Aspects of nutritional management on the breeding farm

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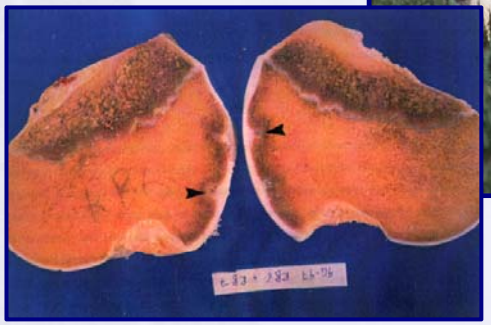
Horse Breeding Operations

- **Overarching goal:**
  - To produce sound, well-grown foals (yearlings) for sale and use in athletic endeavors
- **Horses to feed:**
  - Broodmare
    - Reproductive efficiency
    - Lactation → support foal growth
  - Growing foals
    - Skeletal development
  - Stallions

Consequences of Poor Nutritional Management

- Reduced conception and live foal rates
- Increased services per conception
- High(er) incidence of developmental orthopedic disease (DOD)



Presentation Outline

- *Some principles of nutritional management*
  - Broodmares
    - Importance of body condition
    - Three main phases of broodmare feeding
  - Growing foals → yearlings
    - Nutrition and DOD
  - Stallions (*see notes*)

No math, not many numbers

The Big Picture (*in general*)

- **'Forage-first', pasture-based management**
- **Utilize <u>three basic feeds</u> to meet the needs of different sub-populations on the breeding farm**
  - Broodmares; foals/weanlings/yearlings; and stallions
  - Good-quality grass/legume forage (pasture and hay)
  - 'Concentrate' feed formulated to meet needs of broodmares and growing foals
  - 'Balancer' pellet
- **Group or individual supplemental feeding**

BCS and Reproductive Efficiency

Henneke et al., 1984 Quarter Horses

Initial BCS	Final BCS	% in foal	# cycles to conceive
< 5	> 5	~ 65%	> 2.5
5 or 6	6	~ 90%	~1.5
> 6	> 6	~ 95%	~1.5

Clinical observations – mare body condition & reproductive performance

- BCS ≤ 4 adversely affects reproduction
  - Longer anovulatory or transitional period → delay in the first normal ovulation
  - Energy deficit compounded by lactation
  - *Physiology at work:* **lactation and maintenance of core body functions takes precedence over reproduction**
    - Energy state, fat mass, leptin and other hormonal signals

Clinical observations – mare body condition & reproductive performance

- **What about obesity?** (BCS 8-9 Henneke scale)
  - Limited research studies – BCS > 7 does not reduce reproductive efficiency vs. mares in moderate body condition
    - Cavinder et al. 2005 (Equine Sci Society)
  - Failure to conceive, etc. observed in *equine metabolic syndrome* mares
    - Analogous to polycystic ovarian syndrome (PCOS) in women??

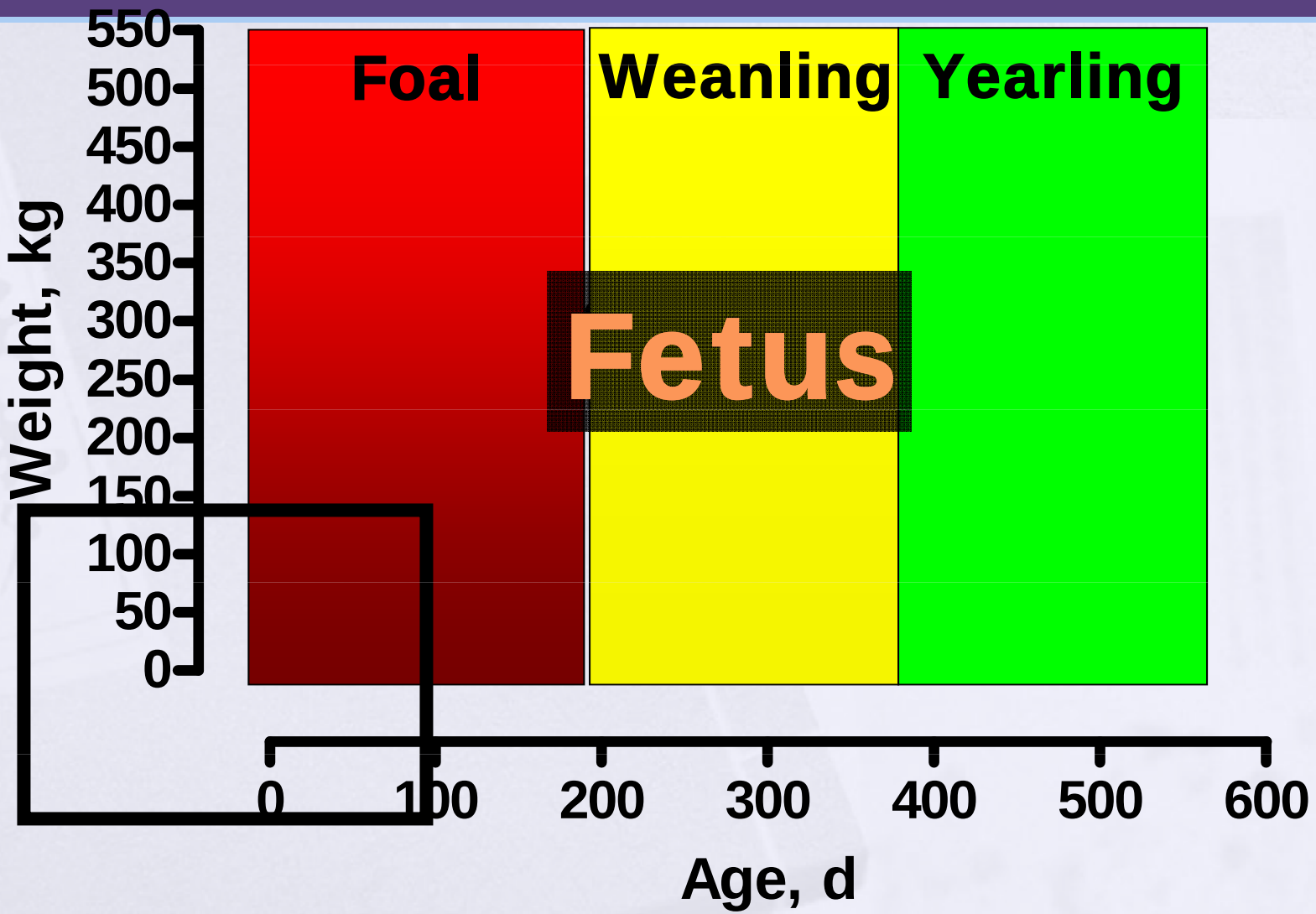
Optimizing Mare Body Condition

- Regular monitoring of body condition
  - Initial assessment ~3 months before onset of breeding season
- Adjust diet to achieve target BCS (5–7)
  - BCS 4→5 equates to ~20 kg (44 lb) weight gain
    - ~20 Mcal DE above maintenance needed for 1 kg gain
    - *Additional* 6 Mcal DE/day will enable 1 BCS increase over ~60 days (4-5 lb of commercial grain-concentrate)
- Weight gain difficult during lactation

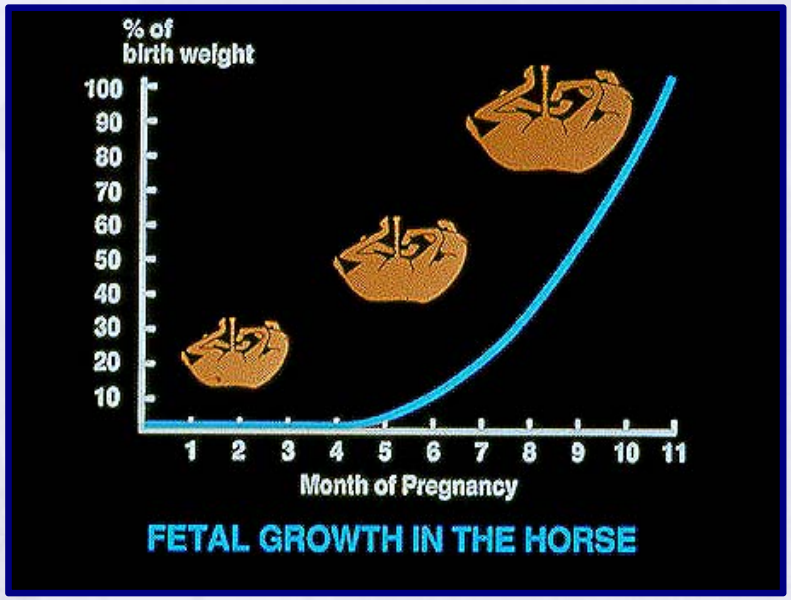
Three Stages of Mare Feeding

- Early pregnancy (0-5 months)
  - Overlap with lactation
- Mid-to-late pregnancy (~6-11 months)
- Lactation

