Shelby J. Filley
Regional Livestock & Forage Specialist

Proper nutrition at a lower cost
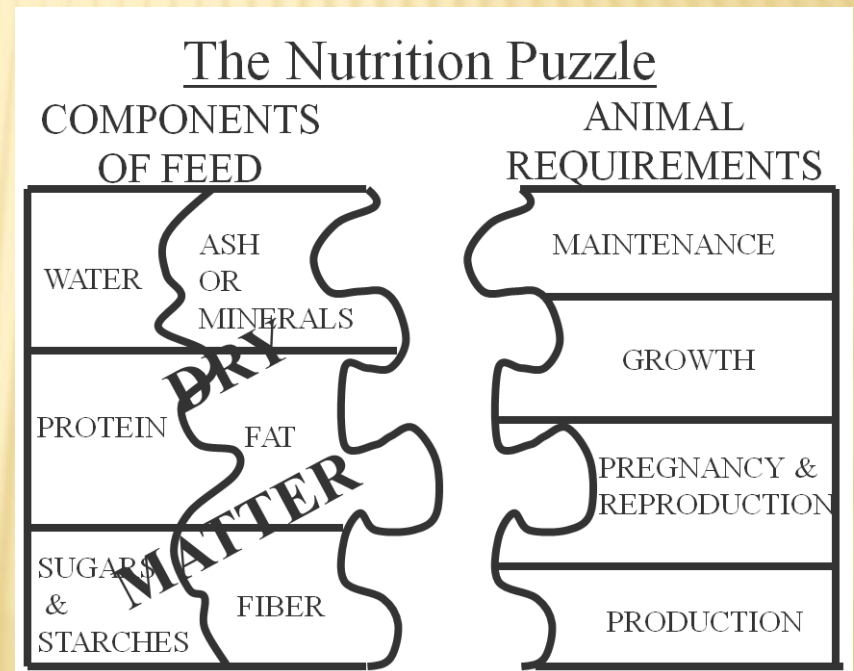
USING A TEST HAY FOR FEEDING LIVESTOCK

OBJECTIVES

- ✖ Understanding a Hay Analysis Report

- ✖ Matching Nutrient Supply & Demand

The Nutrition Puzzle

COMPONENTS OF FEED — WATER, ASH OR MINERALS, PROTEIN, FAT, SUGARS & STARCHES, FIBER, DRY MATTER

ANIMAL REQUIREMENTS — MAINTENANCE, GROWTH, PREGNANCY & REPRODUCTION, PRODUCTION

TESTING HAY/FEEDING APPROPRIATELY

- One producer reduced feeding cost by $38/cow by substituting a low-quality forage (grass seed straw) for 25% of his feed

- Another sold 90 tons of high quality hay determined to be in excess of his needs

- A third reduced the cost per pound gain on weaned calves by adding barley to a forage-based program

- A forth purchased Orchard grass straw, sold alfalfa, and profited $4,000

Average savings = $18/head over the winter feeding period

OSU FORAGE EVALUATION LABORATORY

× Sampling
instructions

OSU FORAGE EVALUATION LABORATORY

- **×** Order form
  - **+** Beef Cattle
  - **+** Other Livestock

UNDERSTANDING YOUR FORAGE TEST RESULTS

- Many terms/acronyms
- Related to plant components
  - Cell wall
  - Cell contents

