

Nutritional Requirements at Each Stage

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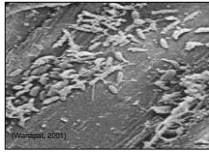
6 major nutrients groups

- proteins
- carbohydrates
- lipids
- minerals
- vitamins
- water



Rumen Microbes

- bacteria, protozoa, yeast
- nitrogen & protein
 - amino acids & proteins
 - NPN: ammonia, urea, etc.
- energy
 - carbohydrates
- minerals
- other nutrients



Cattle (i.e. the host)

protein

- essential amino acids

energy

- carbohydrates
- lipids
 - short or long chain
- excess protein

minerals

- macro
 - Ca, P
 - K, Mg, Na
 - S
- micro
 - Cu, Zn, Mn
 - Se, Co, I
 - Fe

vitamins

- A, D, E, K
- B-vitamin

water

other nutrients

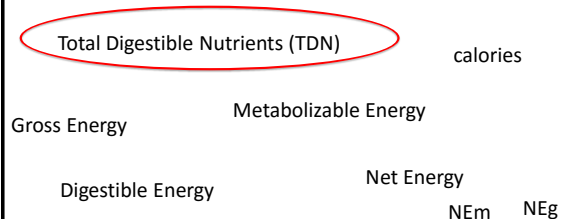
*nutrients in red are not essential in the diet of cattle
(i.e. they can be supplied by rumen microbes)

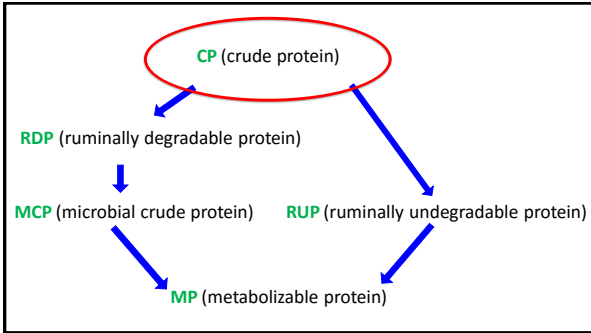
Nutrients needed for 4 main physiological processes.



maintenance energy/protein – the amount of energy/protein it takes to maintain an animal (i.e. the animal is not gaining or losing weight or condition)

Energy Terms





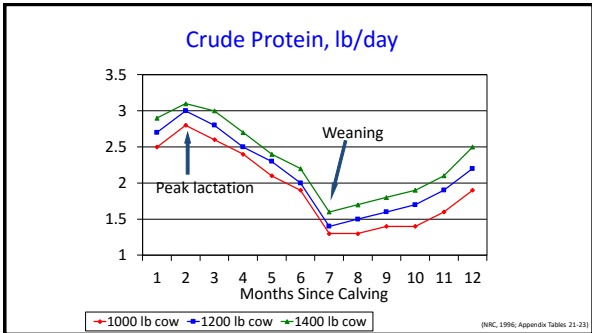
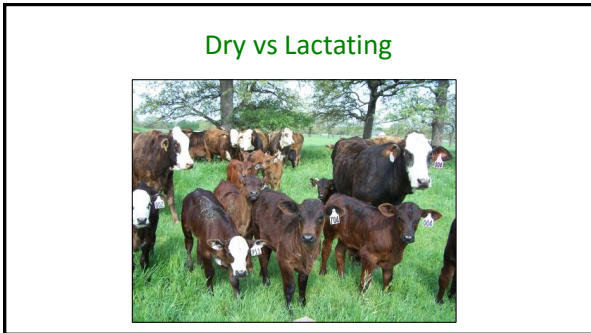
Factors Affecting Nutrient Requirements

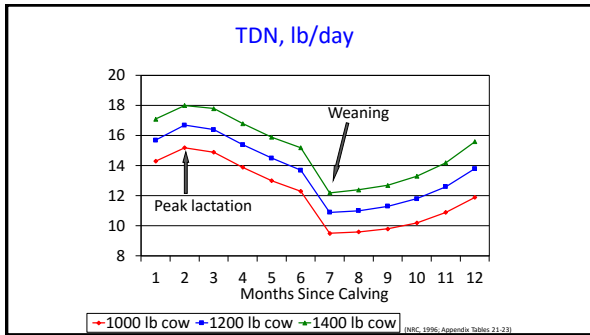
- weight
 - dry vs lactating
 - milk production
 - breed
 - fetal size
 - weather
 - activity
 - rate of gain
 - composition of gain
 - sex
- age
 - previous nutrition
 - body composition
 - hair, hide, etc.
 - management strategies
 - implants, ionophores, etc.
 - genetics
 - animal to animal variation
 - others

