Matching Forages with Animal Requirements

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First things first…

Goal of the nutrition program:

Utilize available feeds to provide a cost-effective, balanced diet

Cost-effective diet → "the most bang for the buck"

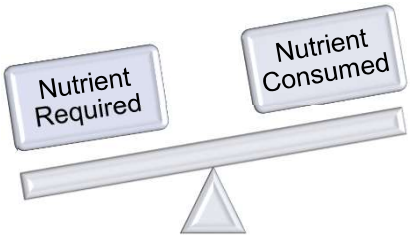
Balanced diet → meets nutrient requirements to ensure desired level of production

Feed with an intention!

What makes a diet “balanced”?

Animal

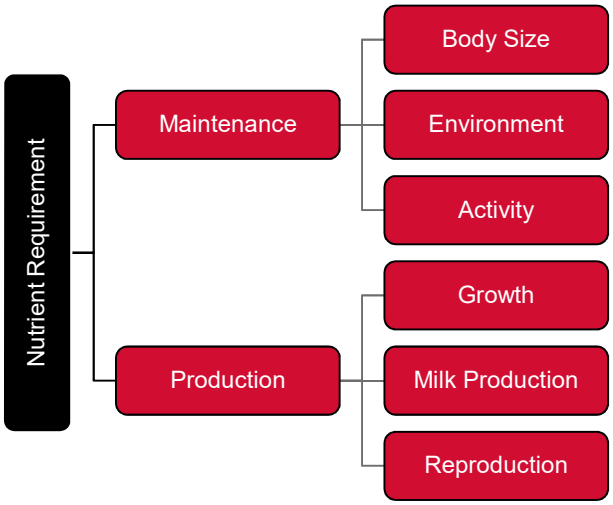
Feed



Environment

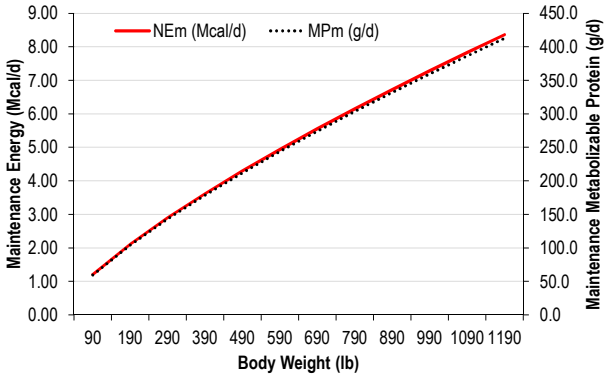
To provide a balanced diet, we first need to know what the animal *requires*…

Nutrient Requirements are Driven by Several Factors



Effect of Body Size on Energy & Protein Needs

- As animals get larger, they require more nutrients to maintain themselves



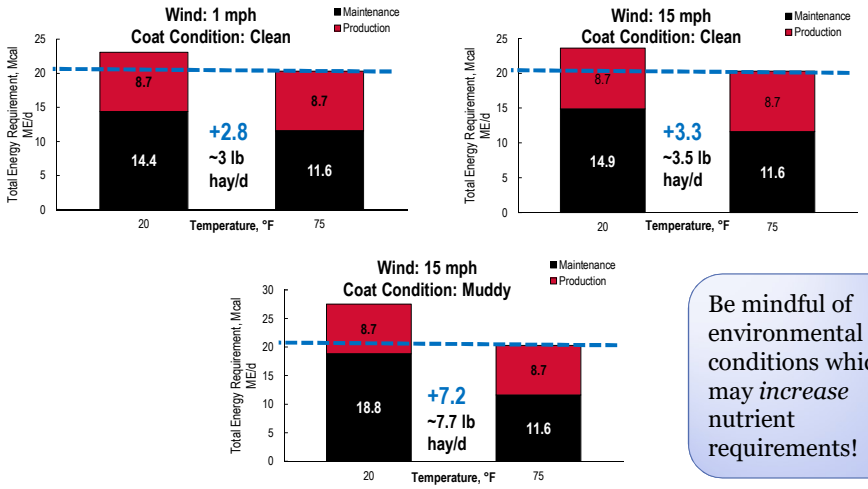
Environment

- Thermoneutral zone: Temperature range at which animals do NOT have to expend substantial energy to maintain body temperature
  - Range varies with coat condition, breed, age, acclimation, and production
- Moisture, mud, and humidity also play a role!

Species	Thermoneutral Range (Adult)[1]
Cattle (beef)	32°F - 77°F
Cattle (dairy)	41°F - 77°F
Goat	50°F - 68°F
Horse	40°F - 80°F
Sheep	70°F - 88°F

[1]Michigan State University Extension

Environment: Effects of Temperature and Coat Condition

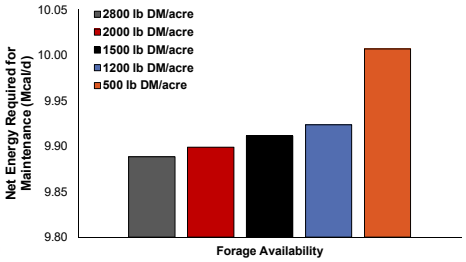


Be mindful of environmental conditions which may *increase* nutrient requirements!

Total energy requirements of a mature, lactating beef cow in 4th month of lactation under various environmental conditions. Data from Nutrient Requirements of Beef Cattle (NRC, 2016).

Activity

- Increased activity level increases nutrient requirements
  - Grazing
  - Breeding
  - Distance to water
  - Socialization



- Less dense pasture stand → increased energy needs!

Maintenance energy requirements of a mature, 1100 pound beef various pasture conditions. Data from Nutrient Requirements of Beef Cattle (NRC, 2016).

Production Requirements

Growth

- Adding body mass
- Requirements depend on type of growth (frame vs. muscle vs. fattening)

Reproduction

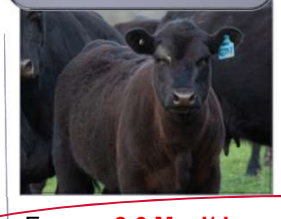
- Breeding: ensure appropriate body condition and nutrient status to maximize fertility
- Gestation: ensure proper nutrition to support fetus and appropriate body condition

Lactation

- High nutrient demand in early lactation
- Requirement varies based on amount and composition (fat and protein) of milk produced

Growth Rate Increases Energy and Protein Requirements

Steer 1:
530 lbs
ADG of 2.6 lb/d



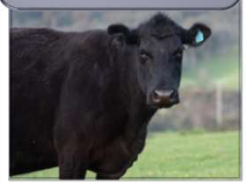
Energy: **8.6 Mcal/d**
Protein (MP): **662 g/d**

Steer 2:
530 lbs
ADG of 1.75 lb/d

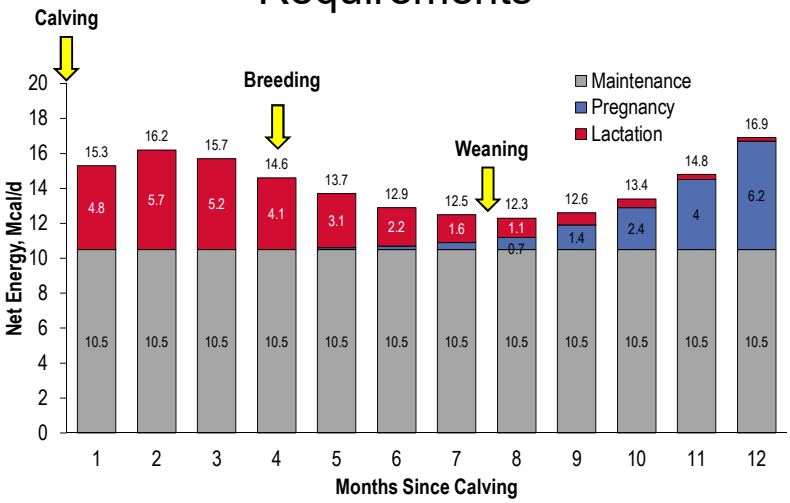
Energy: **7.3 Mcal/d**
Protein (MP): **527 g/d**

Type of growth also affects requirements (fat vs. muscle!)

Lactation Increases Energy and Protein Requirements

Cow 1: Pregnant, 1 month pre-calving	Cow 2: Lactating, 1 month post-calving	Cow 3: Lactating, 6 months post-calving
		
Energy: **14.8 Mcal/d** Protein (MP): **607 g/d**	Energy: **15.3 Mcal/d** Protein (MP): **780 g/d**	Energy: **12.9 Mcal/d** Protein (MP): **601 g/d**

Lactation and Reproduction Affect Energy Requirements



Data adapted from Table 20-5 from the NASEM Beef Cattle Nutrient Requirements (2016)

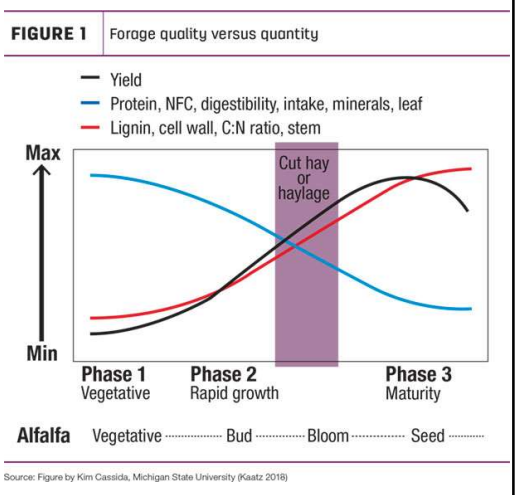
Okay, I have an understanding of what the animals need, what's next?

Forage Analysis!

Forage Analysis

Why?

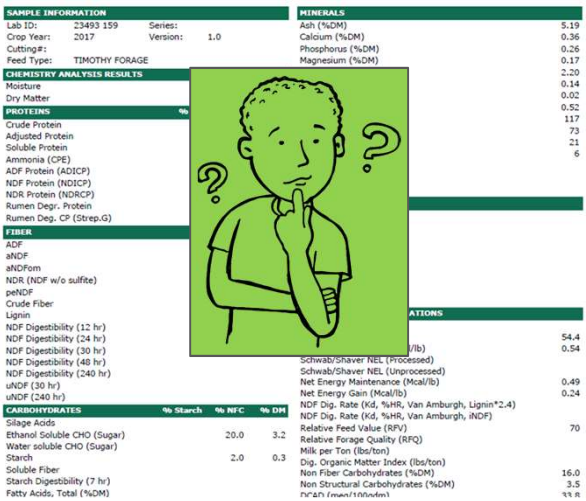
- Nutrient profile and quality is highly variable depending on the forage type and maturity, season, weather conditions, and soil fertility
- Visual appraisal does NOT accurately portray nutrient composition
- Can help with:
  - Forage allocation: who should get what
  - Supplementation strategies: how much (if any) and what type is needed



How to Obtain a Forage Analysis

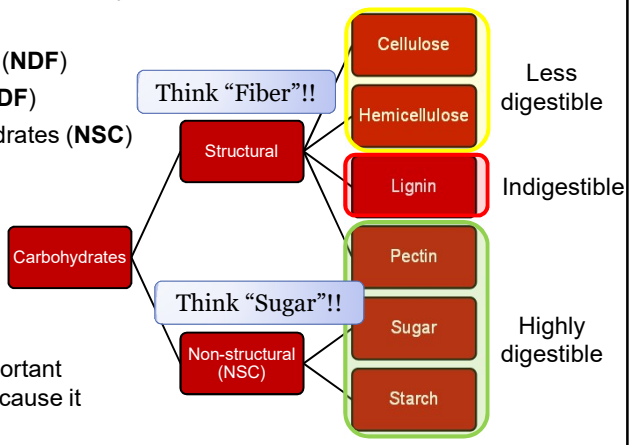
1. Collect sample
   - Pasture:
     - Collect clippings from 20 or more random areas throughout each pasture or paddock shortly before grazing
     - Cut at a height that will mimic grazing height (3-4”, depending on the forage)
     - Avoid sampling overly mature grasses, seedheads, and weeds that animals avoid consuming
   - Baled hay or silage → obtain multiple core samples
2. Ship sample to a forage lab ASAP after collection
   - Visit: go.umd.edu/foragetest for a list of certified forage labs in our area
3. Receive lab results and interpret results

Dissecting the Forage Analysis Report



Dissecting the Forage Report: Carbohydrates/Fiber

- Most energy in the diet is from carbohydrates!
- Report includes:
  - Neutral Detergent Fiber (**NDF**)
  - Acid Detergent Fiber (**ADF**)
  - Non-structural Carbohydrates (**NSC**)
  - Sugar
  - Starch
  - Lignin



NDF is one of the most important carbohydrates to look at because it helps reflect "gut fill"!