- Lets start with the plant first, then return to the laboratory report

✖ Forage Quality is related to physical characteristics of the plant

+ Components & Morphology

PLANT CELL

PRIMARY WALL

SECONDARY WALL

CELL CONTENTS

- PROTEIN
- SUGARS
- STARCH
- PECTINS
- FATS
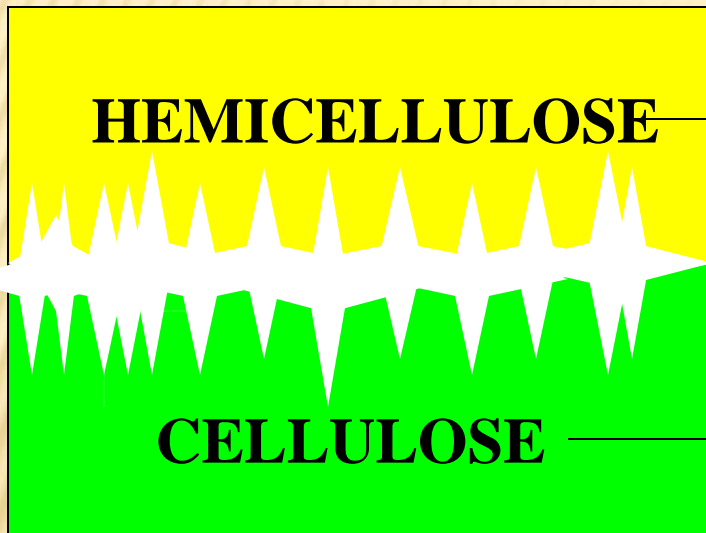
CROSS SECTION
