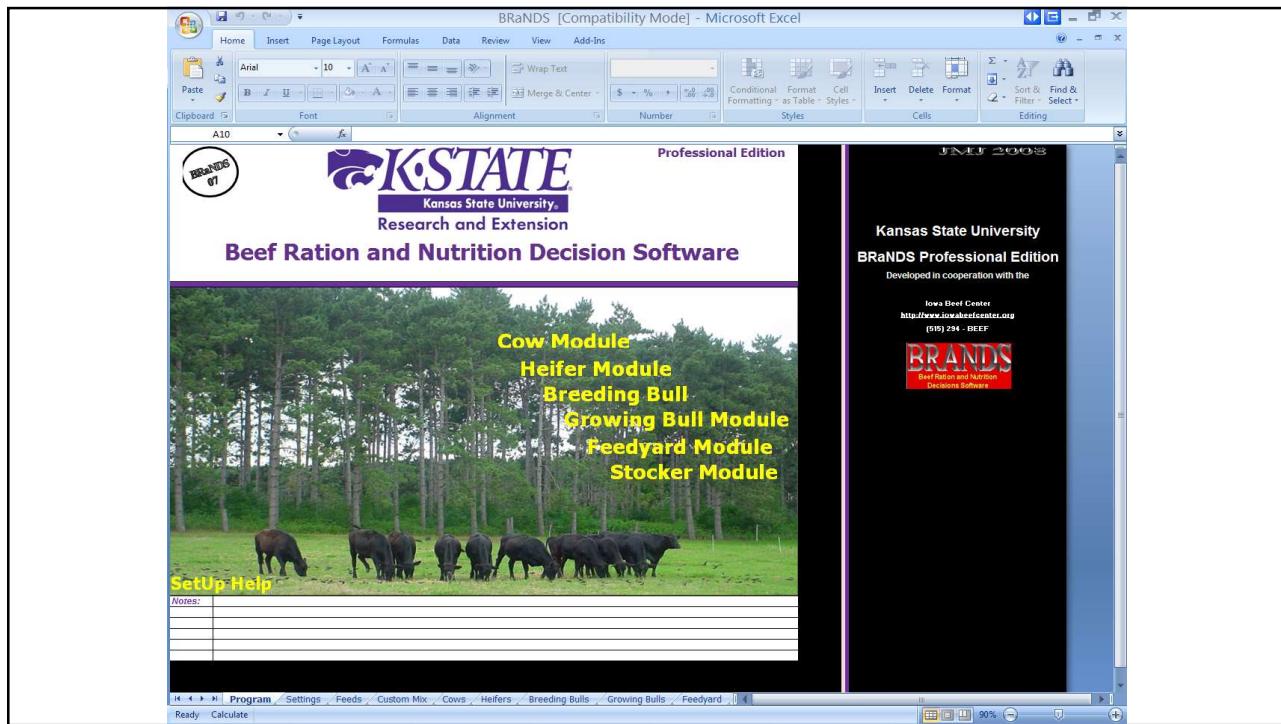
## Relative Feed Value (RFV)

- RFV has no units but is used only as an index to compare the potential of two or more like forages for energy intake
- Forages with NDF = 53% and ADF = 41% represent a RFV of 100.

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## How Do I Use the Results?

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BRaNDS [Compatibility Mode] - Microsoft Excel																		
Feed Library		Producer: KSU Winter Ranch Mgt Seminar																
		Help More Tips																
* Select #	Feeds	* Feedstuff	Lb/unit	\$/unit	Units	Inventory	* DM %	* TDN %	* NEg Mcal/lb	* CP %	* DIP %	Solubility %	* NDF %	ADF %	* % NDF	NFC %	Salt %	
		Water	8.3												100	100		
		1 DRY ROUGHAGE																
1		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		
		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	90.00	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- pre bloom	2000	\$60.00	1.00	88.00	58.00	0.58	0.32	16.00								
		10 Brome- mid bloom	2000	\$60.00	1.00	90.00	54.00	0.51	0.25	10.00								
2		11 Brome- Maturity	2000	\$60.00	1.00	90.00	50.00	0.49	0.19	5.00								
		12 Buffalo- vegetat	2000	\$60.00	1.00	26.00	66.00	0.68	0.42	10.00								
		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 Fescue-Late blo	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	55.00	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	50.00	0.51	0.27	10.00	80.00	25.00	46.00	34.00	82.00	28.00		
		27 Soybean Stover	2000	\$50.00	1.00	83.00	49.00	0.27	0.04	12.00	70.00	15.00	75.00	60.00	82.00	15.00		
		28 Sunflower Seeds	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	98.00	100.00		
		30 Wheat straw-Amn	2000	\$60.00	1.00	90.00	50.00	0.43	0.18	9.00								
		(your own)																

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BRaNDS [Compatibility Mode] - Microsoft Excel

**Inputs**

File Utilities

Save | Restore | Delete

Feeding period - start: 1/15/11 | Feeding period - end: 2/15/11 | Mature cow size: large | Breed type: British, higher milk | Current condition score: 5 | Desired condition change: +1/4 CS/mol | Production stage: 3rd trimester | Notes for Summary Printout:   
head | Wt. overrite: 1400 lbs