Dissecting the Forage Report: Neutral Detergent Fiber (NDF)

- Feed intake is limited by NDF%
  - "Filling" effect
- NDF% increases as the plant matures, but NDF digestibility (NDFD) decreases
- Mature forages are lower quality because they are less digestible and can limit overall intake

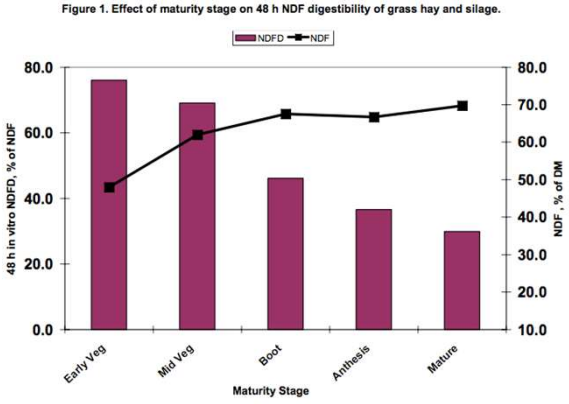
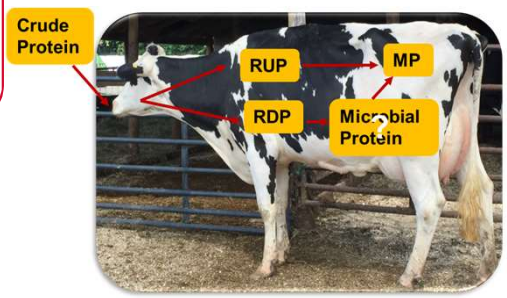


Image Credit: University of Wisconsin-Madison Extension

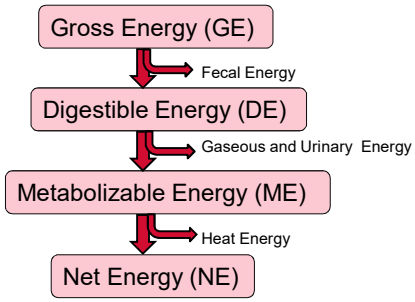
Dissecting the Forage Report: Protein

- Report includes:
  - Crude Protein (**CP**)
    - Calculated based on N content
  - Metabolizable Protein (**MP**)
    - Reflects what is actually available to the animal
  - Rumen-degraded protein (RDP)
    - Protein degraded in the rumen
  - Various protein fractions
    - Used in ration balancing software



Dissecting the Forage Report: Energy

- Net Energy (**NE**)
  - Maintenance (NE_m)
  - Lactation (NE_l)
  - Gain (NE_g)
- Digested Energy (**DE**)
- Metabolizable Energy (**ME**)
- Total Digestible Nutrients (**TDN**)



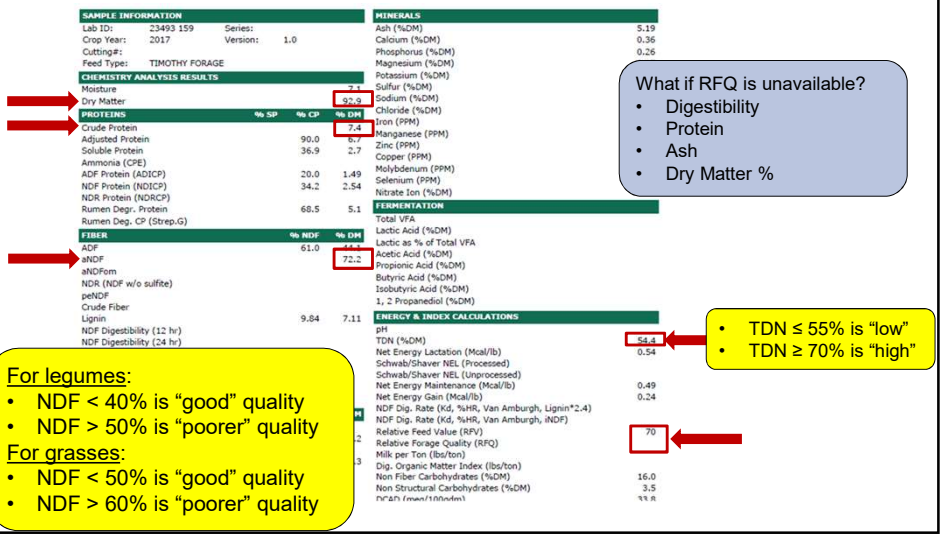
- TDN vs. NE
  - TDN is used to estimate energy availability when the diet is made up mostly of forage (hay or pasture).
  - NE is used in controlled feeding systems when the diet is made up of concentrates or total mixed rations (TMR).

RFV and RFQ

- Both are single measures to help indicate forage quality
  - Allows for comparison across forages
  - Not directly measured but calculated based on other values
  - Accounts for total digestible nutrients AND dry matter intake
- Relative feed value (RFV)
  - Digestible dry matter predicted from ADF
  - Intake potential predicted from NDF
- Relative forage quality (RFQ)
  - Similar to RFV but also accounts for digestible fiber (NDFD)
  - Digestibility based on TDN instead of calculating from ADF

Credit: Dr. Amanda Grev, University of Maryland Extension

Dissecting the Forage Analysis Report



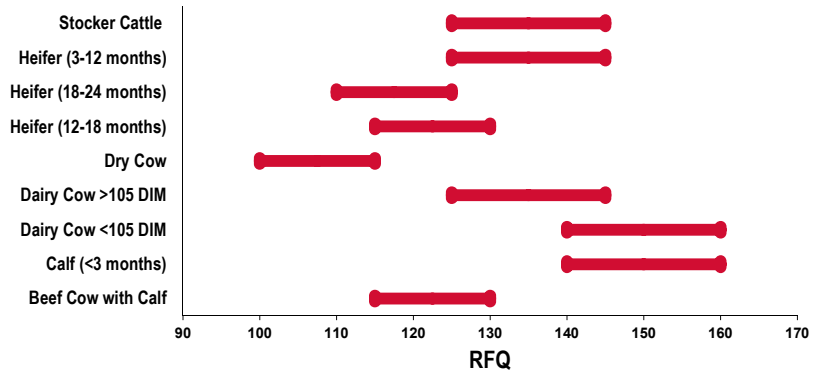
What if RFQ is unavailable?
- Digestibility
- Protein
- Ash
- Dry Matter %

- TDN ≤ 55% is "low"
- TDN ≥ 70% is "high"

For legumes:
- NDF < 40% is "good" quality
- NDF > 50% is "poorer" quality

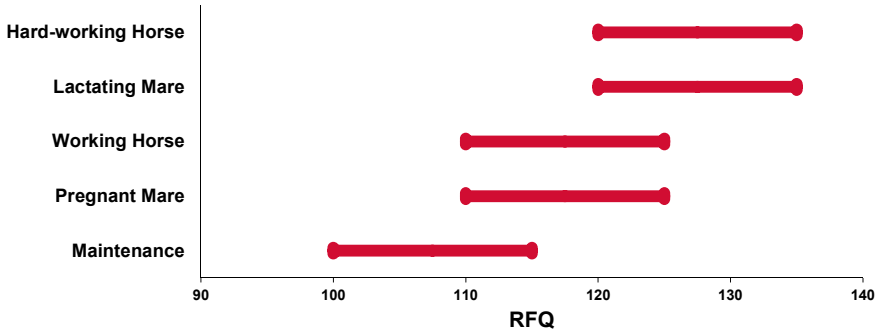
For grasses:
- NDF < 50% is "good" quality
- NDF > 60% is "poorer" quality

Forage Quality by Animal Requirements: Cattle



Data from Undersander et al., 2011.

Forage Quality by Animal Requirements: Horses



Data from Undersander et al., 2011.

What type of forage should I feed?

Maintenance:

- High fiber (>60% NDF)
- Low energy (55-60% TDN)
- Low protein (8-10% CP)

Examples:

- Mature bulls or rams outside of breeding season
- Mature dry cows, ewes, mares
- Mature horses not used for extensive exercise

What type of forage should I feed?

Reproduction:

- Gestation: First and second trimesters
  - High fiber (>60% NDF)
  - Low energy (55-60% TDN)
  - Low protein (8-10% CP)

- Gestation: Third trimester
  - Moderate fiber (<55% NDF)
  - Moderate to high energy (60-65% TDN)
  - Moderate protein (10-12% CP)

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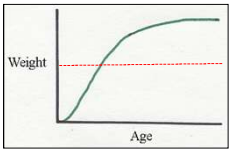
What type of forage should I feed?

Growth:

- <50% of mature weight
  - Low fiber (30-40% NDF)
  - High energy (>65% TDN)
  - High protein (16-18% CP)
- >50% of mature weight
  - Moderate fiber (50-60% NDF)
  - Moderate energy (65% TDN)
  - Moderate protein (12% CP)



http://animalbiosciences.uoguelph.ca/~swatland/HTML10234/LEC20/LEC20.html

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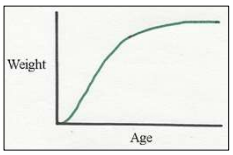
What type of forage should I feed?

Finishing:

- Very low fiber (<30% NDF)
- High energy (>65% TDN)
- Moderate protein (8-10% CP)



http://animalbiosciences.uoguelph.ca/~swatland/HTML10234/LEC20/LEC20.html

What type of forage should I feed?

Lactation:

- Low fiber (<50% NDF)
- High energy (>60% TDN)
- High protein (12-14% CP)

Ideal Forage Characteristics by Physiological State

Type of Production	Fiber (%NDF)	Energy (%TDN)	Protein (%CP)
Maintenance (mature breeding males outside of breeding season; Mature horses not extensively exercised)	>60%	55-60%	8-10%
Pregnancy (1st & 2nd trimesters)	>60%	55-60%	8-10%
Pregnancy (3rd trimester)	<55%	60-65%	10-12%
Growth (<50% of mature weight)	30-40%	>65%	16-18%
Growth (>50% of mature weight)	50-60%	65%	12%
Growth (finishing/fattening)	<30%	>65%	8-10%
Lactation	<50%	>60%	12-14%

How do you know if you've done a good job?

The animals will tell you!