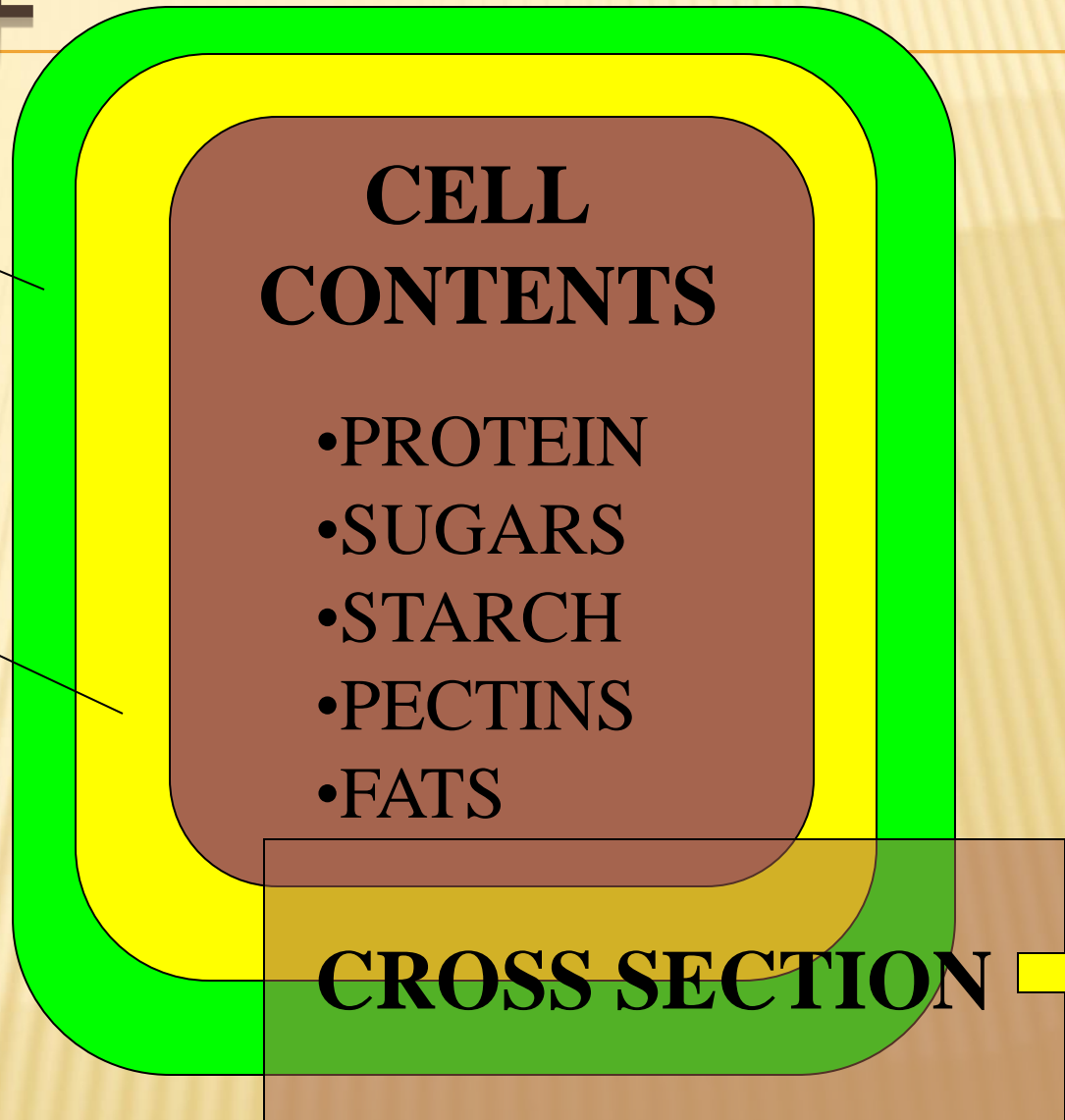
FORAGE ADF AND DRY MATTER DIGESTIBILITY
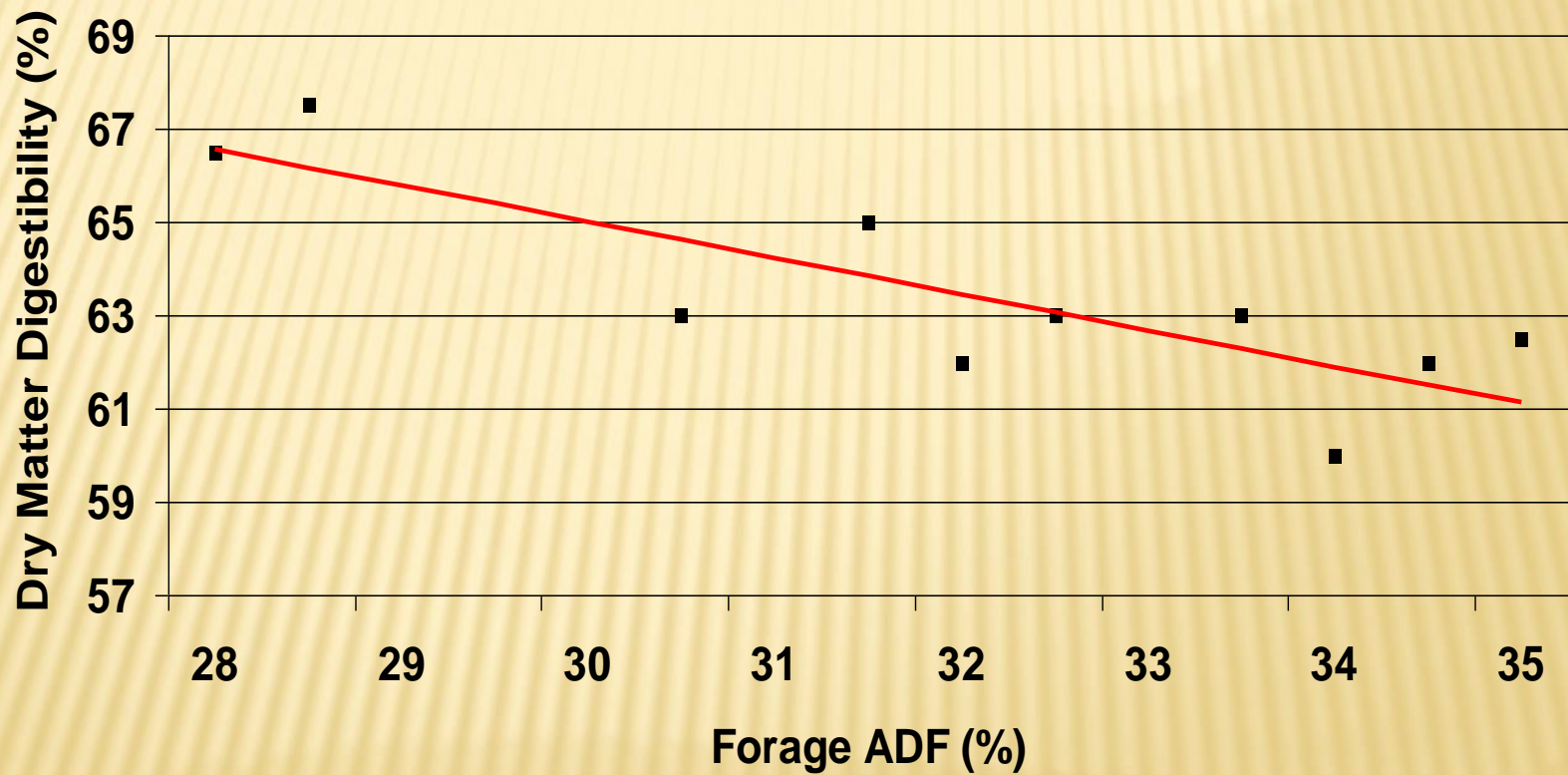
Adapted from Miller et al. (1991)
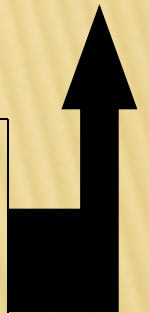
FORAGE NDF AND DRY MATTER INTAKE
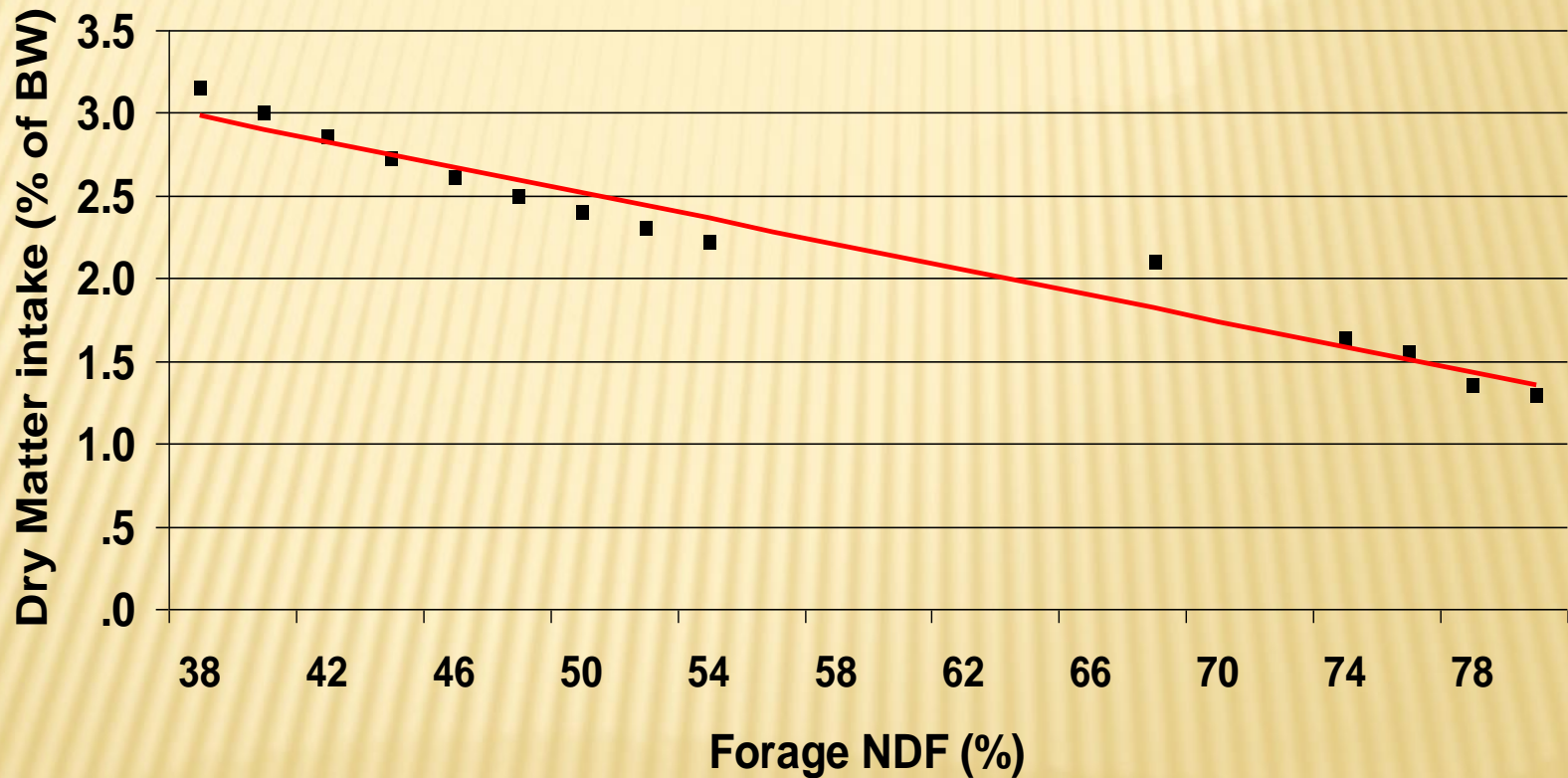
Adapted from Mertens (1985) & Burns et al. (1997)