Stages of Foal Growth

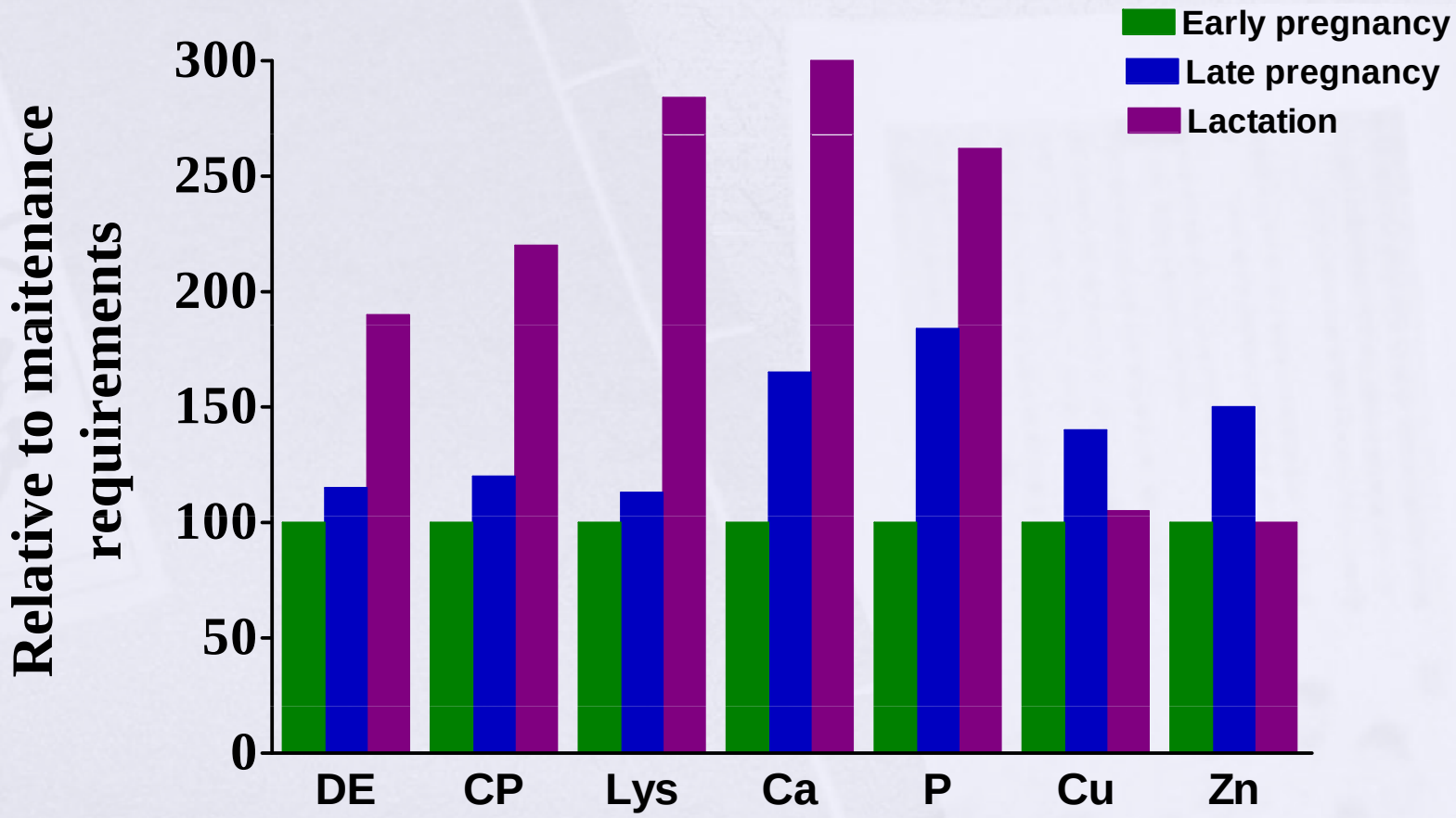


Fetal-placental tissue growth



- Exponential growth of fetal-placental unit begins around 5 months gestation
- At 7 months
  - Fetus is ~20% of birth weight
  - ~2% of mare body weight
- **Quantity of energy and protein to support growth of fetal-placental unit increases above maintenance in 5th month**

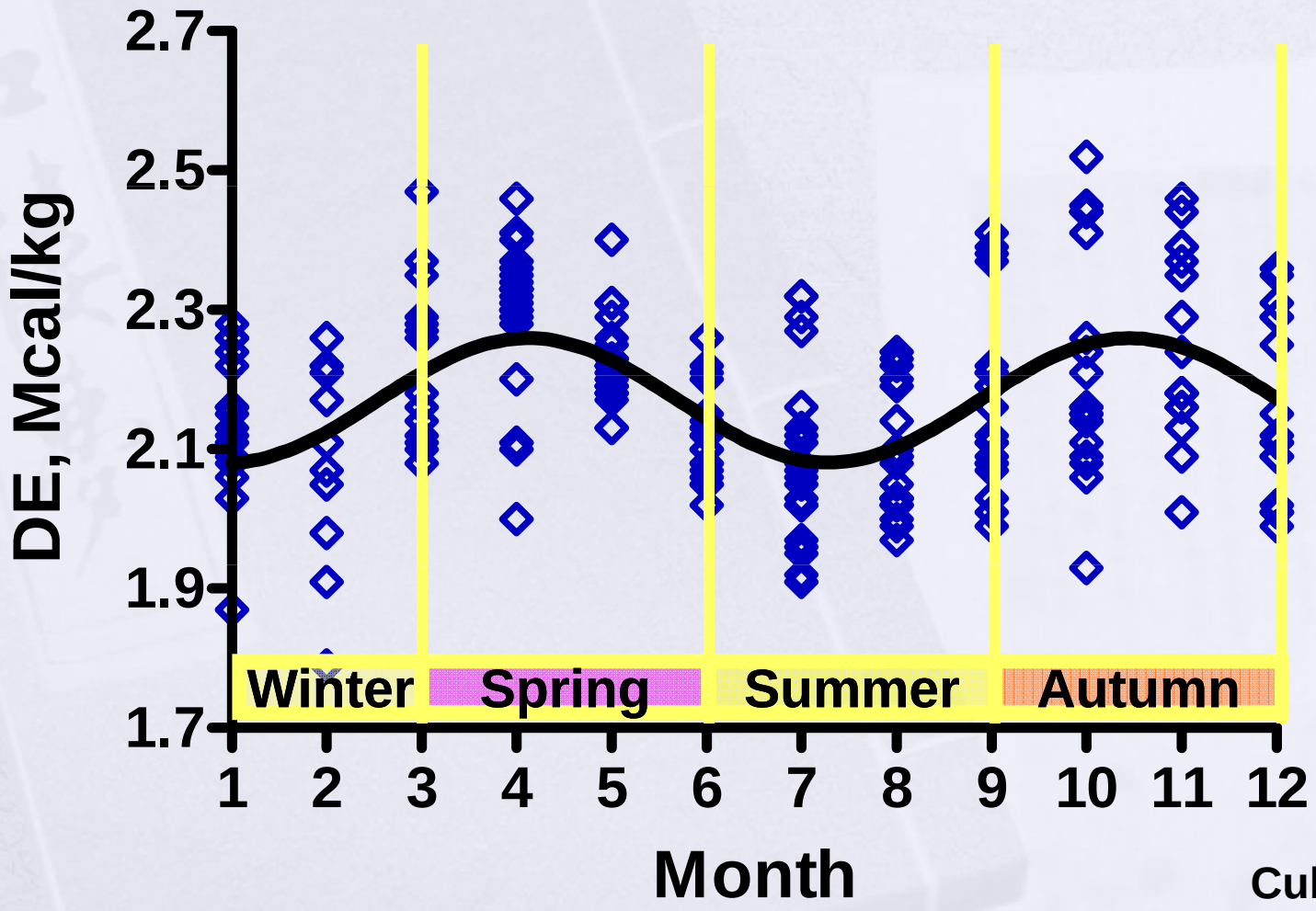
Nutrients requirements of broodmares (% of maintenance requirement)