Things to consider:

- Body condition
- Manure Consistency
- Production Performance
- Health

Body Condition

- Evaluation of the amount of "flesh" (fat) an animal carries
  - Scoring system varies by species, but concept is the same
- Ideal condition varies by physiological state
  - Critical for any system that involves breeding females
- When to score (minimum)
  - Late gestation
  - At parturition
  - At breeding
  - At weaning

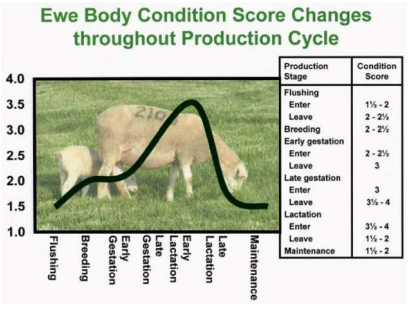


Image Credit: Kentucky Cooperative Extension

Body Condition

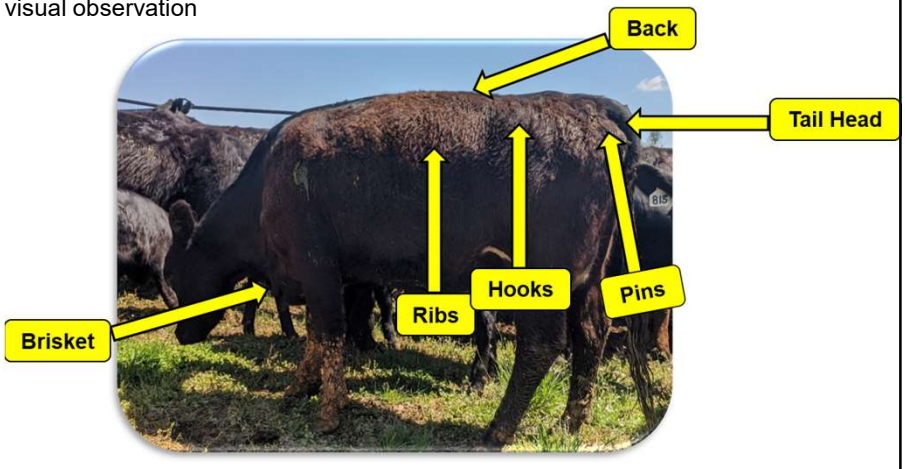
- Useful to evaluate effectiveness of a diet
  - Under conditioned: animals are under nourished → increase nutrient density
  - Over conditioned: animals are over nourished → reduce nutrient density

- The **same person(s)** should evaluate condition on a **routine basis**!

Photo Credit: Virginia Cooperative Extension

Body Condition: Beef Cattle

Assess areas via touch or visual observation



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Body Condition: Beef Cattle

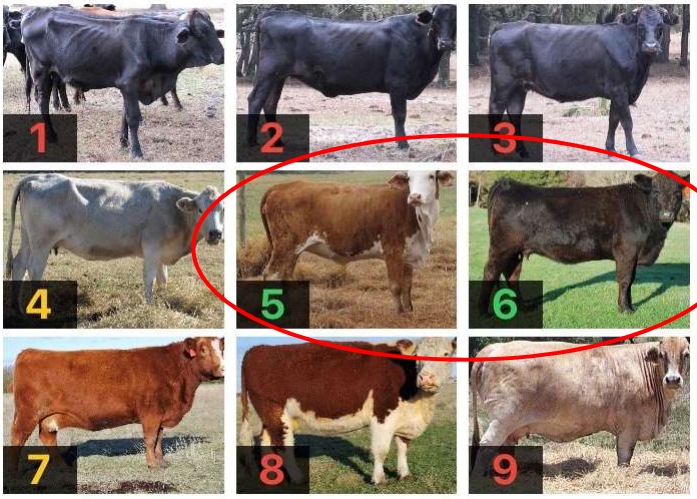

Image Credit: Crystalyx.com

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Body Condition: Sheep

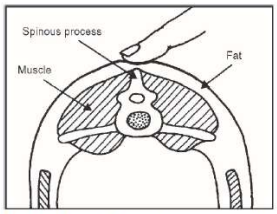


Figure 1. Feel for the spine in the center of the sheep's back, behind its last rib and in front of its hip bone.

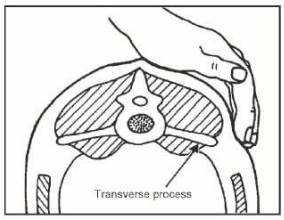


Figure 2. Feel for the tips of the transverse processes.

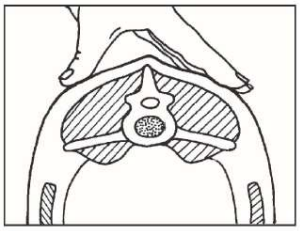
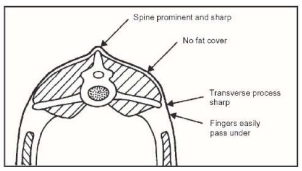


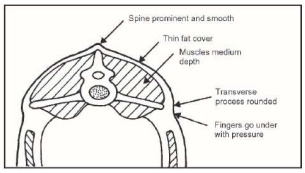
Figure 3. Feel for fullness of muscle and fat cover.

Image Credits: Kentucky Cooperative Extension

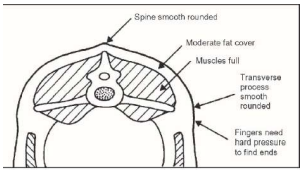
Body Condition: Sheep



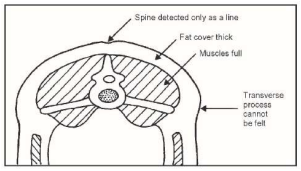
Score 1



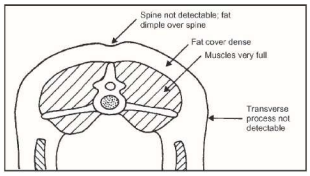
Score 2



Score 3



Score 4

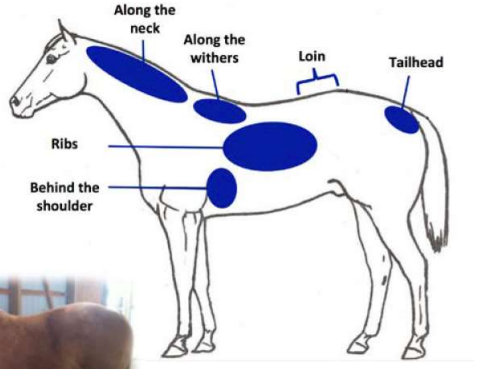


Score 5

Image Credits: Kentucky Cooperative Extension

Body Condition: Horses

Condition Score: 1



Condition Score: 5

Condition Score: 8

Image Credits: University of Tennessee Extension

Manure Scores (Cattle)

- Can indicate dietary issues 1-3 days ago
  - Protein, carbohydrate, or fiber imbalances
- Can also indicate sick animals
- Score of 3 is ideal, but normal ranges between 2 and 4

Image Credit: Alltech.com

Manure Scores (Cattle)

Score	Interpretation	Suggestion
1	Animal is sick or is consuming excessive protein/rapidly fermentable carbohydrates or insufficient fiber	Feed additional fiber (hay)
2	Diet contains excessive protein/fermentable carbohydrates or insufficient fiber	Feed additional fiber (hay)
3	Diet is matched to animal nutrient requirements	No diet changes indicated
4	Diet contains insufficient degradable protein/fermentable carbohydrates or excessive low quality fiber	Supplement protein
5	Animal is dehydrated or consuming excessive poor quality forage that is likely not meeting nutritional needs	Increase forage quality

Source: Dr. Robert Wells, Noble Research Institute

Production Performance

- Weight gain
  - Average daily gain
- Reproduction
  - Pregnancy rate
  - Pregnancy loss
  - Stillbirths
- Milk production
  - Offspring growth rates
  - Direct measurement

You can't evaluate what you don't measure!

Health

Incidence of disease

- Retained placenta
- Dystocia (birthing difficulty)
- Grass tetany
- Milk fever
- Ketosis (Pregnancy Toxemia)
- Mastitis
- Parasites
- Lameness

Photo Credit: Jeff Semler, University of Maryland Extension

https://iamcountryside.com/cattle/assist-a-cow-giving-birth/

Summary

- Animal nutritional requirements vary depending on animal size, environment, activity level, and the type and level of production
- Forage testing allows for accurate quality assessment to help allocate forages appropriately
- Focus on values like TDN, CP, NDF, and RFQ
  - Animals with higher nutritional requirements will need higher quality forage (greater TDN, CP, RFQ and lower NDF)
- Monitor body condition, performance, and health to determine if animals need higher or lower quality forage

Thank you!

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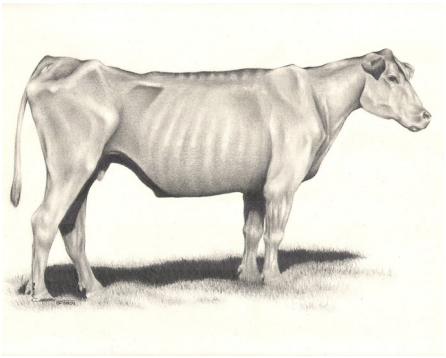
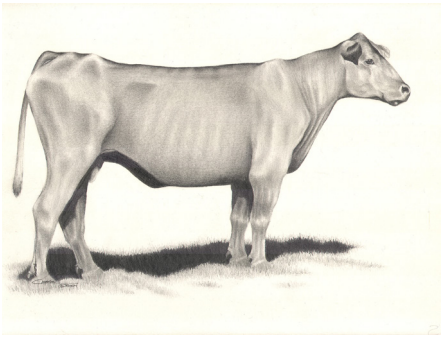
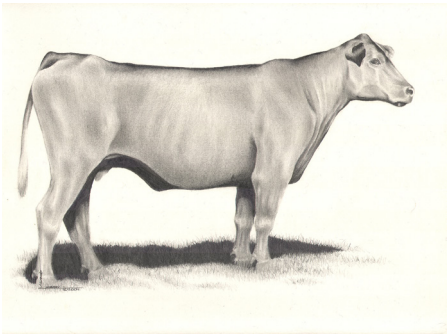
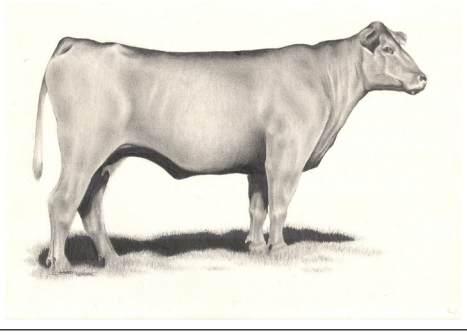
Body Condition Scoring System (BCS) *for Beef Cattle*

(Richards et al., 1986. Journal of Animal Science 62:300.)
Photos courtesy of University of Minnesota Beef Team

Condition	BCS	Description	
Thin	**1**	**Emaciated** Cow is extremely emaciated with no palpable fat detectable over spinous processes, transverse processes, hip bones, or ribs. Tail head and ribs project quite prominently.	
	2	**Poor** Cow still appears somewhat emaciated but tail-head and ribs are less prominent. Individual spinous processes are still rather sharp to the touch, but some tissue cover over dorsal portion of ribs.	
	3	**Thin** Ribs are still individually identifiable but not quite as sharp to the touch. There is obvious palpable fat along spine and over tail-head with some tissue cover over dorsal portion of ribs.	
Borderline	**4**	**Borderline** Individual ribs are no longer visually obvious. The spinous processes can be identified individually on palpation but feel rounded rather than sharp. Some fat cover over ribs, transverse processes, and hip bones.	

Condition	BCS	Description	
Optimum/ moderate	**5**	**Moderate** Cow has generally good overall appearance. On palpation, fat cover over ribs feels spongy and areas on either side of tail-head now have palpable fat cover.	
	6	**High moderate** Firm pressure now needs to be applied to feel spinous processes. A high degree of fat is palpable over ribs and around tail-head.	
Fat	**7**	**Good** Cow appears fleshy and obviously carries considerable fat. Very spongy fat cover over ribs and around tail-head. In fact, "rounds" or "pones" beginning to be obvious. Some fat around vulva and in crotch.	
	8	**Fat** Cow very fleshy and over-conditioned. Spinous processes almost impossible to palpate. Cow has large fat deposits over ribs and around tail-head, and below vulva. "Rounds" or "pones" are obvious.	
	9	**Extremely fat** Cow obviously extremely wasty and patchy and looks blocky. Tail-head and hips buried in fatty tissue and "rounds" or "pones" of fat are protruding. Bone structure no longer visible and barely palpable. Animal's mobility might even be impaired by large fatty deposits.	