FORAGE VALUE

& PLANT MATURITY

* As plants mature:
  + Fiber increases:
    Acid detergent fiber (ADF) & Neutral detergent fiber (NDF)

  + Protein & energy decrease

  + Digestibility decreases (ADF factor)

  + Feed intake decreases (NDF factor)

FORAGE PLANT CHARACTERISTICS

× Forage Quality

  + Young, tender growth vs. older, fibrous growth

TRADE-OFF BETWEEN YIELD AND ENERGY
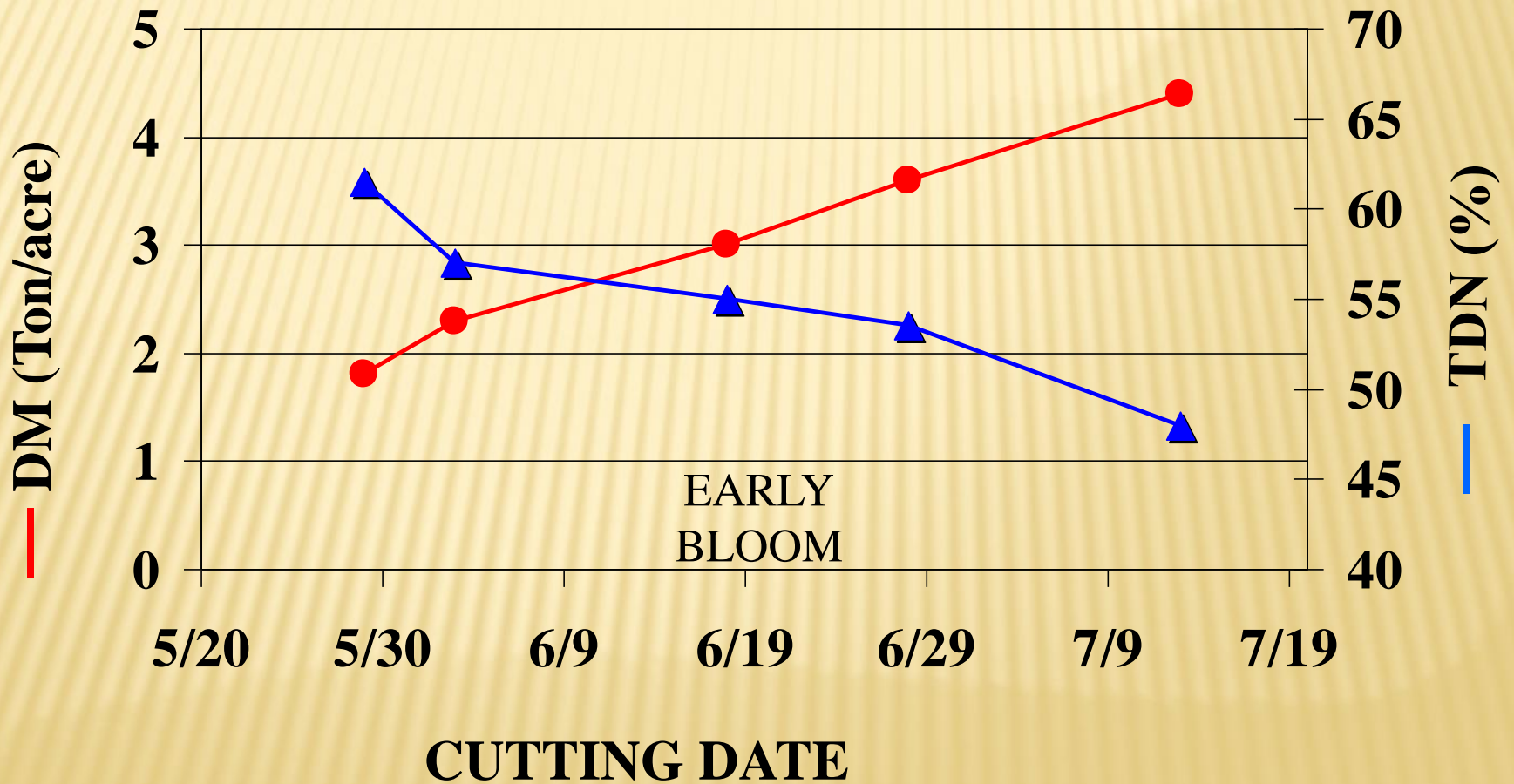
TRADE-OFF BETWEEN YIELD AND PROTEIN
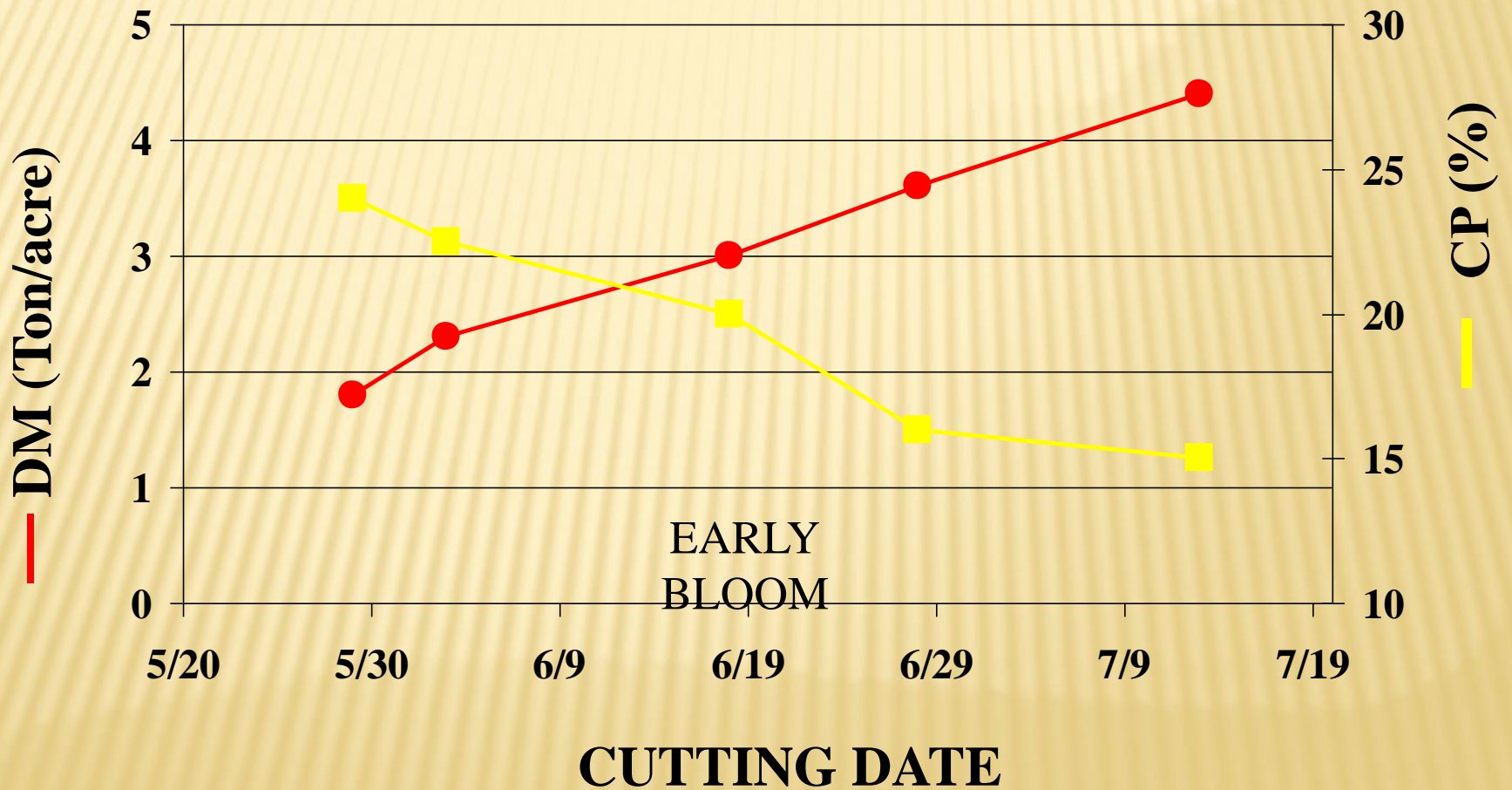
MAKE GOOD HAY
OR... WATCH YOUR NEIGHBORING FIELDS
FOR GOOD CUTTING PRACTICES

Hay Making on the West Side
(WSU publication EB 1897)
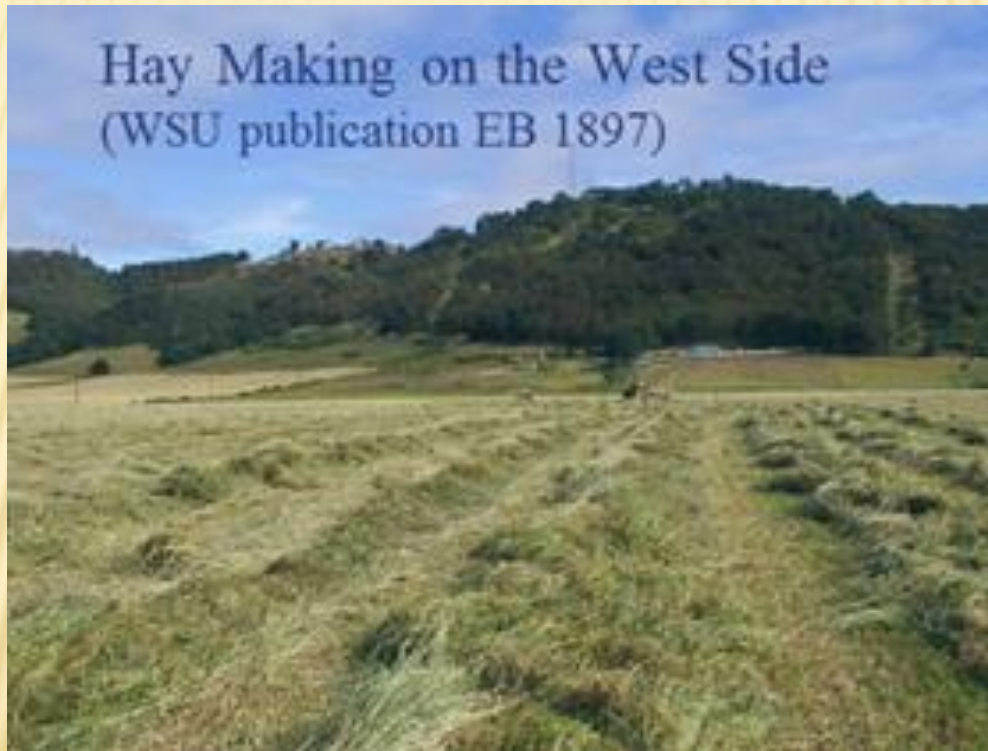
TYPICAL CHEMICAL COMPOSITION OF GRASSES