Early-to-mid pregnancy (1st 5-6 months)

- Requirements approximate ‘mature horse maintenance’
- Forage primary component of ration
  - Grain, sweet feeds etc. not needed – **avoid overfeeding**
  - Exception – thin mares, need for improvement in BCS (get them to BCS 6 by late pregnancy)
- Is forage alone sufficient? e.g. pasture

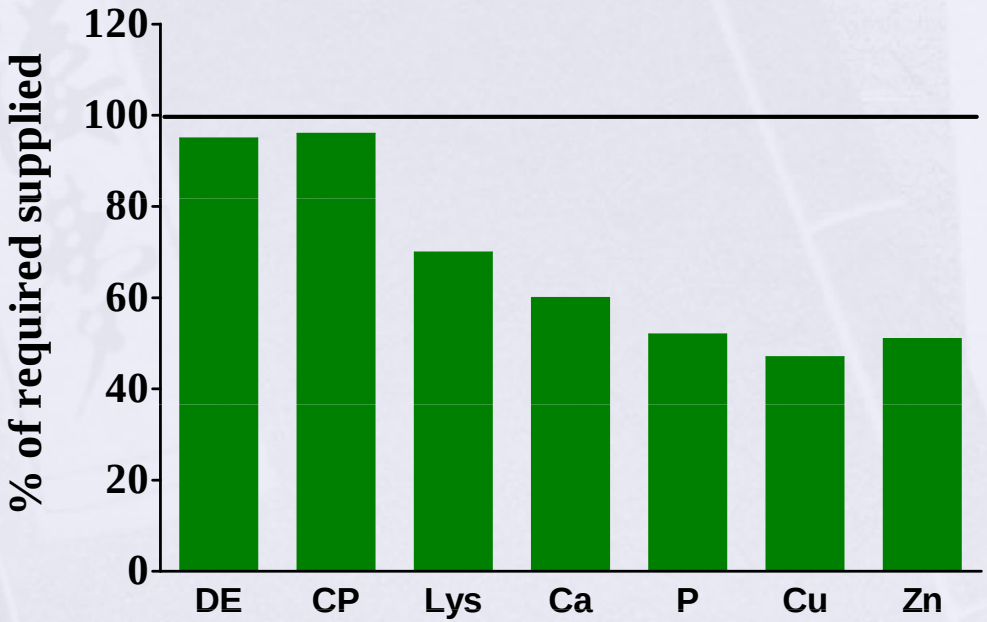
Seasonal nutrient patterns – pasture forage



Cubitt et al., 2005

Early pregnant mare – forage only

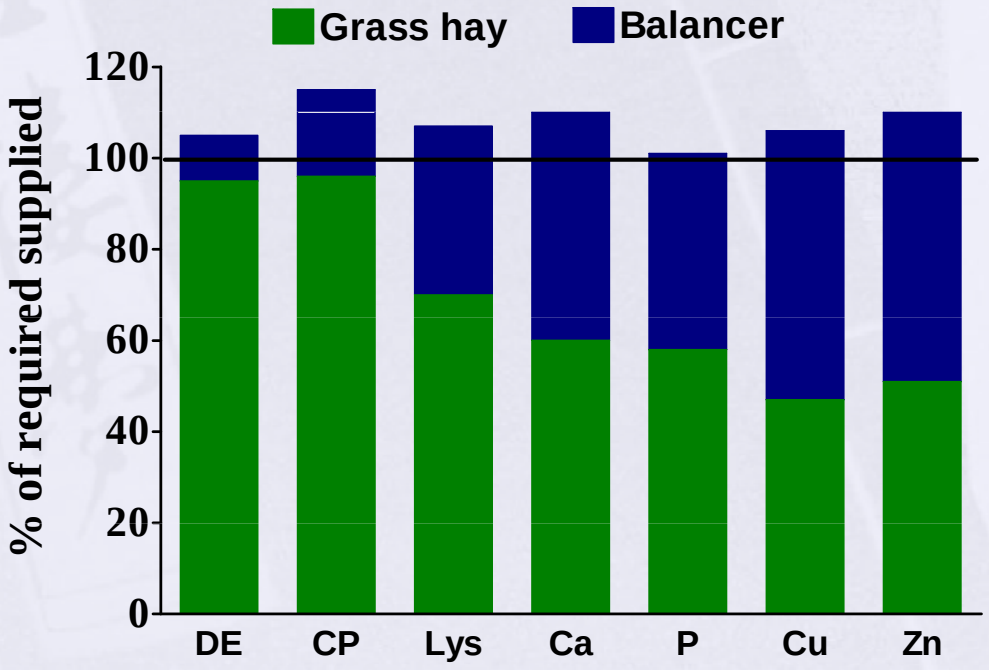
Pasture forage or grass hay (2% BW on dry matter basis)



1100 lb mare

Example only – impact of forage quality

Early pregnant mare – forage plus balancer pellet



2% BW as grass forage

2 lb balancer pellet

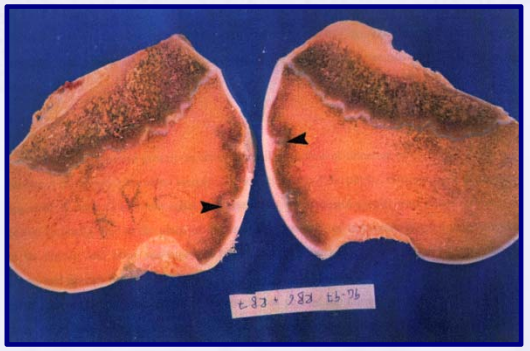
- 25% protein
- 3.0% calcium
- 2.0% phosphorus
- 80 ppm copper
- 300 ppm zinc
- 0.6 ppm selenium

Pregnant mares (months 7-11)

- **DE requirements ~15-20% higher vs. early pregnancy**
- **Large increases in protein and mineral needs**
  - Fetal tissues retain ~77 g protein, 7.5 g Ca and 4 g P per day during last 4 months
  - Fetal storage of trace minerals
    - Fe, Zn, Cu and Mn in liver
    - Milk content of these nutrients low

Impact of Copper Supplementation Strategy on Foal Status

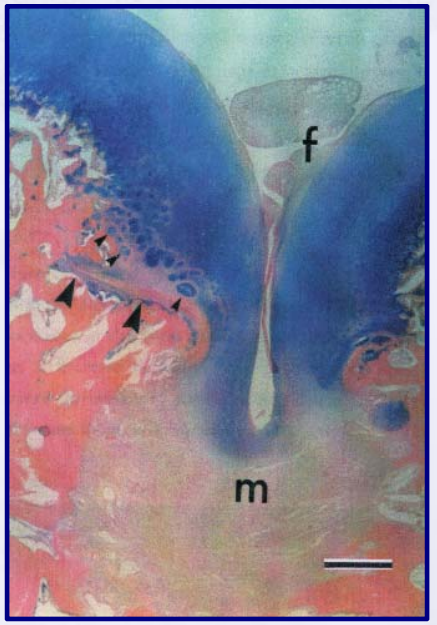
- **Four treatment groups**
  1. Mares supplemented (30 ppm diet), foals not
  2. Both mares and foals supplemented
  3. Mares *not* supplemented, foals *were* supplemented
  4. Neither mares nor foals supplemented
- **Assessed copper status in foals by liver biopsy, physitis score, and OCD lesions (150 days of age)**