Made available by:
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Body Condition Scoring of Cows

EXTENSION

September 2021

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Condition Scores

The body condition scoring (BCS) system is used to assess body energy stores in beef cows. Energy stores are reflected primarily by the relative amount of fat available to metabolize as an energy source. When dietary energy is inadequate to meet the animal's energy need, fat is mobilized along with some muscle and organ tissue. Said another way, when cows lose weight, they burn fat and some protein tissue (muscle and organ weight). When cows gain weight, they gain primarily fat tissue with minimal gain in protein tissue.

Body condition is important because there is a close relationship between BCS at calving and the first 90 days after calving to reproductive success. In addition, cow body condition influences the calf's ability to develop a strong immune system.

Current BCS is a snapshot in time of the balance between recent nutrient supply and recent nutrient requirements. Many different management factors influence this balance of supply vs demand. Overgrazing, for example, often leads to a situation where inadequate nutrient supply is available to meet the animal's requirements, eventually leading to weight loss. Body condition is a good reflection of the match or mismatch of a cow's genetic potential to the forage and management system.

The BCS system used for beef cows range from 1 to 9, with a score of 1 reflecting cows that are emaciated and a score of 9 reflecting cows that are obese. Thin cows should receive a lower score and fat cows should receive a higher score. A description of each score follows and the appearance of key areas of the body are provided in Figure 1.

Cattle descriptions by the nine condition scores are:

BCS 1. The cow is severely emaciated and physically weak with all ribs and bone structure easily visible. Cattle in this score are extremely rare and are usually inflicted with a disease and/or parasitism.

BCS 2. (Figure 2) The cow appears emaciated, similar to BCS 1, but not weakened. Muscle tissue seems severely depleted through the hindquarters and shoulder.

BCS 3. (Figure 3) The cow is very thin with no fat on ribs or in brisket and the backbone is easily visible. Some muscle depletion appears evident through the hindquarters.

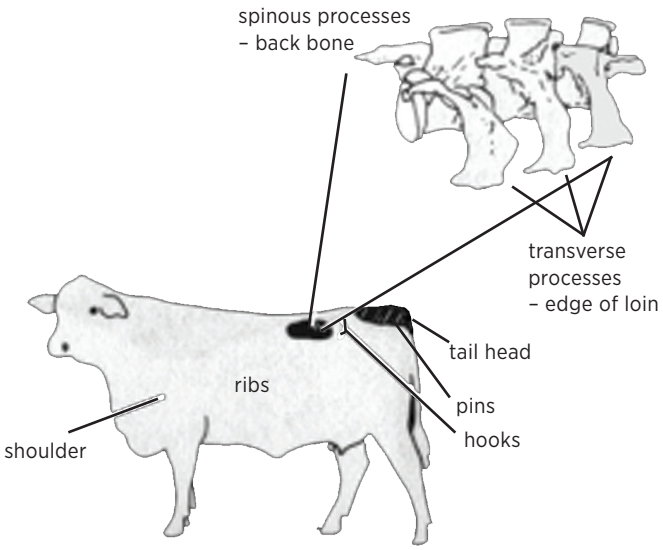

Figure 1. Key areas to examine for body condition scoring.

BCS 4. (Figure 4) The cow appears slightly thin, with several ribs easily visible and the backbone showing. The spinous processes (along the edge of the loin) are still sharp and barely visible individually. Muscle tissue is not depleted through the shoulders and hindquarters.

BCS 5. (Figure 5) The cow may be described as moderate to thin. The last two ribs can be seen and little evidence of fat is present in the brisket, over the ribs or around the tail head. The spinous processes are smooth and difficult to identify.

BCS 6. (Figure 6) The cow exhibits a smooth appearance throughout. Some fat deposition is present in the brisket and over the tail head. The back appears rounded and fat can be palpated over the ribs and pin bones.

BCS 7. (Figure 7) The cow appears in very good flesh. The brisket is full, the tail head shows pockets of fat and the back appears square due to fat. The ribs are not visible and appear smooth due to fat cover.

BCS 8. The cow is obese. Her neck is thick and her back appears flat or square due to excessive fat. The brisket is distended and large pockets of fat are evident around the tail head.

Figure 2. BCS 1.

Figure 3. BCS 3.

Figure 4 BCS 4.

BCS 9. These cows are extremely obese and may have problems with mobility due to excessive weight and restriction of limbs. The animal's topline will be square and flat with large dimples or pockets due to excessive fat cover. The front leg set will be wide due to a bulging brisket. The entire underline will bulge with fat, including the udder and naval. The tail head will not be visible as it will be covered in a large mass of fat.

When condition scoring cows, the technician should disregard (or look beyond) age, frame size, rib depth, body length, pregnancy status and hair coat. Condition scoring is

Figure 5. BCS 5.

Figure 6. BCS 6.

Figure 7. BCS 7.

intended to provide a consistent system to quantify relative fatness regardless of these other factors that create differences in cows' appearance.

There is a strong relationship between weight and body condition score. For each one-unit change in BCS, cows should gain or lose approximately 7% of their BCS-5 weight (NASEM, 2016). For example, a cow that weighs 1,200 pounds when she is in BCS 5 should reach a BCS 6 at 1,284 pounds and a BCS 4 at 1,116 pounds.

Why Body Condition is Important

One of the major constraints in the improvement of reproductive efficiency of beef cows is the duration of the post-calving anestrous period. If cows are to maintain a calving interval of one year, they must conceive within 80 days to 85 days after calving. Body condition at calving time determines the rebreeding performance of beef cows in the subsequent breeding season to a great extent (Selk).

Figure 8 represents the rebreeding percentage of six research herds in four states and includes mature as well as young cows. It clearly shows the body condition at calving greatly determines the rebreeding percentage of cows during the subsequent 60- to 90-day breeding season. Based on research with mature and young cows, those maintaining body weight, therefore, having ample energy reserves before parturition, exhibited estrus sooner than cows that lost considerable body weight and consequently had poor energy reserves. Body weight change during pregnancy is confounded with embryo and placenta growth. Therefore, the estimation of body fat by use of body condition scores is more useful in quantifying the energy status of beef cows. The numeric system of body condition scoring is an excellent estimator of percentage body fat in beef cows. Body condition score accounted for 85% to 91% of the variation in stored body energy (percent fat) in cows.

The processes of fetal development, delivering a calf, milk production and repair of the reproductive tract all are physiological stresses. These stresses require the availability and utilization of large quantities of energy to enable cows to be rebred in the required 85 days. Add to these physiological stresses the environmental stress of cold, wet weather on spring calving cows and the nutritional stress of energy intake that is below body maintenance needs. As the intake falls short of the energy utilized, the cow compensates by mobilizing stored energy or adipose tissue, and through a period of several weeks, a noticeable change in the outward appearance of the cow takes place.

This is a change in the body condition and can be monitored by assigning body condition scores to cows and quantifying the degree of change. Cows in a thin body condition at calving return to estrus slowly. Postpartum increases in energy intake can modify the length of the postpartum interval. However, increases in the quality and quantity of feed to increase postpartum body condition can be very expensive.

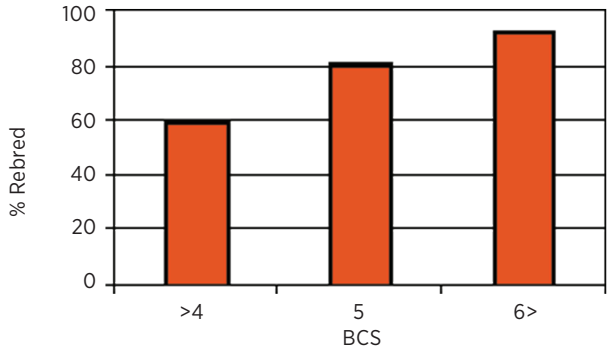

Figure 8. Percent rebred at next breeding season per day, according to body condition at calving (summary of six trials in four states) BCS 4 or less, BCS 5, BCS 6 or more. Source: Field and Sands.

Improvement in reproductive performance achieved by expensive postpartum feeding to thin cows may not be adequate to justify the cost of the additional nutrients. Oklahoma scientists used 81 Hereford and Angus x Hereford heifers to study the effects of body condition score at calving and postpartum nutrition on rebreeding rates at 90 days and 120 days postpartum (Bell et al.). Heifers were divided into two groups in November and allowed to lose body condition or maintain body condition until calving in February and March. Each of those groups was then divided and fed to gain weight and body condition postpartum or to maintain body condition postpartum.

Figure 9 illustrates the change in body weight of heifers that calved with a greater than BCS 5, or those that calved with a BCS less than or equal to 4.9. The same pattern has been illustrated in the other experiments is manifest clearly with these heifers. Thin heifers that were given ample opportunity to regain weight and body condition after calving actually weighed more and had greater body condition by eight weeks than those heifers that had good body condition at calving and maintained their weight through the breeding season. However, the rebreeding performance (on the right side of the legend of the graph) was significantly lower for those that were thin (67%) at parturition compared to heifers that were in adequate body condition at calving and maintained condition through the breeding season (91%). Postpartum increases in energy therefore, weight and body condition gave a modest improvement in rebreeding performance, but the increased expense was not adequately rewarded. The groups that were fed to maintain postpartum condition and weight received 4 pounds of cottonseed meal supplement (41% crude protein; $.13 per pound) per day.

The supplement cost for the 69-day feeding period was approximately $36 per cow. The cows in the gain groups were fed 28 pounds of a grain mix (12% CP; $.073 per pound) at a total supplement cost of $141. Both groups had free choice access to grass hay (Wettemann). The improvement in reproductive performance (67% pregnant versus 36% pregnant) of the thin 2-year-old heifers was not enough to offset the large investment in feed costs in most cases.

Other data sets have shown conclusively cows that calve in thin body condition, but regain weight and condition going

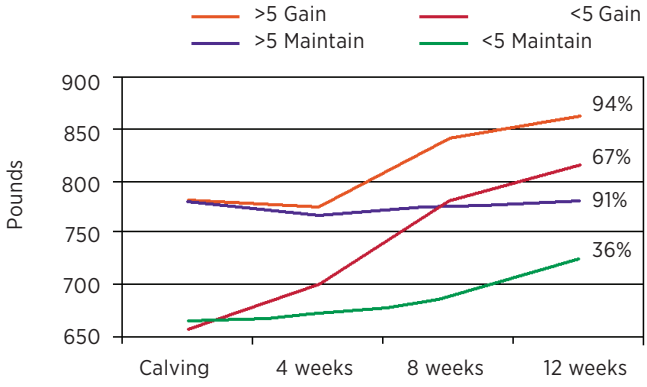

Figure 20.9. Postpartum body weight of heifers with body condition less than 5 or greater than or equal to 5 at calving and fed to gain or maintain weight. Pregnancy rates are indicated on the right side of the legend. Source: Bell et al.

into the breeding season, do not rebreed at the same rate as those that calve in good condition and maintain that condition into the breeding season. Table 1 from Missouri researchers illustrates the number of days between calving to the return to heat cycles depending on body condition at calving and body condition change after calving.

This data clearly shows young cows that calve in thin body condition (BCS 3 or BCS 4) cannot gain enough body condition after calving to achieve the same rebreeding performance as cows that calve in moderate body condition (BCS 5.5) and maintain or lose only a slight amount of condition.