MATURITY	CP	ADF	NDF
VEG-BOOT	>18	<33	<55
BOOT-EARLY HEAD	13-18	34-38	55-60
HEAD-MILK	8-12	39-41	61-65
DOUGH	<8	>41	>65

TYPICAL CHEMICAL COMPOSITION OF ALFALFA

MATURITY	CP	ADF	NDF
Bud-First Flower	>19	<31	<40
F.F.- mid bloom	17-19	31-35	40-46
Mid-full bloom	13-16	36-41	46-51
Post bloom	<13	>41	>51

GRASS/CLOVER HAY AND HALAGE

	LOW-PROTEIN (5-8.9%CP)	MID-PROTEIN (9-11.9%CP)	HIGH-PROTEIN (12-16%CP)	HAYLAGE (1 SAMPLE)
CRUDE PROTEIN (%)	6.9	9.9	12.5	9.0
ACID DETERGENT FIBER (%)	42	39	37	44.1
NEUTRAL DETERGENT FIBER (%)	66	64	57	65.8
TOTAL DIGESTIBLE NUTRIENTS (%)	56	58	60	57
% OF SAMPLES	64	28	8	-

ALFALFA BASED FORAGES

	ALFALFA/ GRASS MIX	ALFALFA	ALFALFA HAYLAGE
CRUDE PROTEIN (%)	17 - 20	16- 20	20
ACID DETERGENT FIBER (%)	31 -38	34-43	41
NEUTRAL DETERGENT FIBER (%)	43 - 50	41-53	50
TOTAL DIGESTIBLE NUTRIENTS (%)	59 - 61	56-60	57

FORAGE TESTING LABORATORY

SAMPLE ANALYZED BY: 27

.907

DATE SAMPLED	LAB RECEIVED	DATE PRINTED	STATE	CO.	FARM
11/01/00	11/15/00	11/18/00	92	00	0000

SAMPLE DESCRIPTION	FARM	CODE	LAB SAMPLE
MMG HAY (NNE)		104	724587

ANALYSIS RESULTS

COMPONENTS	AS SAMPLED BASIS	DRY MATTER BASIS
% MOISTURE	9.3	
% DRY MATTER	90.7	
% CRUDE PROTEIN	10.3	11.3
% AVAILABLE PROTEIN		
% UNAVAILABLE PROTEIN		
% ADJUSTED CRUDE PROTEIN	10.3	11.3
% SOLUBLE PROTEIN	-	22
% ACID DETERGENT FIBER	30.7	33.8
% NEUTRAL DETERGENT FIBER	52.4	57.8
% CRUDE FAT		
% NSC	19.0	20.9
% T D N	53	58
NET ENERGY (LACTATION) -Mcal/lb.	.54	.60
NET ENERGY (MAINTENANCE)-Mcal/lb.	.53	.58
NET ENERGY (GAIN) -Mcal/lb.	.29	.32
% CALCIUM	.20	.22
% PHOSPHORUS	.19	.21
% MAGNESIUM	.38	.42
% POTASSIUM	1.31	1.45
% SODIUM	.208	.230
PPM IRON	482	531
PPM ZINC	19	21
PPM COPPER	6	6
PPM MANGANESE	280	308
PPM MOLYBDENUM	1.5	1.6
% SULFUR	.21	.23
% PROTEIN EQUIV. FROM UREA		
% PROTEIN EQUIV. FROM AMMONIA		
% NITRATE ION		
% CHLORIDE ION		
pH		
REL. FEED VALUE		101.0
HORSE TDN, %	44	49
HORSE DE, MCAL/LB.	.88	.97

◊ HOLIDAY LAB CLOSINGS ◊
THANKSGIVING 11/28/96 AND 11/29/96
CHRISTMAS 12/25/96 NEW YEAR'S 1/1/97

COMMENTS:

1. TDN DETERMINED BY OSU EQUATION. NET ENERGIES DETERMINED USING 1988 NRC DAIRY EQUATIONS.
2. HORSE ENERGIES CONFORM TO THE 1989 NRC NUTRIENT REQUIREMENTS OF HORSES.

FOR NORTHEAST DHIA SUPERVISOR				
KIND	DESCRIPTION	% DM	NEl	% PROTEIN
1	DRY ROUGHAGE	91	60	11

Moisture = water

Dry Matter = total - water

DM = protein, fats, carbohydrates, ash

For example:

1 ton load of feed

Differing %DM

Differs in amount of feed

Compare feeds (hay or baleage)
on a 100% DM basis

1,200 lb of water or 60%

800 lb of dry matter or 40%

HOLLOW BELLY LIVESTOCK CO.

1,740 lb of dry matter or 87%

260 lb of moisture or 13%

HOLLOWBELLY LIVESTOCK CO.

FORAGE TESTING LABORATORY

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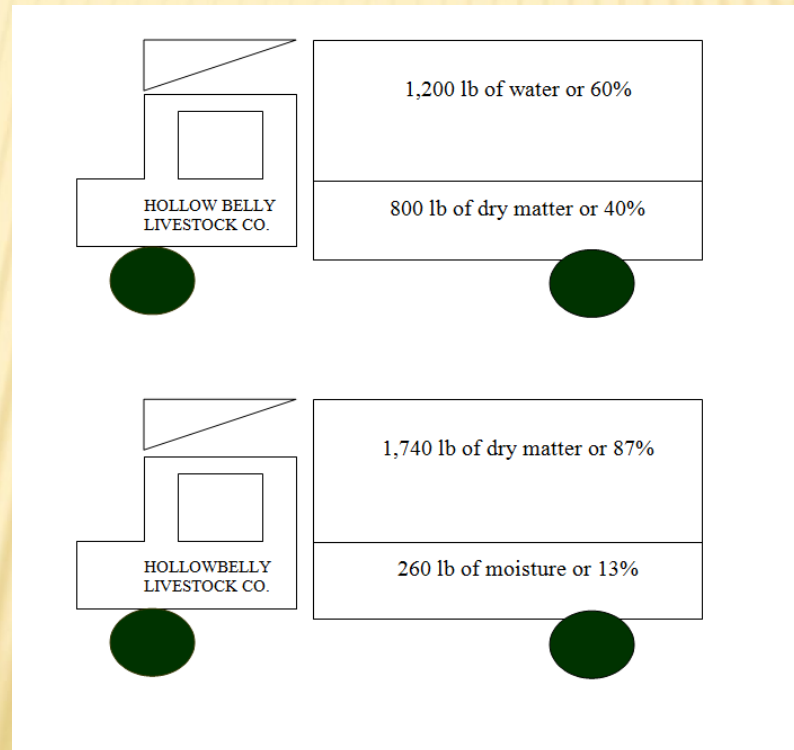2. HORSE ENERGIES CONFORM TO THE 1989 NRC NUTRIENT REQUIREMENTS OF HORSES.