Pearce *et al.* 1998

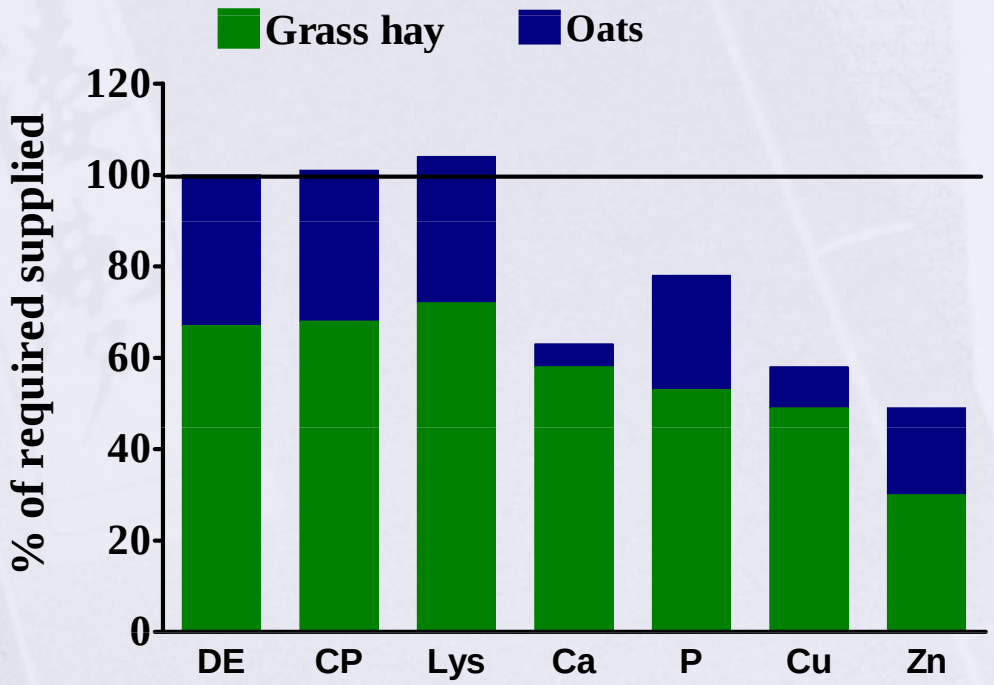
Impact of Copper Supplementation Strategy on Foal Status

- *Only* Cu supplementation in the mare resulted in an increase in liver Cu in foals
- Physitis scores and number of articular lesions lower in foals born to *mares* supplemented in late pregnancy
  - No significant effect of foal Cu supplementation
- ***Bottom line*** – the Cu content of the pregnant mare's diet is critical for normal foal development



Pregnant mare (last trimester)

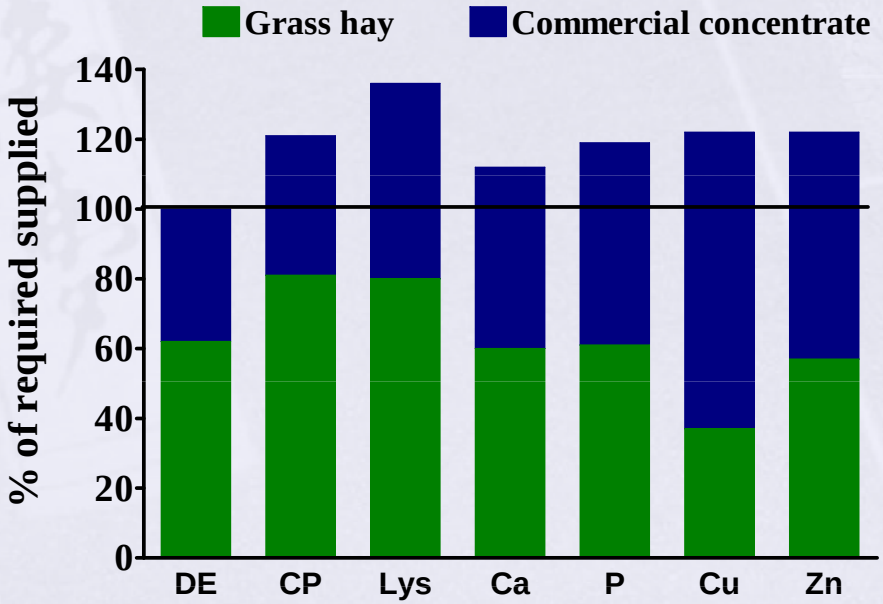
Grass hay & oats



- 2% BW grass hay (20lb) & 6 lb oats
- Oats
  - 11.8% CP
  - 0.08% Ca
  - 0.34% P
  - 6 ppm Cu
  - 35 ppm Zn

Pregnant mare (last trimester)

Grass hay & concentrate



- 2% BW grass hay (20 lb) & 6 lb concentrate
- Concentrate
  - 14.0% CP
  - 0.8% Ca
  - 0.6% P
  - 55 ppm Cu
  - 200 ppm Zn

Lactation (0 – 3 months)

- Dry matter intake increases, may exceed *3.0% BW/day*
  - Up to 2.5% BW (dry matter) from pasture
  - Spring forage nutrient-rich
    - 17-19% CP, 2.4-2.6 Mcal DE/kg DM)
- Grain concentrate ~0.5-1.0 kg/100 kg BW/day depending on forage quality and quantity
  - Gradual increase over ~7 days
  - Potential benefits of oil supplementation (higher fat feeds)
- **<u>Underfeeding</u> and <u>weight loss</u> main concerns**
  - Impact on milk production and reproductive efficiency

Lactating Mare Nutrition

- **Supplemental feeding thru lactation**
  - ↓ milk production, ↓ nutrient needs after 3 months BUT……..
    - feed intake by foals
    - ↓ forage availability in summer
- **Feeding at and after weaning**
  - Decrease grain ~7 days pre-weaning
  - Pasture turnout ± balancer pellet or grain-concentrate
    - Thin mares may need continued supplemental high-quality forage and grain to regain body condition

Foal Feeding Programs

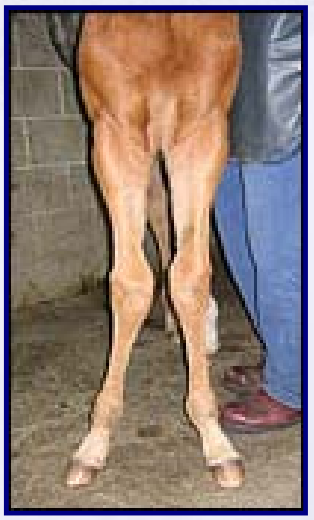
GOALS

- **Provide nutrients and energy in right balance and quantity**
  - Amino acids (lysine, threonine), Ca:P, trace minerals
- **(relatively) steady increase in size and BW**
  - Avoid very rapid or erratic growth rates
  - Avoid rapid compensatory growth spurts
  - Avoid overweight/obesity