Cows must be rebred by 85 days after calving to calve again at the same time the next year. Notice that none of the averages for cows that calved in thin body condition were recycling in time to maintain a 12-month calving interval.

Table 1. Predicted number of days from calving to first heat as affected by body condition score at calving and body condition score change after calving in young beef cows. (body condition score scale : 1 = emaciated; 9 = obese).

BCS at calving	*Condition score change after calving to day 90*						
	-1	-0.5	0	0.5	1	1.5	2
3	189	173	160	150	143	139	139
4	161	145	131	121	115	111	111
5	133	116	103	93	86	83	82
5.5	118	102	89	79	72	69	66

Source: Lalman et al.

Conclusion

Producers should manage their calving season, genetics, grazing system, supplementation program and herd health to achieve herd average BCS of 5 to 6 in mature cows at calving time and BCS 6 in first-calf heifers at calving time. Subsequently, producers should manage their operation with the goal of minimizing the amount of weight and BCS loss between the time of calving and breeding. Early management to meet these goals are important because drastic changes in BCS during late-pregnancy and early lactation are extremely difficult and costly to achieve.

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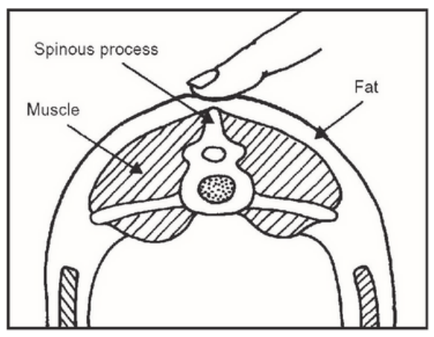
BARN STANDARDS

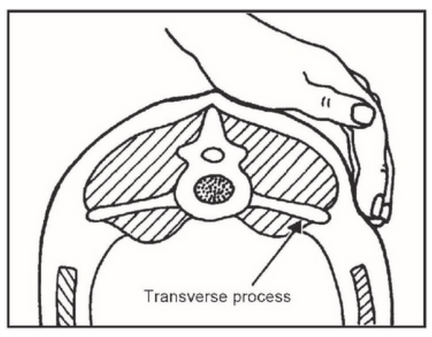
EWE BODY CONDITION SCORE

PROCEDURES TO ASSIGN BCS

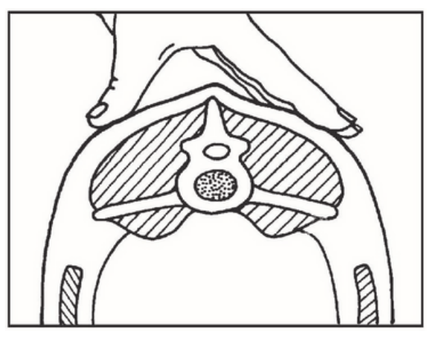
The BCS estimates the conditioning of muscling and fat development. Scoring is based on handling the animal to determine the extent of muscling and fat deposition over and around the vertebrae in the loin region. When handling ewes to assign a BCS make sure each ewe is standing on a level surface in a relaxed manner. For more details consult UK Publication ASC-228



Feel for the spine in the center of the sheep's back, behind its last rib and in front of its hip bone.

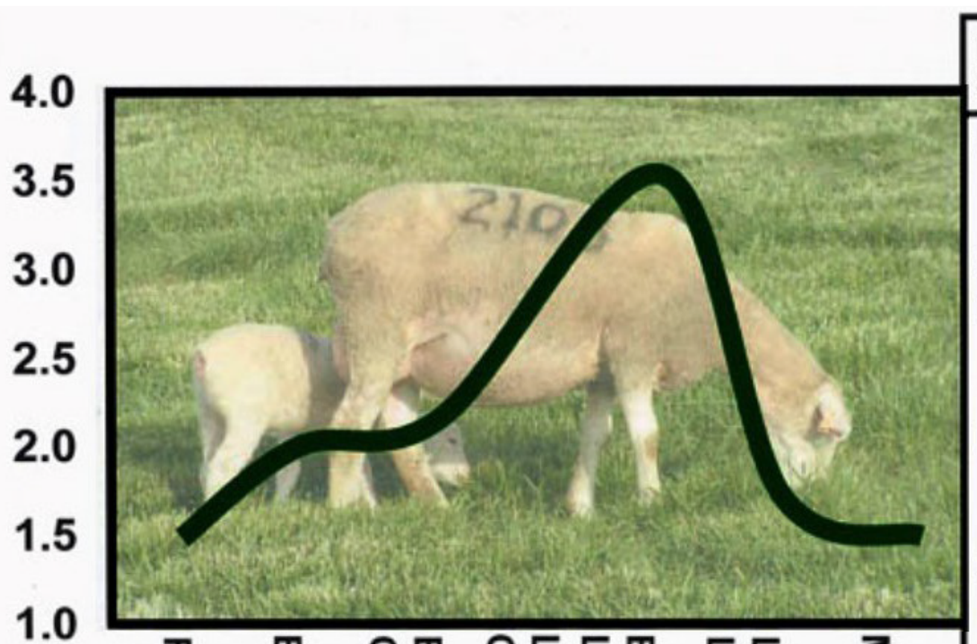


Feel for the tips of the transverse processes.



Feel for fullness of muscle and fat cover.

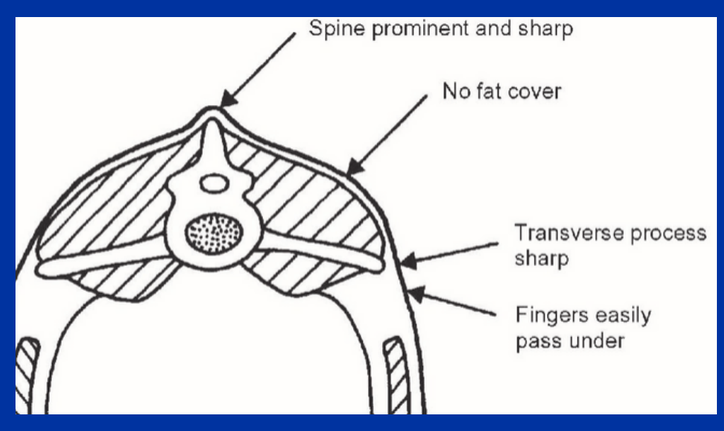
EWE BCS CHANGES THROUGHOUT PRODUCTION CYCLE



Production Stage	Condition Score
Flushing	
Enter	1½ - 2
Leave	2 - 2½
Breeding	2 - 2½
Early gestation	
Enter	2 - 2½
Leave	3
Late gestation	
Enter	3
Leave	3½ - 4
Lactation	
Enter	3½ - 4
Leave	1½ - 2
Maintenance	1½ - 2

BCS SCORES

1



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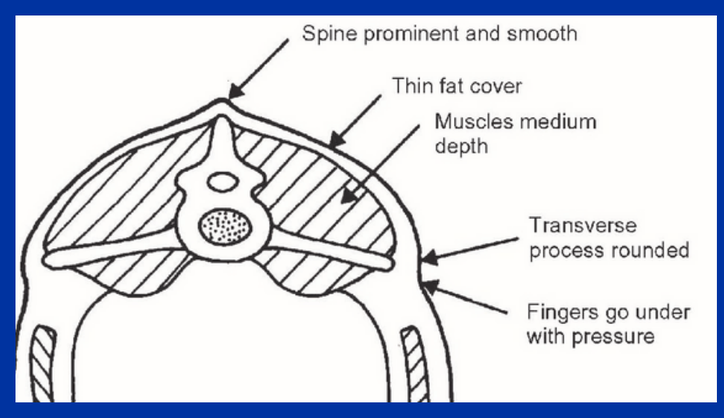

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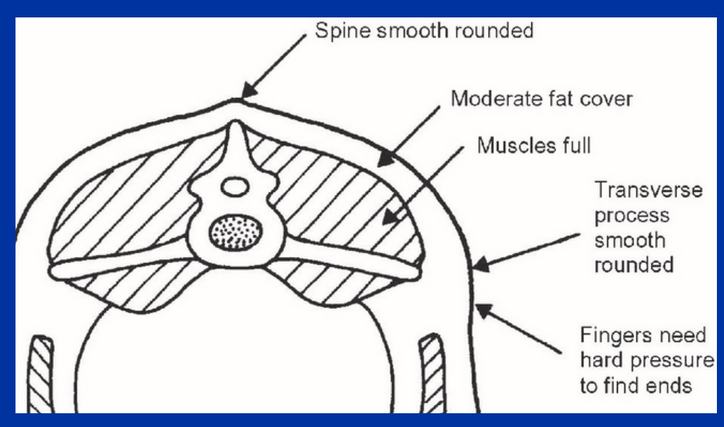

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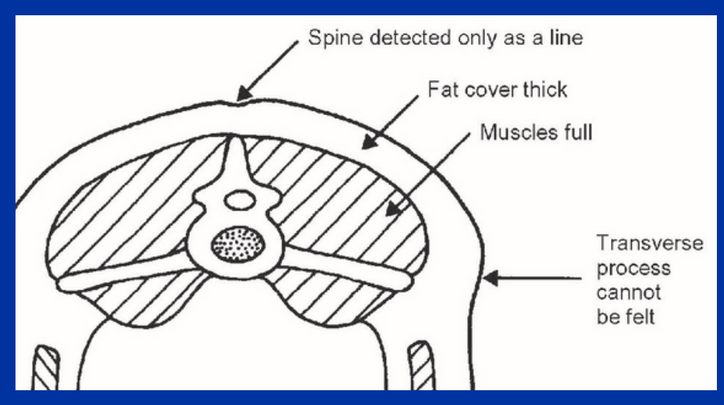

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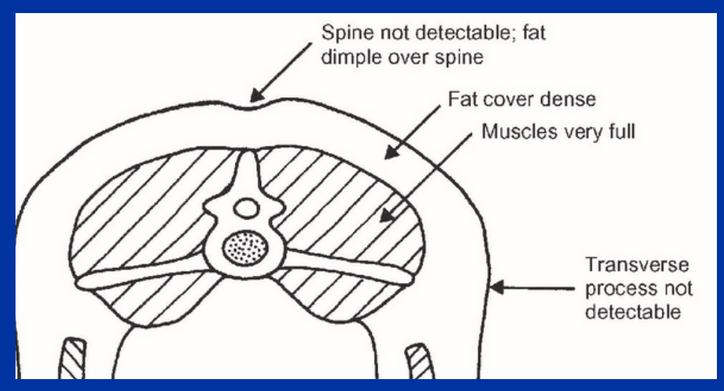

University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service

ASSEMBLED BY THE CALLOWAY COUNTY EXTENSION OFFICE

Figures, tables, and information taken from UK Publication ASC-228 Body Condition Scoring Ewes, Donald G. Ely and Debra K. Aaron

ASC-228

University of Kentucky
College of Agriculture,
Food and Environment
Cooperative Extension Service

Body Condition Scoring Ewes

Donald G. Ely and Debra K. Aaron, Animal and Food Sciences

Introduction

Body condition scoring is a system of classifying breeding ewes on the basis of differences in body fat. While it is subjective, with practice it can be accurate enough to indicate the nutritional status of individual ewes as well as the entire flock. Thus, it allows the shepherd to identify, record, and adjust the feed intake of ewes determined to be thin, in average flesh, or fat. In the long run, this can save money for producers and/or prevent problems attributable to ewe condition.

Scoring System

Body condition scores (BCS) change during the year as ewes progress through each stage of production: flushing/breeding, early gestation, late gestation, parturition, early lactation, and late lactation. Weight at a given stage of production is the best indicator of whether ewes are too thin, too fat, or just right to do the job to the best of their abilities. However, mature weights vary among individuals and breeds, making it difficult to use weight to determine the correct body condition for a specific stage of production. Body condition scoring describes the condition of ewes, is convenient, and is more accurate than a simple eye appraisal.