Weight

$NE_m = 0.077 \text{ Mcal} \times SBW^{0.75}$
 · (weight in kg)

$MP_m = 3.8 \text{ gm} \times SBW^{0.75}$





Breed

Lower maintenance energy requirement


- Brahman
- Brahman influenced

Average maintenance energy requirement

- Angus
- Hereford
- Charolais

Higher maintenance energy requirement

- Simmental
- Holstein




Fetal Size

fetal size is influenced by both:

- calf birth weight
- stage of gestation

over 75% of fetal growth occurs during the last trimester



Weather


temperatures **above** or **below** the thermoneutral zone increase maintenance energy requirements



Activity

physical activity increases maintenance energy requirements

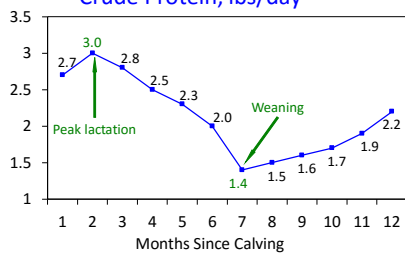
increases range from 10 to 50% depending on conditions and distanced traveled



Nutrient Requirements

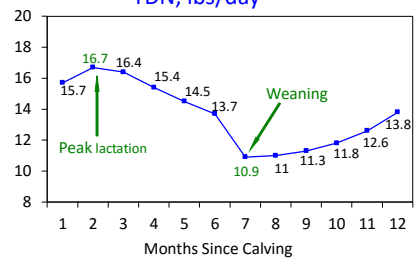
Absolute Amounts

Requirements of a 1200 lb Mature Cow
Crude Protein, lbs/day



(NRC, 1996, Appendix Table 21-23)

Requirements of a 1200 lb Mature Cow
TDN, lbs/day



(NRC, 1996, Appendix Table 21-23)

Percent of Diet DM

easier to use
assumes normal intake

need higher % CP and % TDN

calves
growing cattle

lactating cows
mature dry cows
mature bulls

need lower % CP and % TDN



Weaned Heifer to Mature Cow Example

Assumptions for Weaned Heifer to Mature Cow Example

- Angus
- 1300 lb cow at maturity
- 25 lb of milk production at maturity
- BCS of 5
- high marbling
- 70 lb calf at birth
- no weather stress



Replacement Heifer Targets

target breeding

- 13.5 to 15 months of age
 - 65% of mature weight
- example
- 845 lb = 1300 x 0.65



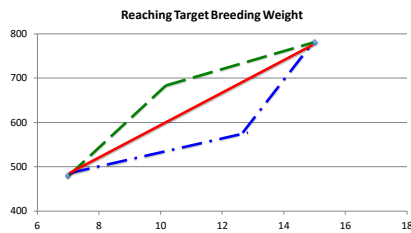
Weaning to Breeding

- age
 - weaning: 7 months
 - breeding: 14 months
- weight
 - weaning: 520 lbs (40% of mature weight)
 - breeding: 845 lbs
- target ADG
 - $325 \text{ lb} \div 210 \text{ d} = 1.55 \text{ lbs}$

Weaning to Breeding

- age
 - weaning: 7 months
 - breeding: 14 months
- weight
 - weaning: 520 lbs (40% of mature weight)
 - weaning: 585 lbs (45% of mature weight)
 - breeding: 845 lbs
- target ADG
 - $325 \text{ lb} \div 210 \text{ d} = 1.55 \text{ lbs}$
 - $260 \text{ lb} \div 210 \text{ d} = 1.24 \text{ lb}$

Heifer Development Strategies



udder sensitive to excess condition: 4 to 10 m of age

open heifer: **weaning – breeding**

Target ADG: **1.55 lb** mature weight: **1300 lb**

Age, months	Weight	% CP	% TDN	% Ca	% P	DMI, lb
7	520	11	61	0.44	0.22	13.0
8.7	600	10	60	0.38	0.20	15.0
10.9	700	8.5	59	0.33	0.18	17.5
13.0	800	8	58	0.29	0.16	20.0
14.0	845	8	57	0.28	0.16	21.1

*Estimated dietary requirements for high marbling Angus heifer with no weather stress. Assumes a 1,300 lb mature weight. (NRC, 2016)