The Big Concern

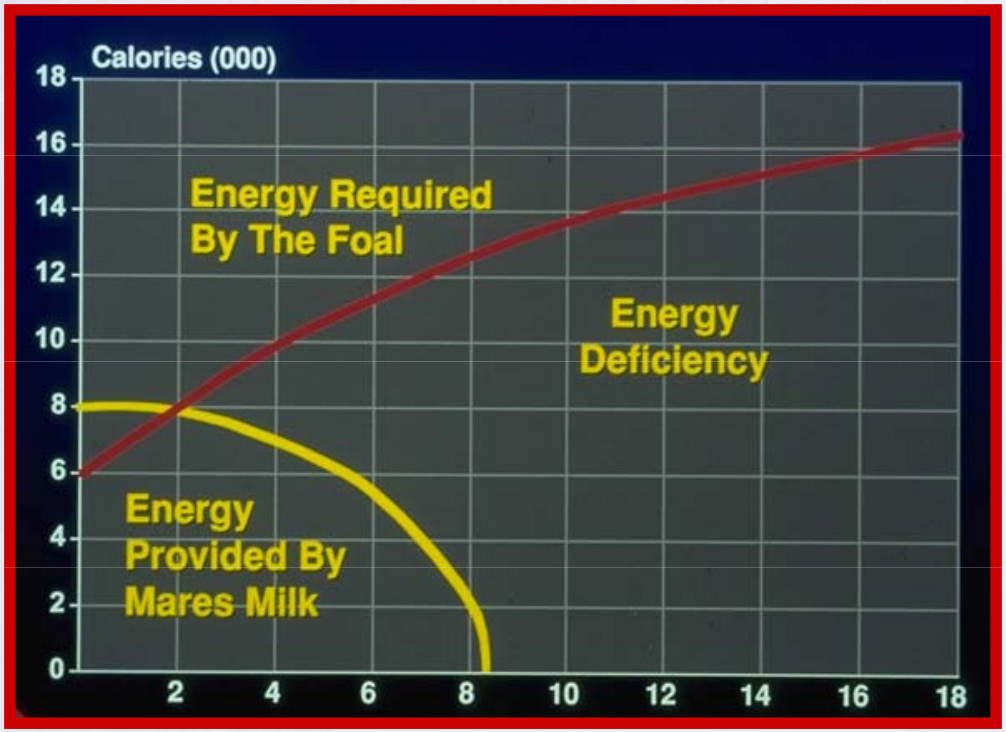
Developmental Orthopedic Disease

- Developmental bone diseases are multifactorial in origin
- Factors that might influence include:
  - Genetics ***(? Up to 25% of phenotype)***
    - Conformation
    - Rapid Growth
  - Exercise
    - Excess or Lack
  - Trauma
  - **Nutrition** (frequently blamed)



Foal Nutrient Requirements

- Milk alone will not provide calories and nutrients needed to sustain growth rate after ~3 months of age



Foal Feed Intake

- Eating some forage and feed between 1-2 months
- 4-5 months - ~40% to 60% of energy/nutrient needs come from forage and feed
- Typical concentrate/feed intakes
  - 0.5 to 1.5 lb per month of age per day for 4- to 8-month old foals
    - Lower end with plentiful, quality forage
    - Higher end if forage quantity and decline

Creep feeding vs. with mare

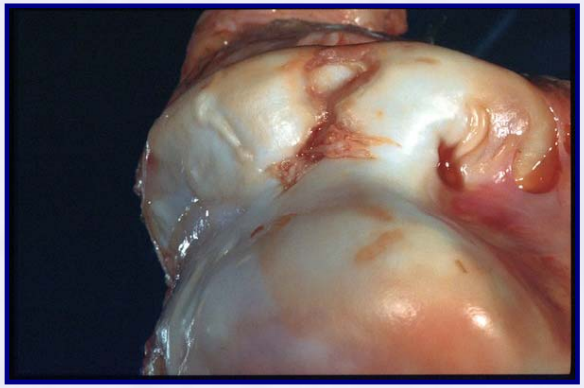
- Ensures nutrient needs are met (*not exceeded*)
- Familiarizes foal with grain/concentrate pre-weaning
- Start 8 – 12 weeks of age
- Purpose formulated creep feeds
  - ~16% crude protein
  - Protein sources – dried milk products, soybean meal (lysine)
  - Ca:P ratio ≥ 1:1 (1.4:1 – 2:1)

Feeding Weanlings

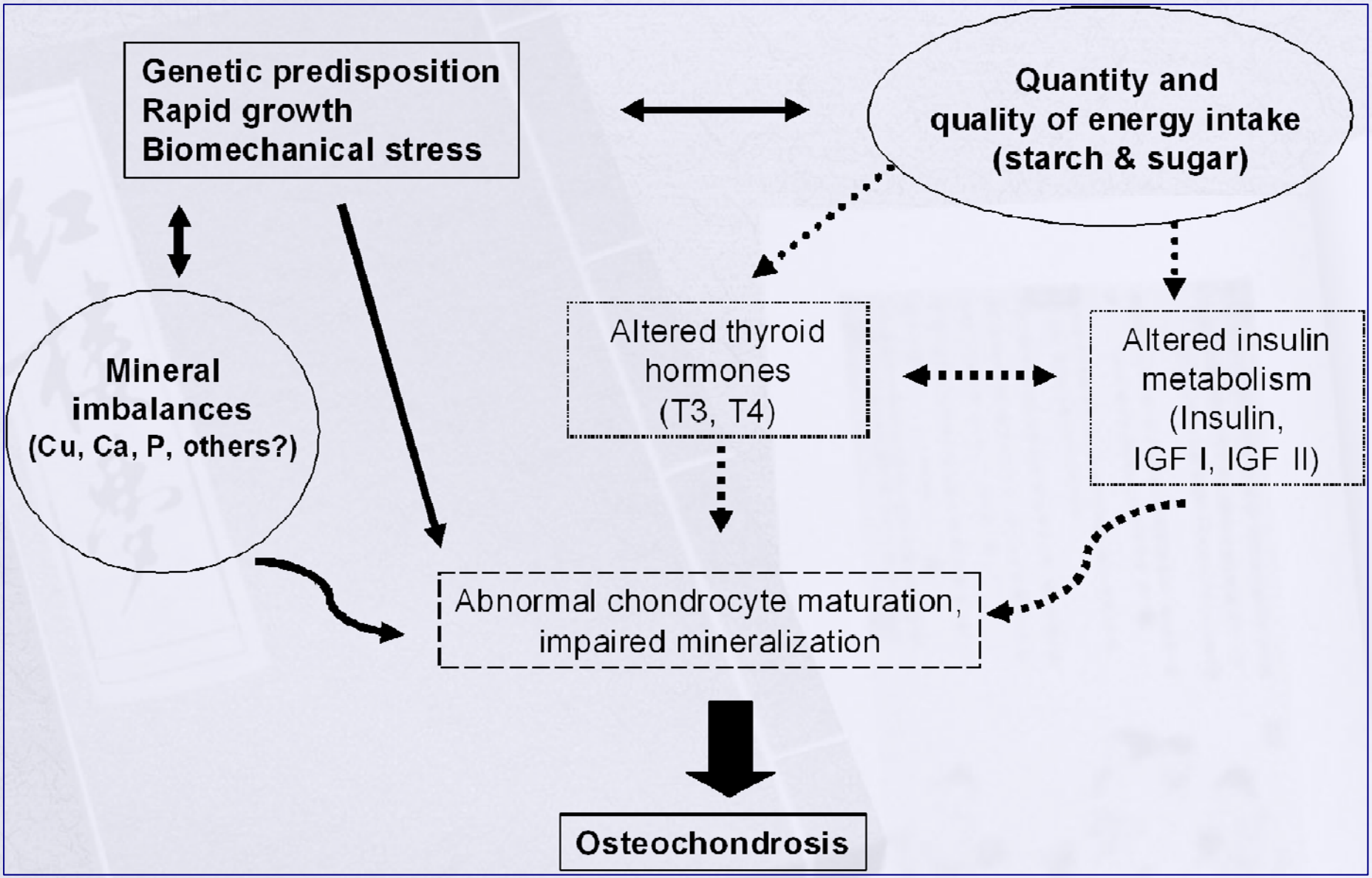
- Total intake ~3% BW/day as dry matter
  - ~2%+ BW as pasture or *high quality* hay
    - Type and maturity will influence the amount of concentrate/supplement needed
- "Normal" concentrate intake varies widely
  - Desired growth rate (*'bigger is better'* at sale time)
- Poorer quality forage
  - 50:50 hay to concentrate
- High quality forage (e.g. alfalfa, ample pasture)
  - 70:30 hay to concentrate
- **Starch-rich vs. lower starch, higher oil feeds**

DOD – Nutritional Concerns

- "**Over-nutrition**" ⇒ too many groceries ⇒ high growth rates and over-conditioning
- Other dietary issues
  - Microminerals: *copper, zinc, manganese*
  - Macrominerals: *calcium, phosphorus*
  - Protein excess/poor quality
  - *Interactions of the above*