Calf birth weight: moderate | Wind exposure: full | Hair condition: clean, dry | Hair coat: heavy, winter | Temperature: 10 o colder | 20 degrees F | Maintenance adj.:   
Cow group size: 1st calf: | 2nd calf: | Mature: |   
1st calf: | 2nd calf: | Mature: |   
head | Wt. overrite: 1400 lbs

**Ration Balancing Screen**

Tips: Producer: KSI Winter Ranch Mtg Seminar Feed Library: feedmill

**Ration Composition**

Formulate | Save | eDMI Level: 35.0% | Consumption Ratio: 100.0% | Balanced for (head): 1

	lbs./day	% waste	TMR mix	% of DM	% of As-Fed
Alfalfa- late b	8.00	5.0	x	19.14%	17.32%
Brome-Mature	32.00	x	75.60%	76.97%	
Native-Winter	2.50	5.0	x	5.26%	5.71%
DDGw/S					
36 natural					

**Ration Evaluation**

Scale intake? yes | Feed delivered corresponds with mature cow.

Balance	Mature cow
Dry matter intake	33.9 lbs.
Estimated DMI	34.4 lbs.
Consumption	98%
Net energy rgntr.	150%
Met. protein rgntr.	94%

Water: 13.5 gallons/ hd. 81.4% Ration DM | Crude Protein: 41.8 % ByPass 33.7 % Soluble

Program | Settings | Feeds | Custom Mix | Cows | Heifers | Breeding Bulls | Growing Bulls | Feedyard | Print | Ready

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BRaNDS [Compatibility Mode] - Microsoft Excel

D41

status: low | low | low | low | low | warning | low | ok | low | low | ok | 107.87

Conc.: 0.06% | 0.63% | 0.10% | 26.05 | 0.17 | 107.87

**Batch Mix Sheet**

Select either batch size or number of head.  Mix-based on number of head

Number of head: 0 head | Mixes per day: | Increment: 1 head

Mix-based on batch size

Batch size lbs: | Increment: 1.00% | 0 head | lbs. / day

**Formulation Printouts**

Select button to print the desired report.

- Ration Summary
- Mineral & Vitamin Report
- Nutrient Graph
- Ration Adequacy
- Ration Adequacy Graph
- Blend Mix Sheet
- Feed Analysis

**Ration Plan Sheet**

Indicate up to 3 different rations to feed and print report.

Ration #1: Head on Feed: | Date starting: | Date ending: | Notes: |   
Ration #2: Head on Feed: | Date starting: | Date ending: | Notes: |   
Ration #3: Head on Feed: | Date starting: | Date ending: | Notes: |

**Feed Requirement for Period**

The daily use values listed below are based on the number and maturity of animals listed above in the input section.

46 Day(s)	2/15/11	through	4/3/11	Head	2	= % Storage shrink	Print
Daily Requirement				Period - Total Feed	Period - Bulk Feed		

Program | Settings | Feeds | Custom Mix | Cows | Heifers | Breeding Bulls | Growing Bulls | Feedyard | Print | Ready

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BRaNDS [Compatibility Mode] - Microsoft Excel

Print Preview

Print Page Setup Zoom Next Page Previous Page Show Margins Close Print Preview

Print Zoom Preview

1/10/2011

**KSSTATE**  
KSU Winter Ranch Mgt Seminar Cow Ration Summary

**Inputs**

		Ration \$ / ton
Feeding period-	2/15/11 - 4/1/11	333.33
Mature cow size	1400 lbs	Calf birth wt. moderate
Breed type	British_higher_milk	Wind exposure full
Current condition score	5	Hair condition clean_dry
Desired condition change	+2/4 QSR/mo	Hair coat heavy_winter
Production stage	Early_lactation	Temperature 10 o colder
		Mgmt. Adjustment

**Daily**

Feed	Feed % of	Head count per group	Ration Statistics	
Ration Summary lbs./hd.	DME			mature
Alfalfa- late b	10.00	20.8%	Dry matter intake (lb/hd/d)	38.8
Brome-Mature			Estimated DMI	38.3
Native-Winter	34.00	75.0%	Consumption	10.1%
DDG/BS			Net energy rntn.	133%
36 natural	5.00	9.2%	Netrb. protein rntn.	93%

**Projected performance**

	Daily int gain above pregancy
DME : WT (%)	2.77
BC : Condition change (pts)	0.08
Desired ADG (lbs)	0.77
Ration projected ADG (lbs)	0.25
Excess protein+NEadj.(Mc/d)	
Feed \$/hd/day	\$1.36
Feed cost/group/day	

**Feed Delivered**

	Crude Protein	10.4%	Selb. %	0.29%	
Feed Delivered	49.0 lbs.				
Feed Consumed	48.3 lbs.	CP Degradability	22.7%	Ca:lime	
Ration Dry Matter	80.5 %	D:P Ratio	1:41	Phosph.	0.26% 0.29%
TON	54.4 %	CP Solubility	33.3%	Magnes.	0.06% 0.22%
NE-m / g	0.89	NFC	35.7%	Potass.	0.63% 0.75%
Fat	2.62 %	eNDF	27.8%	Sulfur	0.10% 0.14%
<b>Notes</b>		ADF NDF	9.1%	VITA-4EU	1011.8 68.7

Iowa Beef Center — Cow Module Kansas State University Research and Extension

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## Livestock Feeding Programs

- Can be improved by relying on forage analyses to plan and balance rations.
- However, lab analyses are only useful if the sample represents what your animal consumes.

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