Condition scores for ewes range from 1.0 to 5.0. A score of 1.0 represents the thinnest animals and a score of 5.0 represents the fattest. Usually, 90 percent of the ewes in a flock fall within BCS of 2, 3, and 4. Half scores are often used to improve the evaluation process. Then, the range of scores expands to 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, and 5.0. The intermediate half scores are helpful when an animal's condition is not totally clear (3.0 vs 3.5). Determining an exact BCS is probably not as important as assigning a relative score. For example, a BCS of 3.0 compared to 3.5 is not a big difference, but the difference between a 2.5 and a 4.0 is significant.

Procedures

The BCS estimates the conditioning of muscling and fat development. Scoring is based on handling the animal to determine the extent of muscling and fat deposition over and around the vertebrae in the loin region (Figures 1, 2, and 3).

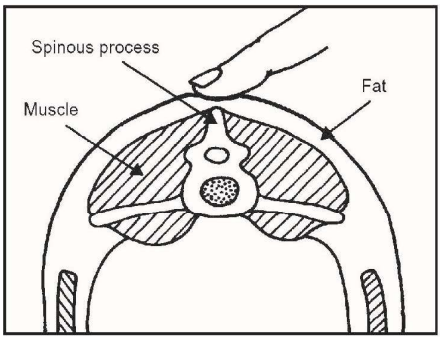

Figure 1. Feel for the spine in the center of the sheep's back, behind its last rib and in front of its hip bone.

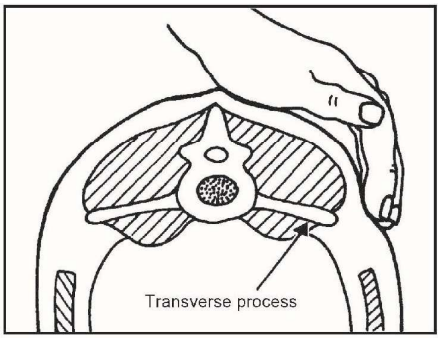

Figure 2. Feel for the tips of the transverse processes.

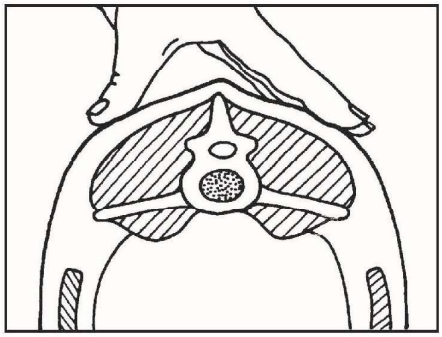

Figure 3. Feel for fullness of muscle and fat cover.

In addition to the central spinal column, loin vertebrae have a vertical bone protrusion on each side (transverse process). Both of these protrusions are palpated and used to assess an individual BCS. See Figures 1, 2, and 3 for photos showing handling of the spinal column, the loin vertebrae, and the ribs of ewes.

When handling ewes to assign a BCS, make sure each ewe is standing on a level surface and in a relaxed manner. Using your fingers (held together) and thumb, determine the sharpness of the spine behind the last rib and in front of the hip bone (Figure 1). Determine the sharpness of the transverse processes at the same time (Figure 2). In addition, it may be helpful to determine the extent of fat covering over the foreribs because, in many instances, the handler may find sharpness over the spine (condition score 2.0) but will find fat over the ribs (condition score 4.0 as illustrated in Figure 4).

Figure 4. BCS 4.0 for the ewe on left compared to 2.0 for the ewe on the right.

Then, one must arrive at an average for an overall BCS. After all points have been evaluated, assign an overall score according to Table 1. Diagrams of the five whole numbers are described in Figures 5 through 9.

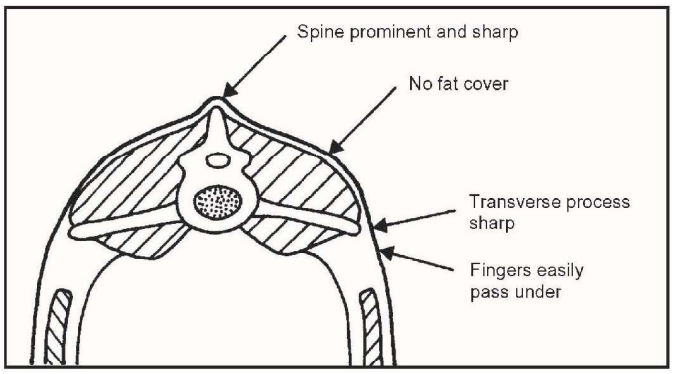

Figure 5. Condition Score 1 (Emaciated). Spinous processes are sharp and prominent. Loin eye muscle is shallow with no fat cover. Transverse processes are sharp; one can pass fingers under ends. It is possible to feel between each process.

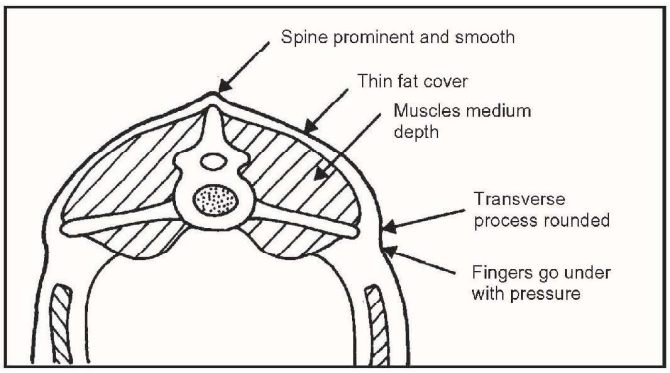

Figure 6. Condition Score 2 (Thin). Spinous processes are smooth and prominent. Loin eye muscle has little fat cover but is full. Transverse processes are smooth and slightly rounded. It is possible to pass fingers under the ends of the transverse processes with a little pressure.

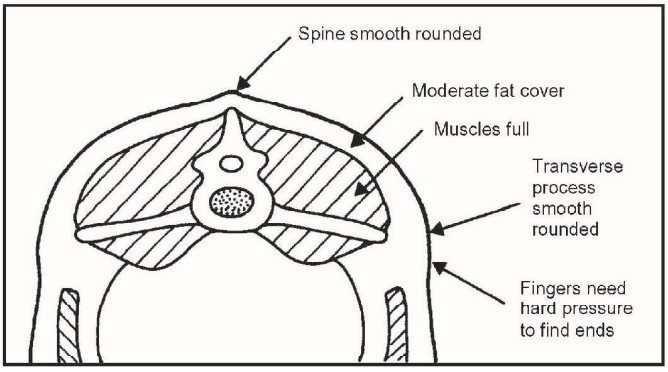

Figure 7. Condition Score 3 (Average). Spinous processes are smooth and rounded, and one can feel individual processes only with pressure. Transverse processes are smooth and well covered, and firm pressure is needed to feel over the ends. Loin eye muscle is full with some fat cover.

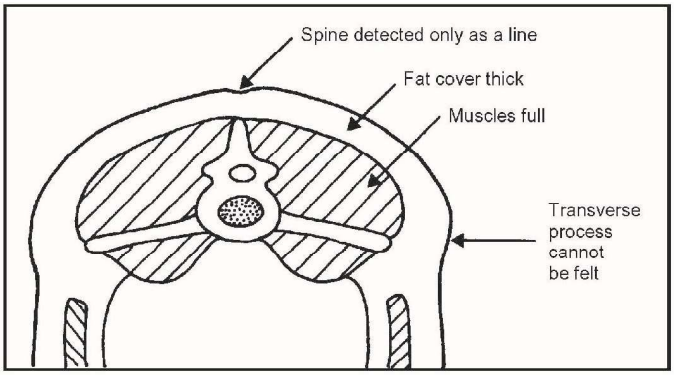

Figure 8. Condition Score 4 (Fat). Spinous processes can be detected only with pressure as a hard line. Transverse processes cannot be felt. Loin eye muscle is full with a thick fat cover.

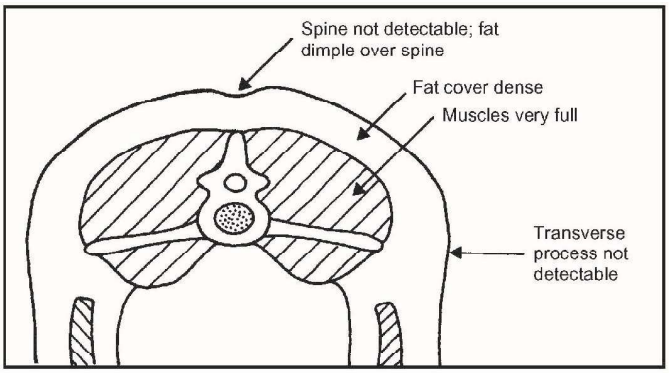

Figure 9. Condition Score 5 (Obese). Spinous processes cannot be detected. There is a depression (dimple) where spine would normally be felt. Transverse processes cannot be detected. Loin eye muscle is very full with a very thick fat cover.

Table 1. Condition Scoring Ewes

Point of Evaluation	Score				
	1	2	3	4	5
Spine	Prominent, sharp	Prominent, smooth	Smooth, rounded	Detected only as a line	Not detectable
Fat cover	None	Thin	Moderate	Thick	Dense
Transverse processes	Prominent, sharp	Prominent, rounded	Smooth, rounded	Not detected	Not detected
Foreribs	Prominent	Prominent with slight covering	Smooth indentation	Slight detection	Smooth, not detected

With increased experience, the BCS might be assessed visually. Certainly this method is less time consuming and minimizes physical labor. But as wool cover, and to some extent hair cover, increases, the accuracy and precision of visual appraisal becomes more difficult. Figure 10 shows the points of visual evaluation.

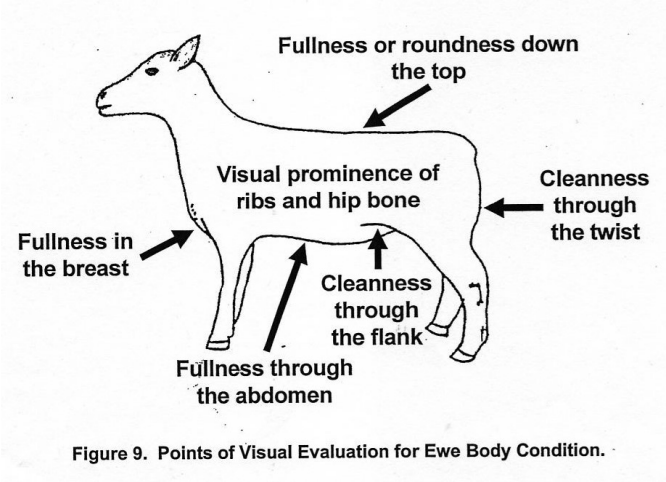

Figure 10. Points of visual evaluation for ewe body condition.

Some of these differ from those of the "hands-on" method because they can be appraised with the naked eye. If visual appraisal is to be used, make sure the end results of both methods are the same.

Changes during the Year

Figure 11 shows how BCS fluctuates during stages of production during a 12-month period (one lamb crop per year). The periods during the year when BCS is most important are flushing/breeding, late gestation, early lactation, and maintenance. On average, a difference of 1.0 BCS is equivalent to 13 percent of the live weight of a ewe with a 3.0 BCS. Thus, a ewe with a maintenance weight of 150 pounds needs to gain 20 pounds to increase her BCS from 2.5 to 3.5.