DOD Risks – Nutritional Interplay

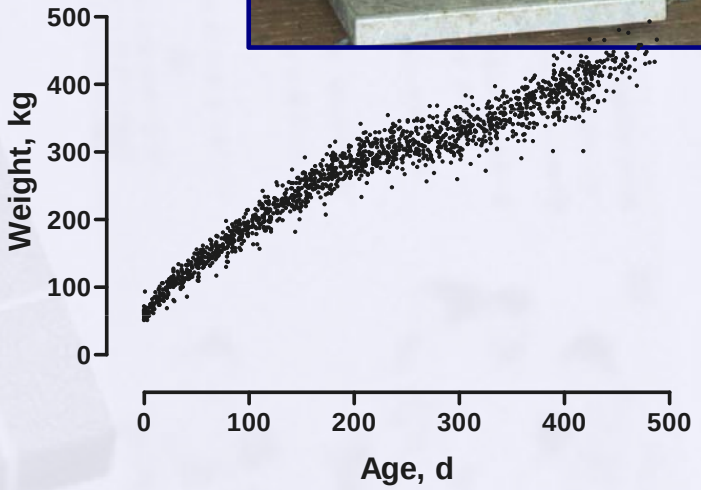


Growth Rate and Osteochondrosis

- Central Kentucky studies:
  - Higher incidence observed in faster growing and over-conditioned ("fat") weanlings
  - Genetics? Genetic × feeding interaction?
- Experimental studies (Savage *et al.* 1993)
  - Energy at 130% NRC $\rightarrow$ $\uparrow$ incidence of DOD
- **Focus on matching dietary energy provision to requirements to 'control' growth rate**

Monitoring Growth

- **Monthly**
  - Body weight
  - Measurements
  - Body condition
- **Computer software to 'track' growth against breed norms**
- **Target BCS ~5 (not fat)**
- **May do survey radiographs**



Foal Condition Scoring

- Weight - 363 lbs
- Height - 50”
- Body Condition - 5

Typical “5”

Fat Deposition in Foals

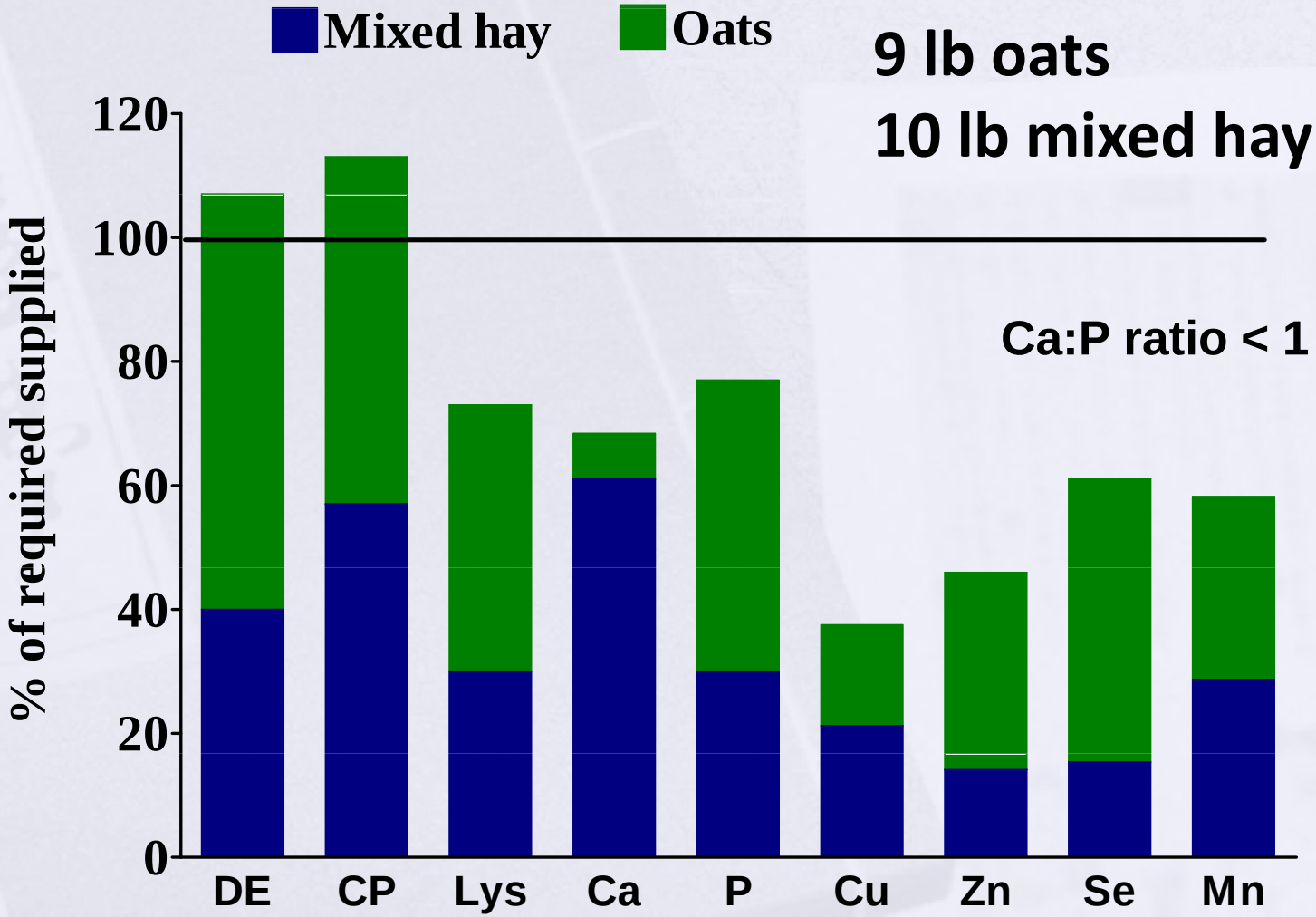
Not what we are looking for!

Growth Nutrition – Pitfalls to Avoid

- **Poor quality roughage-based diets**
  - poor quality hay
  - inadequate protein, minerals, vitamins
- **High grain, low roughage diets**
  - excess energy, inverted Ca:P ratio
- **Radical feeding reductions at first sign of trouble**
  - risk poor skeletal development/poorly grown mature horse

“Red Flag” Diet

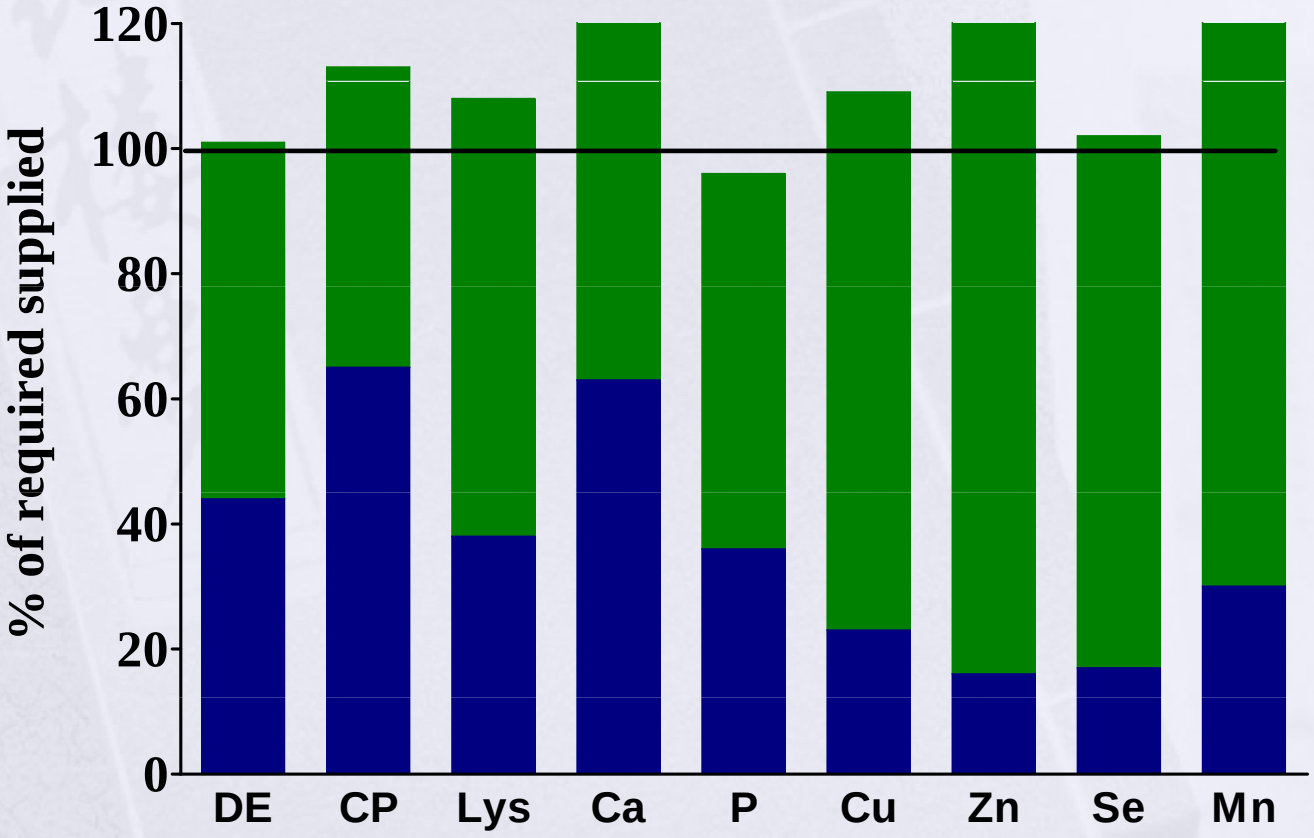
8-month old, 700 lb weanling, moderate growth