Replacement Heifer Targets

target breeding

- 13.5-15 months of age
- 65% of mature weight

example

- 1300 lb mature weight
- 845 lb = 1300 x 0.65

target calving

- 23-25 months of age
- 85% of mature weight

example

- 1300 lb mature weight
- 1105 lb = 1300 x 0.85



Breeding to Calving

- age

- breeding: 14 months
- calving: 23.5 months

- weight

- breeding: 845 lbs
- calving: 1105 lbs

- target ADG

$$260 \text{ lb} \div 285 \text{ d} = 0.91 \text{ lbs}$$

bred heifer: **breeding – calving** calf birthweight: **70 lb**

target ADG: **1.0 lb** age at calving: **24 months** mature wt: **1300 lb**

Age, months	Days Preg.	Weight	% CP	% TDN	% Ca	% P	DMI, lb
16	45	915	8	56	0.26	0.16	19
18	105	965	8	57	0.26	0.16	20
20	165	1025	8	58	0.25	0.15	21
22	225	1085	9	61	0.34	0.19	22
23.5	270	1145	10.5	67	0.36	0.20	23

*Estimated dietary requirements for high marbling Angus heifer with no weather stress. Assumes 1,300 lb mature weight and 25 lb milk potential at maturity (NRC, 2016)



cow: 2 to maturity calf birthweight: **70 lb**
 mature wt: **1300 lb**

Description	% CP	% TDN	% Ca	% P
2-yr-old lactating cow	11.5	60	0.28	0.18
3-yr-old lactating cow	12.5	61	0.30	0.19
mature lactating cow	12.5	61	0.30	0.19
coming 3-yr-old dry cow, 270 d pregnant	9	58	0.26	0.17
mature dry cow, 270 d pregnant	8.5	55	0.26	0.17

*Estimated dietary requirements for high-marbling Angus heifer with no weather stress. Assumed 1,300 lb mature weight and 25 lb milk potential at maturity (NRC, 2016)

Nutrient Priorities of Lactating Cows

survival
 ↓
 lactation
 ↓
 body condition
 or
 reproduction



Steer Examples



Nutrient Requirements

700 lb yearling steer

ADG	% TDN	% CP	% Ca	Ca, gm	DMI, lb
1.0	53	8	0.26	21.3	18.1
1.5	57	9	0.32	26.5	18.5
2.0	61	10	0.38	31.6	18.7
2.5	65	11	0.43	36.1	18.7
3.0	70	12	0.50	41.7	18.7

*Estimated dietary requirements for Brangus type steer under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including body condition, health, breed, environmental factors, use of growth promotants, and others.



Nutrient Requirements

comparison at 2.0 lb/d

weight	% TDN	% CP	% Ca	Ca, gm	DMI, lb
500	65	12.7	0.55	32.2	13.0
600	63	11	0.45	32.3	15.9
700	61	10	0.38	31.6	18.7
800	61	9.5	0.34	31.4	20.6

*Estimated dietary requirements for Brangus type steer under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including body condition, health, breed, environmental factors, use of growth promotants, and others.



Nutrient Requirements

500 lb steer calf

ADG	% TDN	% CP	% Ca	Ca, gm	DMI, lb
1	56	10.0	0.36	20.0	12.5
1.5	60	11.5	0.44	25.6	12.8
2	65	12.7	0.55	32.2	13.0
2.5	70	14.0	0.65	38.1	13.0
3.0	75	15.3	0.75	43.8	13.0

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Nutrient Requirements

600 lb steer calf

ADG	% TDN	% CP	% Ca	Ca, gm	DMI, lb
1.0	55	9	0.31	20.9	15
1.5	59	10	0.38	26.8	15.6
2.0	63	11	0.45	32.3	15.9
2.5	67	12	0.52	37.0	15.9
3.0	72	13.1	0.60	42.7	15.9

*Estimated dietary requirements for Brangus type steer under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including body condition, health, breed, environmental factors, use of growth promotants, and others.

Nutrient Requirements

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2.0	61	10	0.38	31.6	18.7
2.5	65	11	0.43	36.1	18.7
3.0	70	12	0.50	41.7	18.7

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1.0	53	7.8	0.25	22.0	20.0
1.5	57	8.6	0.30	26.9	20.5
2.0	61	9.5	0.34	31.4	20.6
2.5	65	10.3	0.39	35.6	20.6
3.0	70	11.1	0.44	40.6	20.6

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The screenshot shows the website for the Department of Animal Science at Texas A&M University. The main navigation bar includes links for HOME, ABOUT, RESEARCH, EXTENSION, SERVICES, NEWS & EVENTS, CONTACT, and GIVING. The page is titled "Department of Animal Science" and features a "BEEF CATTLE" section. This section includes a map of Texas with a "Beef Cattle Short Course" location marker in August & Sept. Below the map, there is a list of "UPCOMING EVENTS" with details for the "Beef Cattle Short Course" and "Beef Cattle Research & In-Takes". The website also features a search bar and a "Log Out" button.