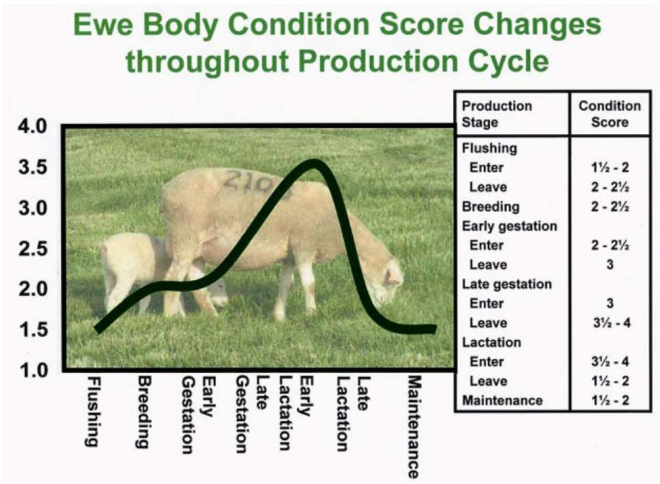

Figure 11. Ewe body condition score changes throughout production cycle

Fat ewes (BCS 4 and 5) may not cycle during breeding. If they do cycle, ovulation rates may be low. To gain a benefit from nutritional flushing, and ultimately lambing rate, ewes must have less than a 3.0 BCS at flushing. Excessively thin ewes (BCS 1.0 to 1.5) may have similar problems. If ewes have a BCS of 3, 4, or 5 as early as 6 weeks before flushing, reduce their feed intake so they will be 1.5 to 2.0 at the beginning of flushing. On the other hand, if they are 1.0 to 1.5, increase intake for 6 weeks prior to flushing, throughout the flushing period, and for 3 weeks into the breeding

season. Optimum BCS during flushing/breeding is 1.5 to 2.5. Body condition score should gradually increase from flushing/breeding, through early gestation (first 110 days) to 3.0 at the beginning of late gestation (last 4 to 6 weeks). A feeding program should be developed that will promote enough gain so ewes will have a 3.5 to 4.0 BCS at lambing. Typically, ewes lose weight during lactation even though they are fed large amounts of high-quality diets. Average BCS of ewes at the end of early lactation (60 days postpartum) can be as low as 1.5 to 2.0. After weaning, nonpregnant and nonlactating ewes can gain significant condition from pasture alone. During this period shepherds must manage pastures so ewes do not become too fat, remembering they should enter the next flushing/breeding season with BCS between 1.5 and 2.5. A proposed stocking rate to maintain a BCS of 1.5 to 2.5 for dry, open ewes at maintenance is presented in Table 2.

Summary

Condition scoring is a valuable management tool that should be performed regularly before flushing/breeding, late gestation, early lactation, and maintenance phases of the annual production year of ewes. Condition scoring allows shepherds to improve flock management, reduce feed costs, and limit health/performance problems resulting from improper nutrition. Flock management is improved because ewes can be grouped into different feeding programs based on their needs. Ultimately, the annual feeding program becomes more economically efficient.

Table 2. Proposed Stocking Rates for Dry, Open Ewes at Maintenance [a,b]

	Grass [c]	
Month	OG/F	BG
April	6 to 15	2 to 4
May	16 to 30	4 to 10
June	20 to 25	13 to 20
July	13 to 16	13 to 16
August	0 to 8	0 to 3
September	8 to 15	3 to 6
October	16 to 20	5 to 8
November	3 to 6	0 to 2

[a] Dry, open ewes at maintenance; number of ewes per acre.
[b] Assuming a mature ewe weight of 150 lb and a daily dry matter consumption of 2.0% of body weight (3.0 lb dry matter intake per head per day).
[c] OG = orchardgrass; F = fescue; BG = bluegrass

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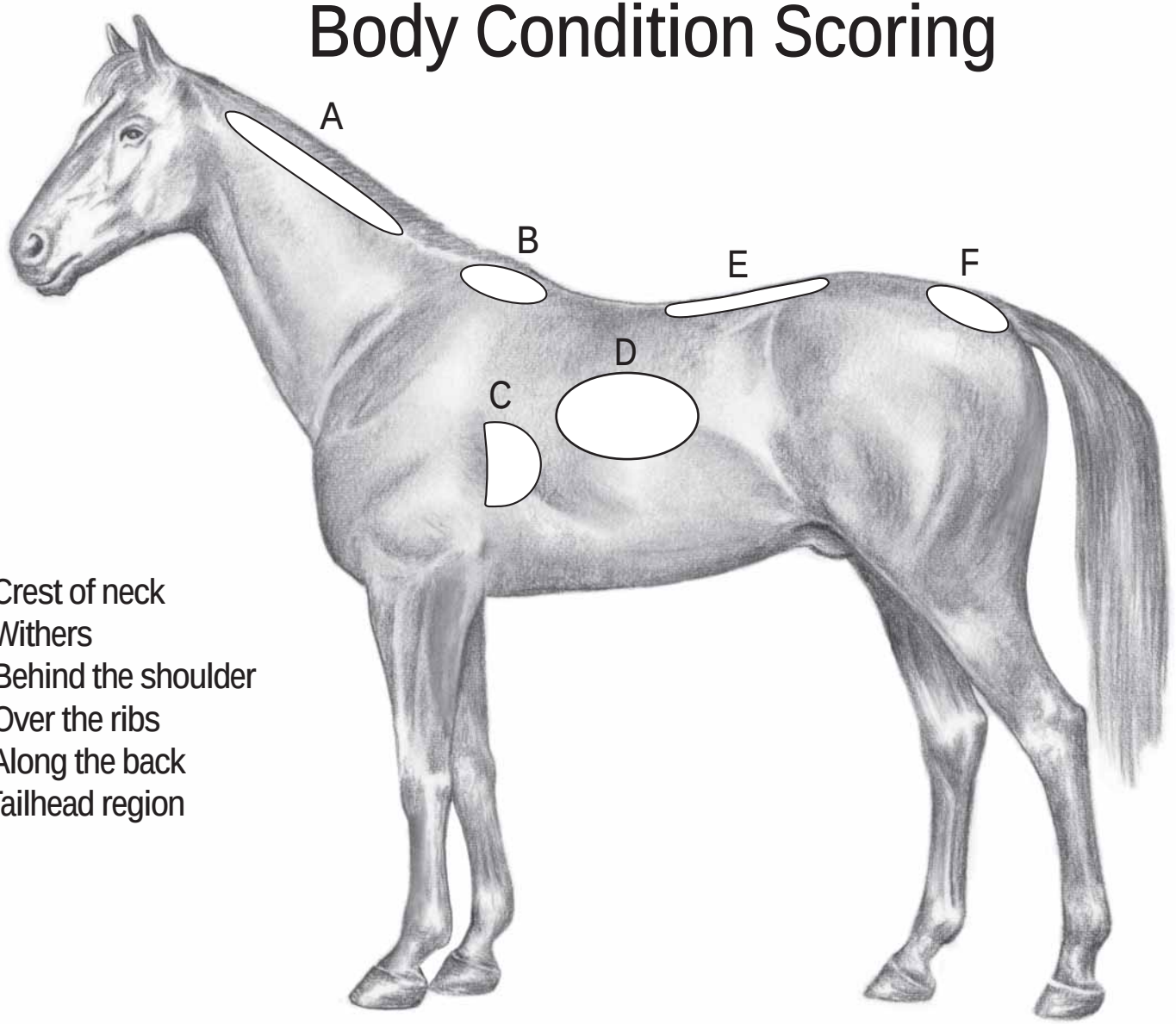
Virginia-Maryland Regional College of Veterinary Medicine

Virginia Cooperative Extension

Body Condition Scoring



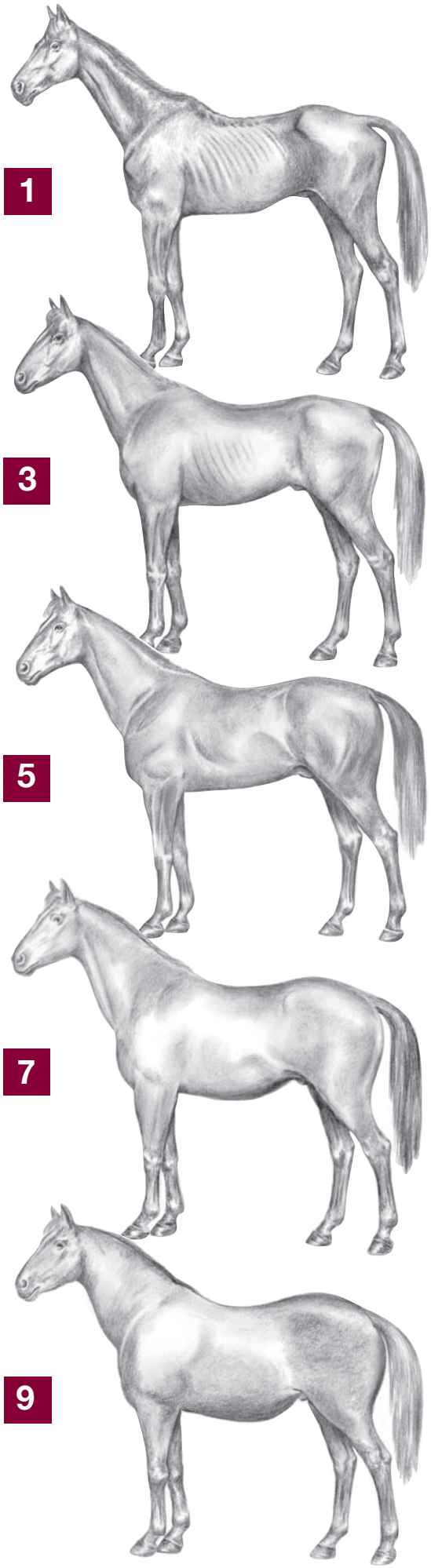
A. Crest of neck
B. Withers
C. Behind the shoulder
D. Over the ribs
E. Along the back
F. Tailhead region

Virginia-Maryland Regional College of Veterinary Medicine

Description of Body Condition Scores (Scores 1-9)

1. Poor: Horse is extremely emaciated. Backbone, ribs, hipbones, and tailhead project prominently. Bone structure of the withers, shoulders, and neck are prominent. No fatty tissues can be felt.
2. Very Thin: Horse is emaciated. Slight fat covering over vertebrae. Backbone, ribs, tailhead, and hipbones are prominent. Withers, shoulders, and neck structures are discernible.
3. Thin: Fat built up about halfway on vertebrae. Slight fat layer can be felt over ribs, but ribs easily seen. The tailhead is prominent, but individual vertebrae cannot be seen. The hipbones, withers, shoulders, and neck structures are faintly discernable.
4. Moderately Thin: Slight ridge along back. Faint outline of ribs can be seen. Fat can be felt around tailhead. Hip bones not obviously discernable. Withers, neck, and shoulders not obviously thin.
5. Moderate: Back is level. Ribs can be easily felt, but not seen. Fat around tailhead beginning to feel spongy. Withers are rounded and shoulders and neck blend smoothly into the body.
6. Moderately Fleshy: May have a slight crease down the back. Fat around the tailhead feels soft. Fat over the ribs feels spongy. Fat beginning to be deposited along the sides of the withers, behind the shoulders, and in the crest of the neck.
7. Fleshy: May have a crease down the back. Individual ribs can be felt, but noticeable fat deposition over the ribs. Fat around tailhead is soft. Noticeable fat deposited along the withers, behind the shoulders, and in the crest of the neck.
8. Fat: Crease down the back is prominent. Ribs difficult to feel. Fat around tailhead prominent. Area along withers filled with fat. Area behind shoulders filled with fat. Prominent crest of neck. Fat deposited along the inner buttocks.
9. Extremely Fat: Obvious crease down back. Fat is in patches over rib area, with buldging fat over tailhead, withers, neck, and behind shoulders. Very prominent crest of neck. Fat along inner buttocks may rub together. Flank is filled in flush with the barrel of the body.

Adapted from Henneke *et al*, 1983



Virginia Cooperative Extension

Equine Welfare Series

THE BODY CONDITION SCORING SYSTEM

Jennie L. Ivey, PhD, PAS, Assistant Professor
Department of Animal Science

Maintaining proper equine health requires a combination of proper nutrition, including access to feed and water, adequate shelter, and quality care. For those managing and/or owning horses it is important to periodically evaluate management practices to ensure the well-being of each horse. A horse's body weight can fluctuate due to season, food availability, changes in exercise, reproductive activities, parasites and dental problems. Also, body weight can affect reproductive capabilities, ability to do work, and overall health status. Identifying animals that are extremely over- or underweight can be relatively easy; however, identifying body condition of horses in-between can be challenging.

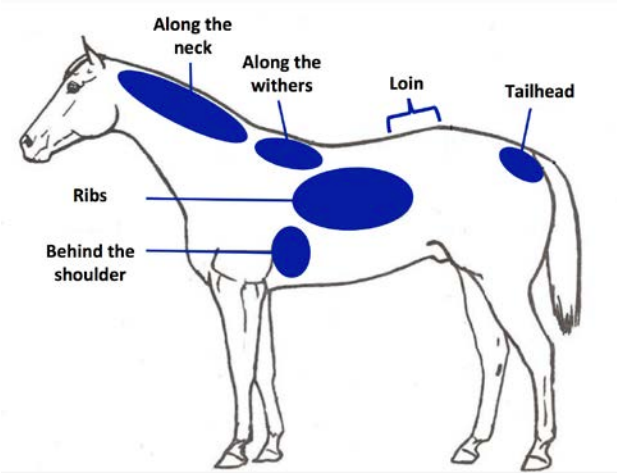


Figure 1: Regions of importance for body condition scoring. Assessment of body condition score (BCS) should be evaluated at the tailhead, loin, ribs, behind the shoulder, and along the wither and neck on both sides of the horse. Determination of fat coverage in each area should be made by visually observing and touching each area.

How do I evaluate my horse's body condition?

Body condition scoring is a useful tool in assessing and managing body weight of horses. Developed by Dr. Don Henneke and colleagues in 1983 as a tool to accurately assess stored body fat in horses, the body condition scoring system has become standard for evaluating equines across breed and age. Using this technique is relatively straightforward yet does require some basic knowledge of horse anatomy and conformation. The body condition score (BCS) utilizes predictable patterns of fat deposition and removal over certain areas during the course of weight gain or loss.

By evaluating six specific regions including the neck, withers, ribs, behind the shoulder, loin and tailhead, determination of overall body condition can be made (Figure 1). Visual and tactile evaluation (touch, palpation) of these areas on both sides of the horse is very important, as it is often difficult to determine the amount of fat coverage without touching each area. Visual examination alone can be used to determine BCS if close proximity to the horse is not possible. After assessment, a numerical value ranging from 1 (emaciated) to 9 (obese) is then assigned based on combined total fat coverage in each of these areas (Table 1). Half scores can be assigned if a horse falls in- between condition classifications. A horse's BCS should be evaluated every four to six weeks as healthy changes in body weight are achieved over time.

*Table 1: Description of individual body condition scores**

Score	Condition	Description
1	Poor	The horse is extremely emaciated. Ribs, tailhead, backbone (spinous and transverse process) and hip bones project prominently. Bone structure of the neck, withers, and shoulder are easily noticeable. No fatty tissues can be felt.
2	Very Thin	The horse is emaciated. A slight fat covering over the vertebrae is present. Ribs, backbone (spinous and transverse process), hips and tailhead are prominent. Neck, shoulders and withers are discernable.
3	Thin	Fat built up about halfway on vertebrae (spinous process can still be felt). Tailhead evident, but individual vertebrae cannot be seen. Slight fat cover over ribs. Hip bones appear rounded but are still noticeable. Withers, shoulders and neck are emphasized.
4	Moderately Thin	Negative crease along back. Faint outline of ribs is noticeable. Fat can be felt around tailhead, prominence is dependent on conformation. Hip bones cannot be seen. Neck, withers and shoulders are not obviously thin.
5	Moderate	Back is level. Ribs are not easily seen but can be felt. Tailhead fat feels spongy. Hip bones are not noticeable. Withers, neck and shoulders are not obviously thin.
6	Moderately Fleshy	Slight crease down back may be present. Fat over ribs can be felt and tailhead fat feels soft. Fat beginning to be deposited on sides of withers, behind shoulders and along the neck.
7	Fleshy	May have crease down back. Individual ribs can be felt, but fat filling between ribs is noticeable. Tailhead fat is soft. Fat deposited along withers, behind shoulder and along the neck.
8	Fat	Crease down back. Difficult to feel ribs. Fat around tailhead is very soft. Areas along withers and behind shoulder are filled with fat. Thickening of neck is noticeable. Fat deposited along inner thigh.
9	Extremely Fat	Obvious crease down back. Patchy fat appearing over ribs. Fat bulging around tailhead, along neck, behind shoulder and along wither. Flank filled with fat. Inner thighs may rub together.

**When assessing the tailhead, loin, ribs, behind the shoulder, along the withers and neck, classify where each region falls in relationship to the score description. Select which score best represents the condition of the horse currently. Half scores can be assigned if the horse falls between classification descriptions.*

Adapted from Henneke, et al., 1983.

What BCS should my horse have?

Originally it was recommended to maintain horses at a body condition score of 5; however, different scenarios can influence how each horse should be conditioned. Depending on the horse's intended use, such as breeding status or level of activity, a different body condition may be more ideal than another. A BCS range between 4 and 7 is reasonable when consideration is given to various factors. For example, pregnancy and lactation require increased energy reserves compared to maintenance levels. Mares entering the breeding season or foaling in low body condition have been found to display low conception rates and require more cycles to achieve a viable pregnancy than horses in a heavier condition.

Body condition scores of either extreme should be avoided. When horses exert energy levels above their dietary intake, or experience long periods of stress, the body will begin to burn fat stores for energy. At a BCS of 3 or less, there is very little body fat to spare so muscle protein is broken down to supply the horse with energy during times of need. Low temperatures or extreme weather conditions can also cause a horse to burn more calories than normal. In these instances, it is recommended to have horses at a higher condition prior to periods of high-energy expenditure in order to prevent reaching a BCS of 3 or below. Elderly horses should also be maintained with care, as a low BCS can be much more difficult to correct in a geriatric animal. Horses with a body condition greater than 7 are also predisposed to various health problems including colic, laminitis (founder) and endocrine imbalances.

Practice Makes Perfect

Using the BCS system often is the best way for evaluators to become consistent and accurate with the evaluation methods. Look at the images in Figure 2 to practice implementing the BCS system.

Figure 2: BCS Examples

A 

B 

C 

Horse A *is a BCS of 1. The horse is extremely thin and the ribs, tailhead, backbone and hip bones project prominently. Bone structure of the withers and shoulders are easily noticeable.*

Horse B *is a BCS of 5. The back is level and the ribs are not easily seen. The hip bones are not noticeable, and the shoulders, withers and neck are not visually thin.*

Horse C *is a BCS of 8. The areas along withers and behind shoulder are filled with fat. Thickening of neck is noticeable and an enlarged crest is displayed. A crease down the back is present.*

BCS Troubleshooting: Tips for Accurate Assessment and Correcting BCS

- Make sure to evaluate all areas of the horse equally as not all horses have the same proportions. Similarly, breed differences also occur and it is important to consider nutritional status of the entire animal, not just one region.
- Horses should not be excessively thin or enormously overweight. Each extreme can cause health problems and should be avoided.
- While using BCS is helpful to determine nutritional status of the horse, it is not an indicator of physical fitness. Other methods can be used to estimate cardiovascular fitness or athletic conditioning.
- Horses will have a longer hair coat in the winter and often appear heavier than they are. Make sure to use palpation to feel for fat covering in the appropriate areas as overestimation can occur when only using visual assessment.
- Increases or decreases to a horse's condition can be made safely through gradual changes in a feeding program. To change one condition score (for example, to take a horse from a BCS of 4 to 5) a gain or loss of approximately 35 to 44 pounds is needed but the exact value can vary with the mature size of the horse (NRC 2007). A horse can safely gain or lose one BCS over the course of 4 to 6 weeks. Be sure to consider a horse's age, health and need for weight change before implementing new feeding practices. Seek assistance from an extension specialist or county agent regarding any questions.
- Take into account age, reproductive status and overall health while body condition scoring. For example, mares in late gestation will often develop a large, pendulous belly. Similarly, horses with intestinal parasites also can display a rounder, distended abdomen. If you have any concerns regarding your horse's health, contact your veterinarian.

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THE SAMUEL ROBERTS NOBLE FOUNDATION

AG News and Views

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LIVESTOCK

Manure scoring determines supplementation needs

by Robert Wells / rswells@noble.org

By October, winter is just a few pages away on the calendar. With the change in season and forages entering dormancy comes the need to pay closer attention to your supplementation strategy to ensure cows do not lose body condition.

The perennial question of "How can you keep a cow from losing condition without overfeeding her?" can be answered fairly accurately by looking at the manure pat. When combined with other estimates such as forage availability and quality, a diet can be quickly changed to meet the cow's nutrient requirements rather than waiting for body condition to fall low enough that the producer will notice a change. Manure scoring can indicate the quality of nutrition a cow has had in the past one to three days, while body condition score will indicate the nutritional history of the past several weeks to months.

Manure is scored on a 1 to 5 basis, with a score of 1 being very fluid and 5 being extremely dry and segmented. The next few paragraphs will detail each score and associated diet quality. Reference photographs have been included with approximate levels of dietary protein and energy (TDN) listed.

A manure score of 1 is of cream soup consistency. It can indicate a sick animal or a highly digestible ration that contains excess protein, carbohydrates or minerals, and low fiber. The addition of hay will slow down the rate of passage and thicken the manure.

Manure that will score a 2 doesn't stack; the pat is usually less than 1 inch thick and will lack consistent form. This manure has the consistency of cake batter. Excess protein, carbohydrates and low fiber characterize the diets that produce this manure. Rate of passage is very high, and adding hay to this diet will slow it down to allow for more absorption in the intestinal tract.

Manure score 3 is ideal and will typically start to take on a normal pat form. The consistency will be similar to thick pancake batter. It will exhibit a slight divot in the middle. The pat will be deeper than a score 2 pat, but will not stack. This diet is not lacking nutritionally, yet is not in excess for the cow and her physiological stage.

Score 4 manure is thick and starting to become somewhat deeper, yet is not stacking. The consistency of the manure will be equivalent to peanut butter. This manure indicates a lack of degradable rumen protein, excess ▸

Score 2: >20% CP; >68% TDN of diet

Score 3: 12-15% CP; 62-70% TDN of diet

Score 5: <6% CP; <55% TDN of diet

low quality fiber or not enough carbohydrates in the diet. Supplementation of additional protein with high rumen-degradable protein can increase total diet digestibility. Cottonseed meal and soybean meal are excellent sources of this type of protein.

The highest and least desirable score is 5. This manure is firm and stacks over 2 inches in height. It will also have clearly defined segments and is very dry. This manure indicates the cow is eating a poor quality forage diet that is inadequate for protein and carbohydrates, and high in low quality fiber. Rate of passage has slowed down to the point that excess water has been reabsorbed in the intestines. The rancher will need to consider additional supplementation to meet the cow's protein and energy requirements.

Cattle have to be in good health for manure scoring to be accurate. Manure scoring is a valuable tool to determine the quality of nutrition the cow has recently consumed and can be used effectively to adjust supplementation to prevent loss of body condition. ■