Better Approach

8-month old, 700 lb weanling, moderate growth

6 lb commercial growth
12 lb mixed hay



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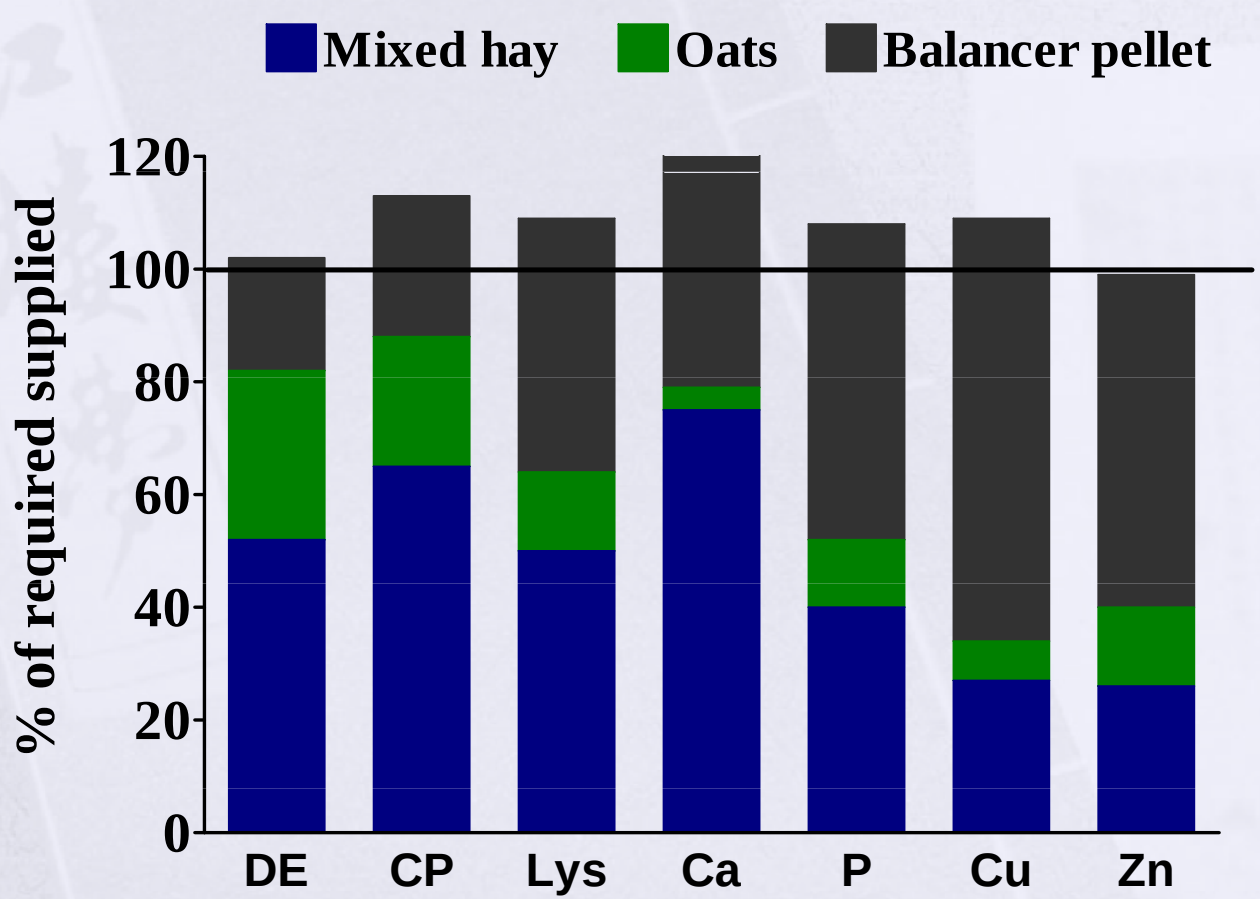
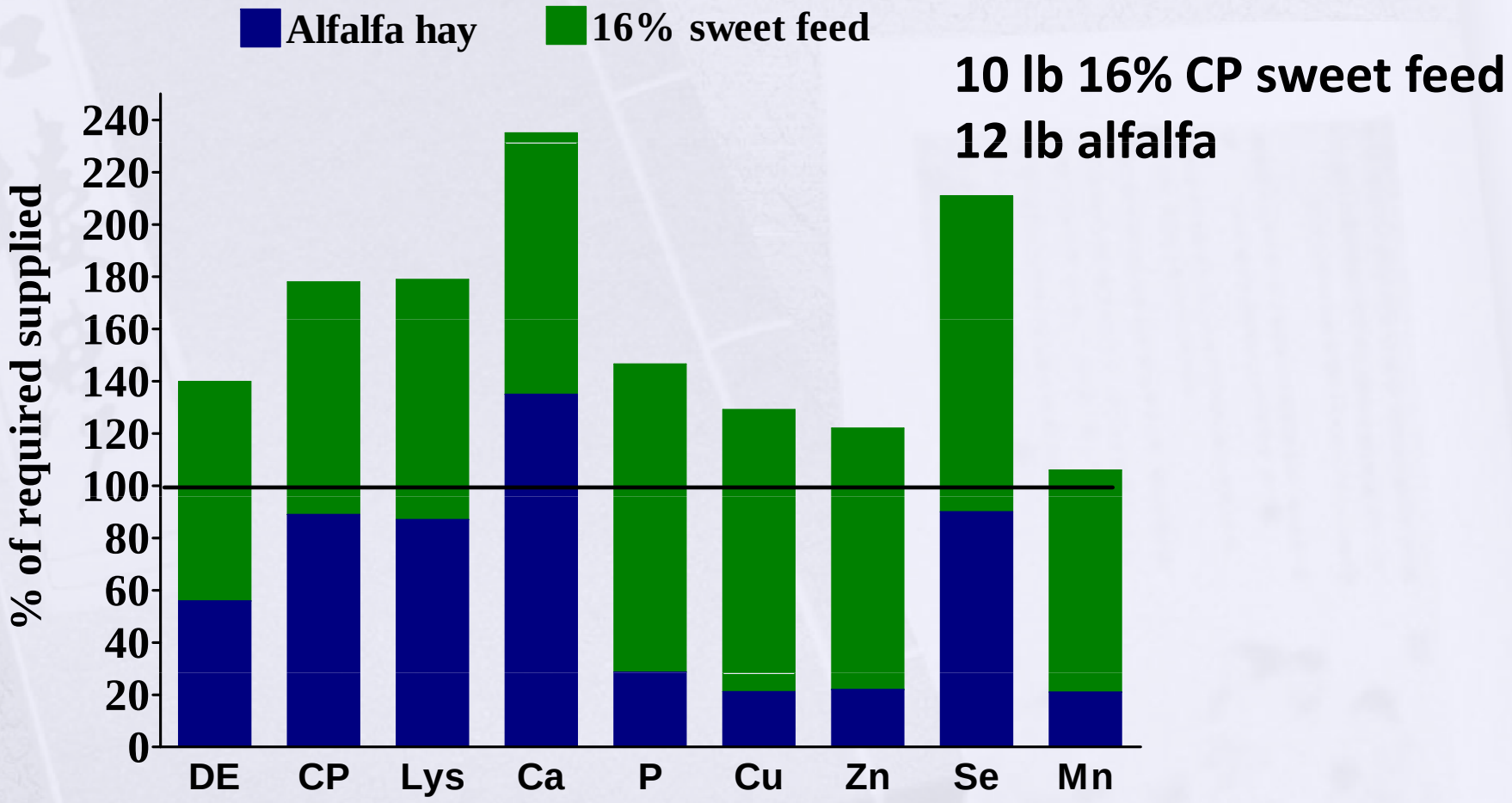