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FOR NORTHEAST DHIA SUPERVISOR

KIND	DESCRIPTION	% DM	NEl	% PROTEIN
1	DRY ROUGHAGE	91	60	11

Crude Protein
CP = %N x 6.25

Acid Detergent Fiber
(ADF; cellulose & lignin)
est. digestibility

Neutral Detergent Fiber
(NDF; cellulose, hemicellulose, & lignin)
est. intake

Crude Fat
(ether extract, EE)
Usually ~ 3%

Non Structural Carbohydrates
(NSC)

FORAGE TESTING LABORATORY

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Total Digestible Nutrients (TDN; = sum of nutrients x digestibility

Net Energy (NE)
= Gross Energy - Losses
- Heat of digestion
- Gases
- Urine
- Feces

Minerals:
macro & micro

Horses - less efficient than ruminants; have different values for energy

USDA AGRICULTURAL MARKETING SERVICE
ALFALFA & ALFALFA\GRASS HAY TESTING GUIDELINES

| Grade	ADF (%)	NDF (%)	RFV	TDN 100 (%)	TDN 90 (%)	CP (%)
Supreme	<27	<34	>185	>62	55.9	>22
Premium	27-29	34-36	170-185	60-62	54.5-55.9	20-22
Good	29-32	36-40	150-170	58-60	52.5-54.5	18-20
Fair	32-35	40-44	130-150	56-58	50.5-52.5	16-18
Utility	>35	>44	<130	<56	<50.5	<16

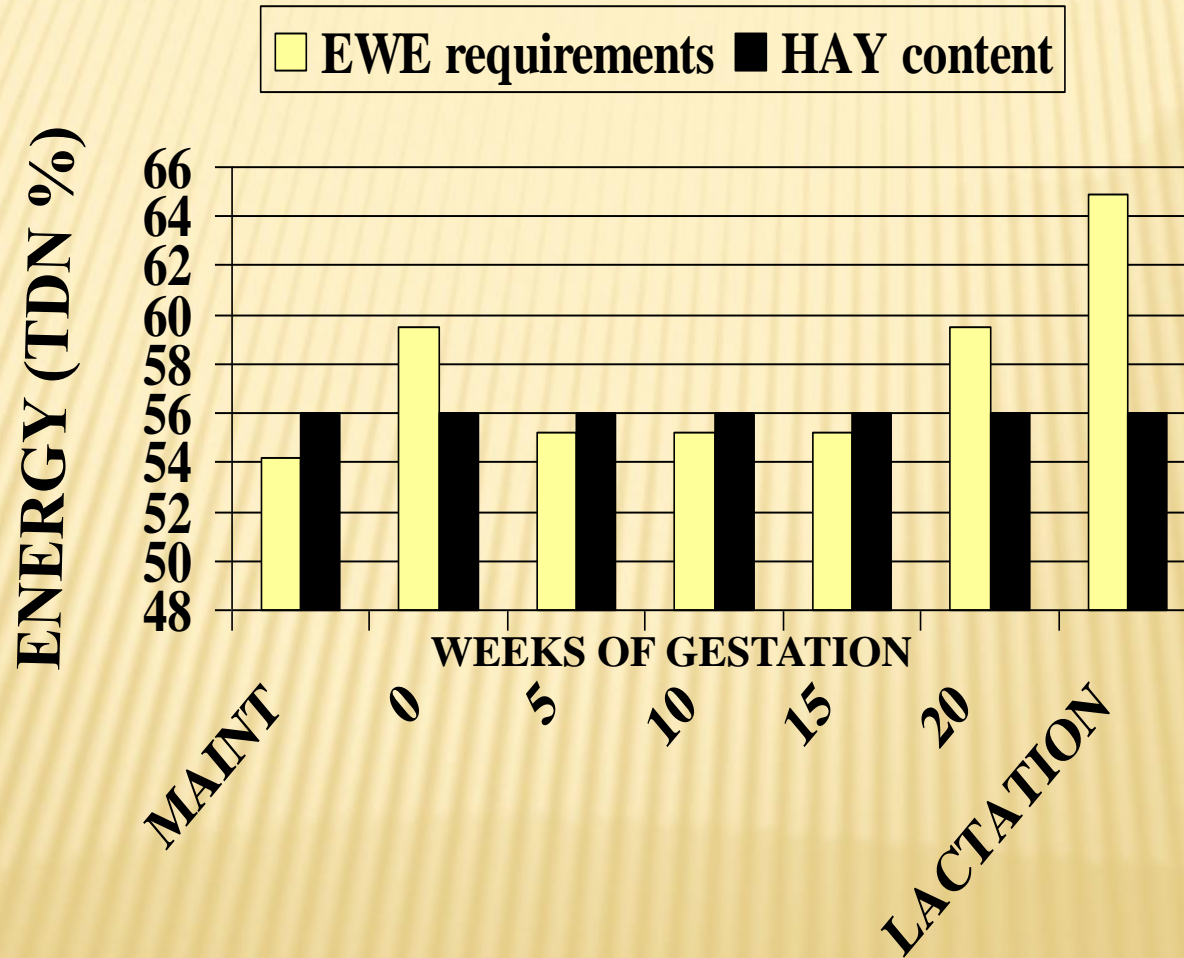RFV: Relative Feed Value

IMPORTANCE OF KNOWING FORAGE QUALITY

- Meet animal nutrient requirements
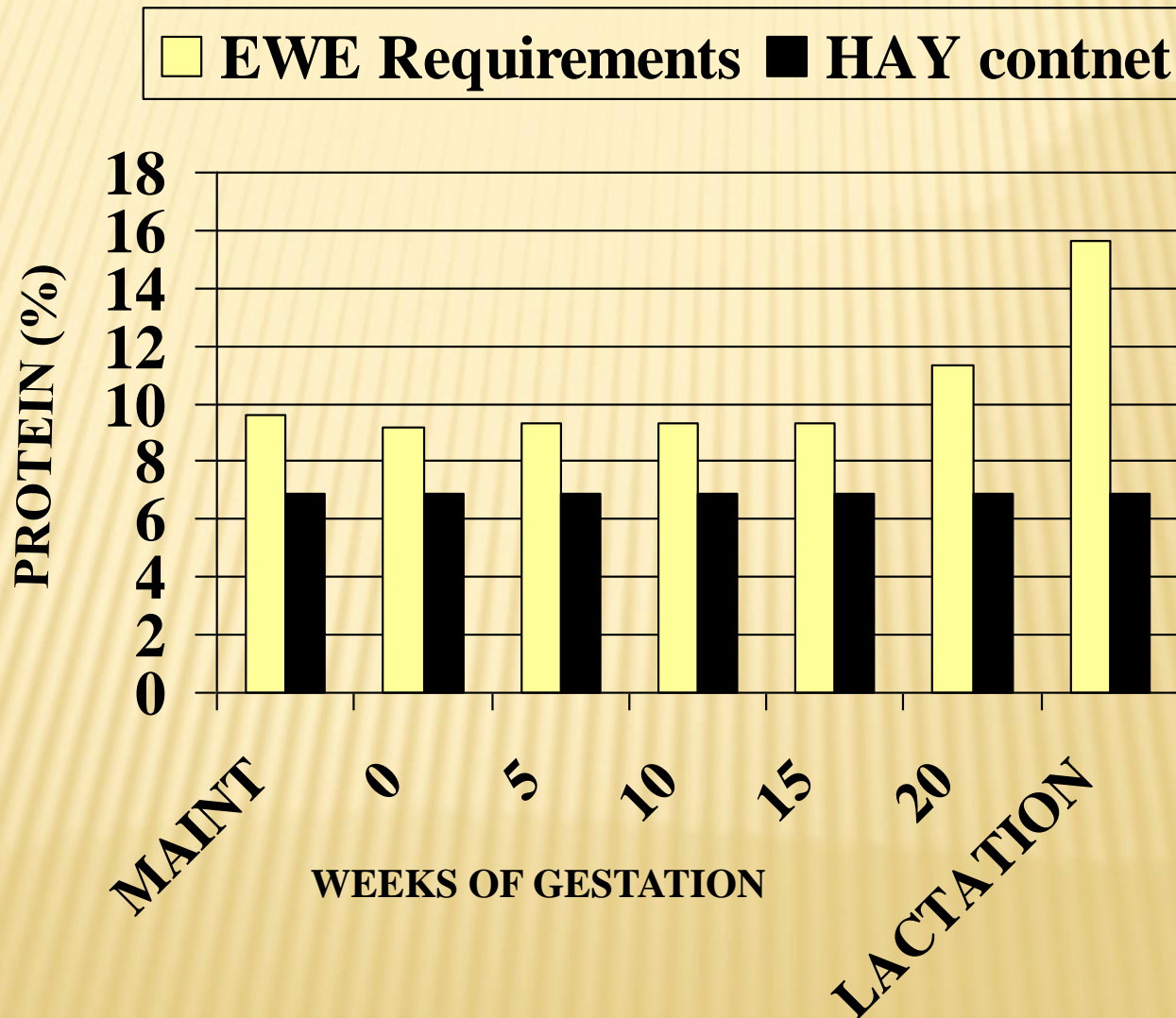- Accurate prediction of livestock production
- Forage marketing

THE NUTRITION PUZZLE
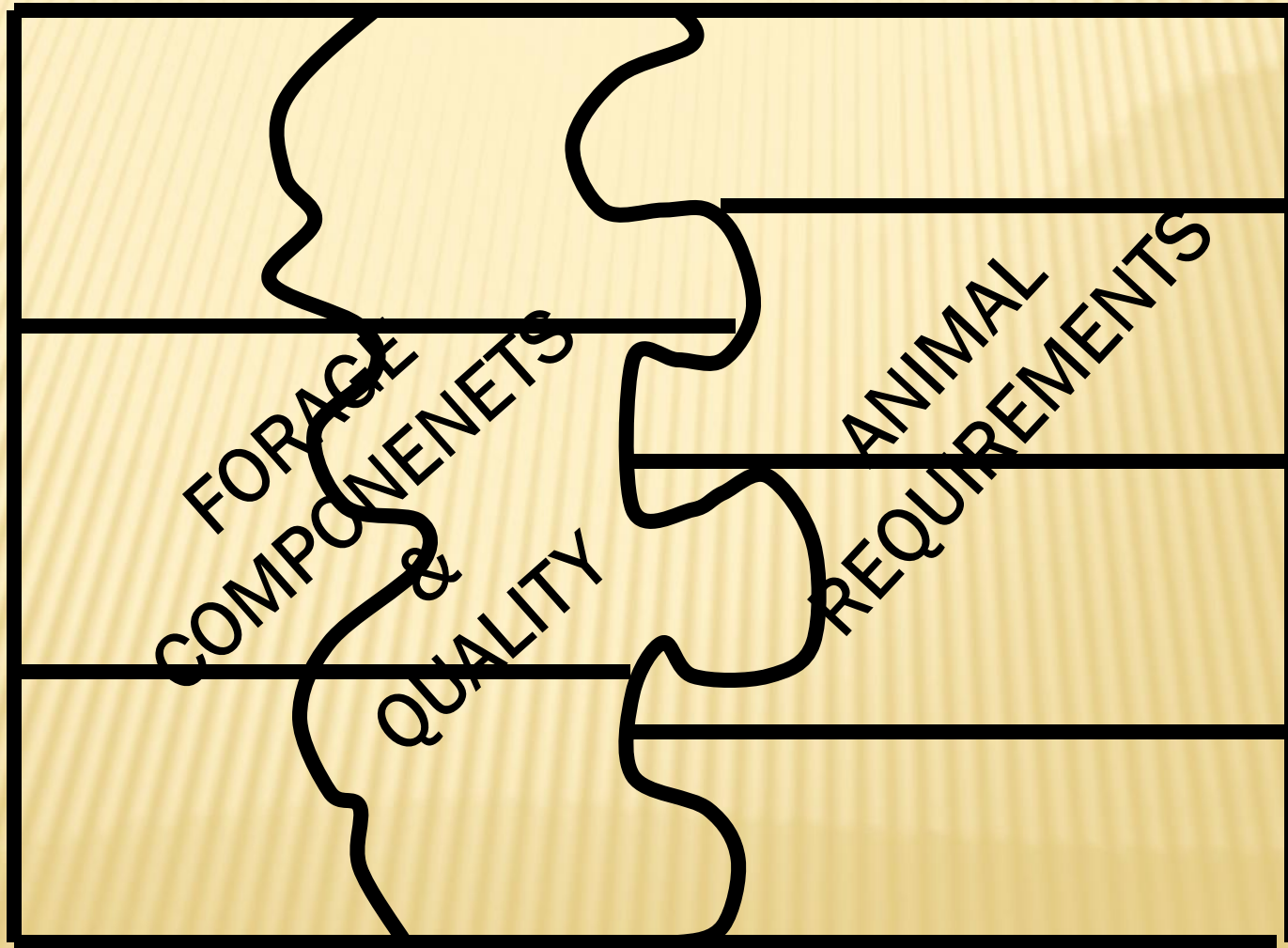
Energy content of grass hay and energy requirements of ewes.

Protein content of grass hay and protein requirements of ewes

NUTRIENT REQUIREMENTS OF SELECTED LIVESTOCK... COMPARE TO HAY

Animal	Weight (lb)	gain (lb/day)	protein (%)	TDN (energy; %)
Pregnant yearling heifer	830 lb	1.3	8.6	58.8
Dry pregnant mature cow	1100 lb	0.9	7.8	53.1
Lactating yearling heifer	830	.4	10.9	63.8
Lactating cow	1100	0	9.7	56.6
Pregnant ewe lamb	121	0.35	11.8	63
Pregnant Ewe	154	0.4	10.7	59
Ewe with twins	154	-0.13	15.0	65
Ewe with singles	154	-0.06	13.4	65
Medium-frame steer calves	500	1	9.5	58.5
Medium-frame steer calves	500	3	14.4	85.0

(NRC Sheep 1985 ; NRC Beef 1984).

REQUIREMENTS FOR DIFFERENT CLASSES OF HORSE

Horse	DE Mcal/lb	CONC. (%)	HAY (%)	Protein (%)
Maintenance	0.9	0	100	8
Pregnant	1.0 – 1.1	20 - 30	70 – 80	10 – 10.6
Lactating	1.2 – 1.15	35 - 50	50 – 65	11 – 13.2
Working	1.15 – 1.3	35 – 65	35 – 65	9.8 – 11.4
Growing	1.15 - 1.4	35 - 70	30 - 65	10.4 – 14.5

Adapted from NRC Nutrient Requirements of Horses, 1989

HORSE HAY

- Sugar Content in Feed & Forage Affects Horses' Health
- CSU 01818
- No "Low Carb" hay
- Low sugar hay
- <10% sugars as WSC

(Water Soluble Carbohydrates)
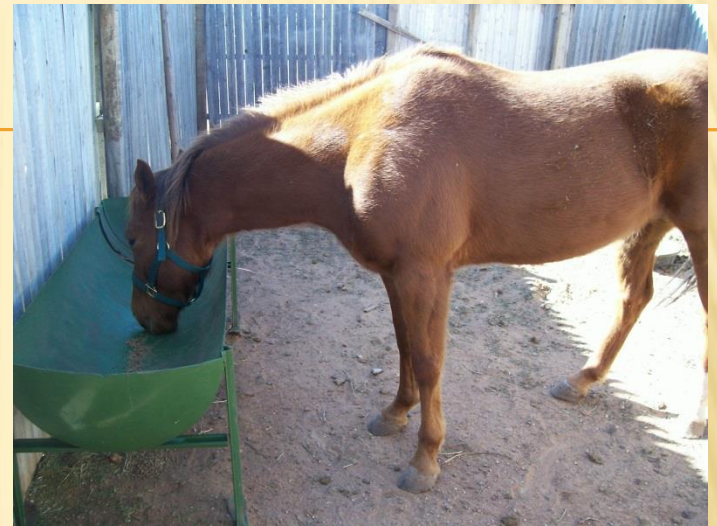
- Potassium (K)
  + Watch fertilizer practices
- Species of grasses and legumes
  + All are okay
  + Feed appropriately
    × Nutrients to match activity

RATION BALANCING INFORMATION

http://extension.oregonstate.edu/douglas/information-livestock-forages-production

EM 8883-E • December 2004

Beef Cattle Nutrition Workbook

Animal Nutrient Requirements
Forage Value
Evaluating Feeds
Minerals and Vitamins
Ration Balancing
Supplements
Body Condition
Heifer Nutrition and Development

- ✖ Beef workbook has examples for balancing rations that work for other livestock
- ✖ Nutrient Requirements for Sheep, Goats, Horses, and Dairy Cows
- ✖ Mineral Assessments
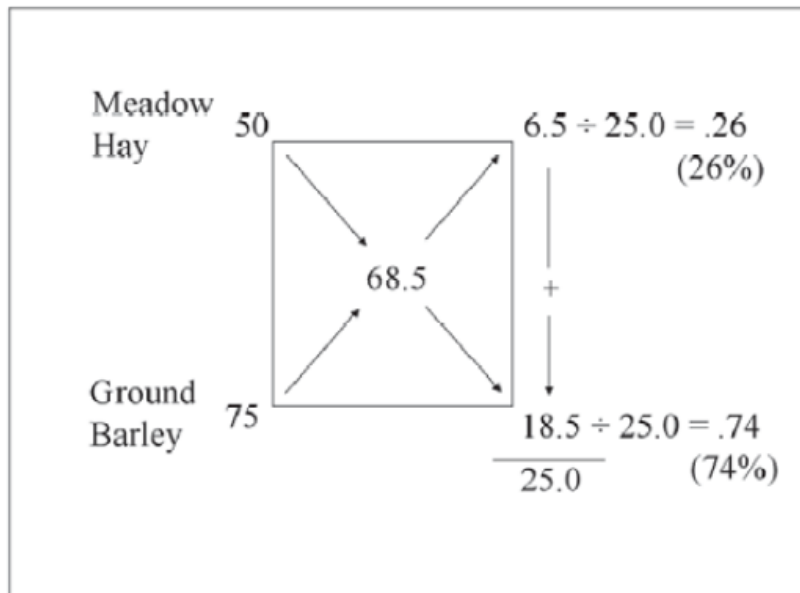
PEARSON SQUARE METHOD
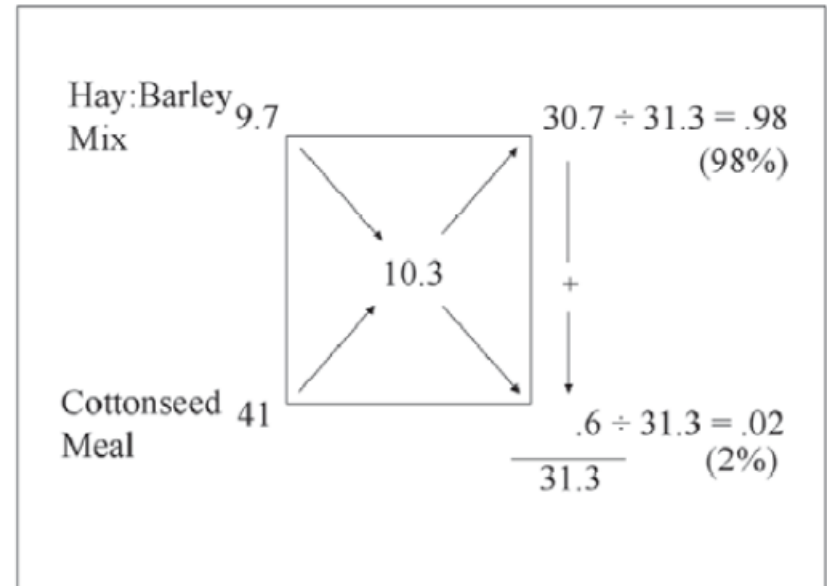

Figure 1. Balancing for TDN using a Pearson Square.

Figure 2. Balancing for CP using a Pearson Square.

OSU Cow-Culator - http://beefcattle.ans.oregonstate.edu/html/forage/Forage.htm

Hire Nutritionist – it pays to have proper nutrition

Bagged feeds – expensive; follow bag instructions or risk unbalanced rations

NEXT STEPS...
TAKE AN ANIMAL NUTRITION CLASS