5 lb oats
2 lb balancer
12 lb mixed hay

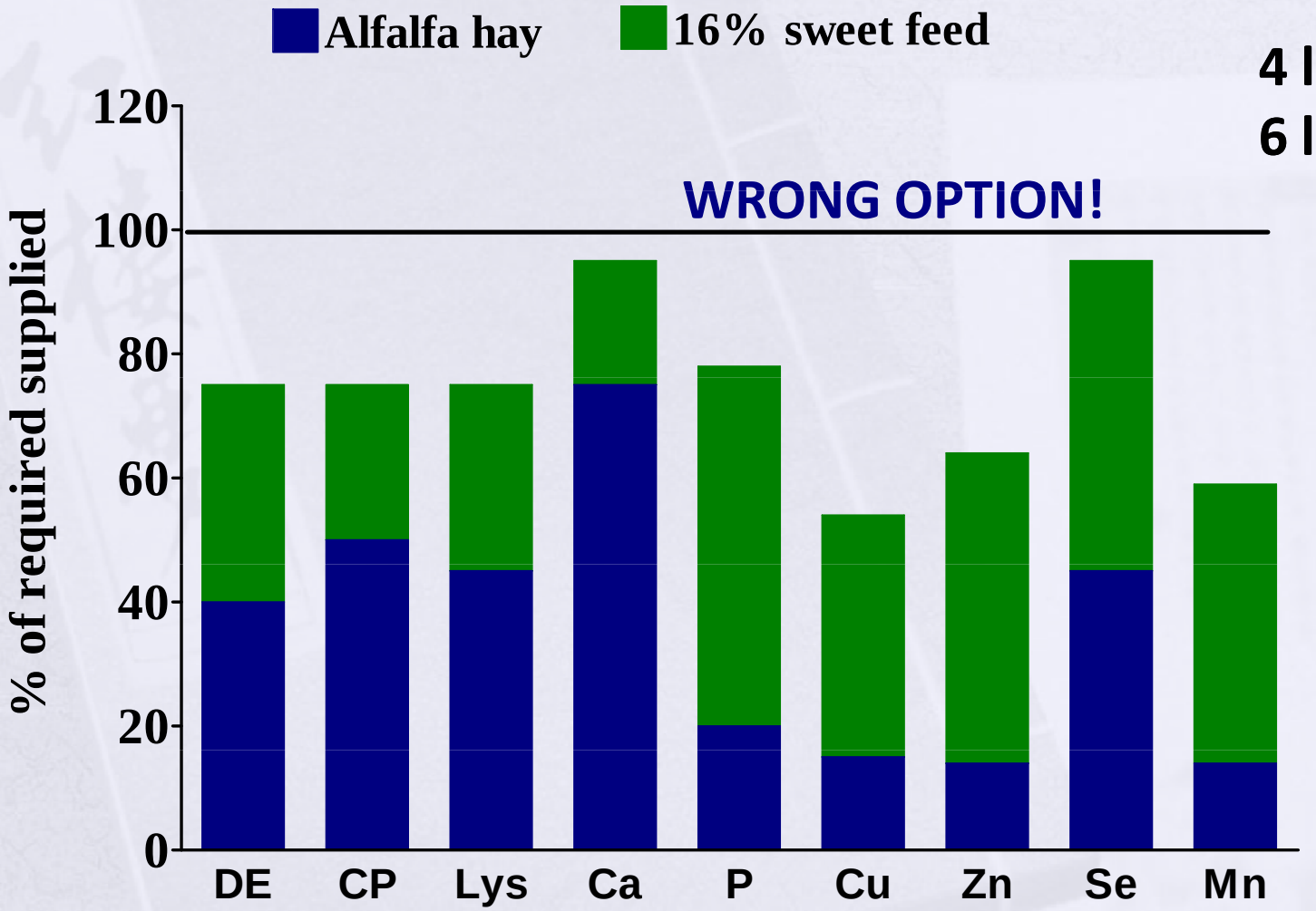
“Red Flag” Diets – Clinical DOD

800 lb weanling, rapid growth, evidence physitis & OCD



Clinical DOD – Cut Feed Quantity

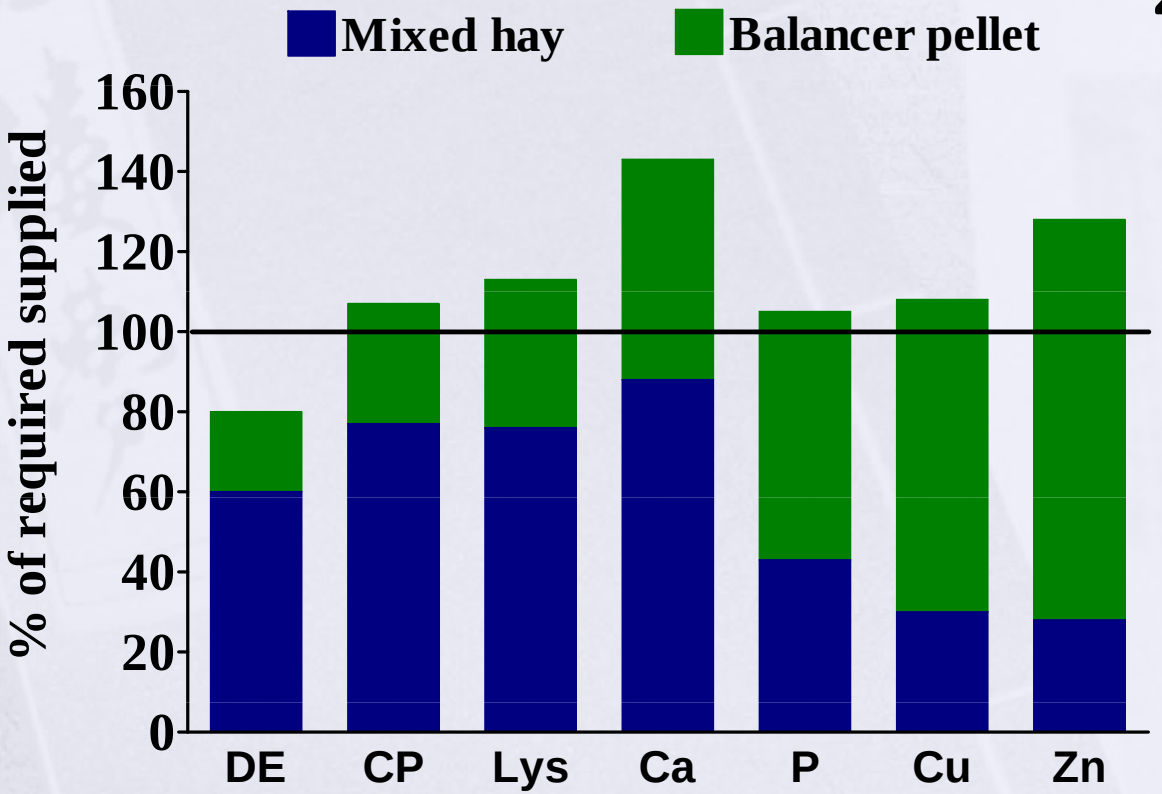
800 lb weanling, rapid growth, evidence physitis & OCD



4 lb sweet feed
6 lb alfalfa

Clinical DOD – Better Option

"Pace Diet"



12 lb mixed hay
2.5 lb balancer (growth)

Take Home Message

- **Broodmare feeding**
  - Early pregnancy: **DON'T OVERFEED!**
  - Late Pregnancy: **TRACE MINERALS!**
  - Lactation: **DON'T UNDERFEED!**
- **Foal feeding**
  - Balanced nutrition critical to development
  - Monitor and manage growth rate
  - Several ways to achieve balanced diet

QUESTIONS

Sponsorship: