Forage Value of Range Plants ~ Grasses, Shrubs, and Forbs

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Based on the most limiting nutrients on rangelands in the western U.S.
- Energy –
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- Nutrients –
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The 3 major factors determining nutritive value in plants:
1. Cell structure: (Cell Wall: Cell Contents)
2. Degree of Lignification
3. Secondary Compounds or “Anti-quality” factors

1) Cell Structure (Wall:Contents)
   - Most digestible compounds in cell contents

2) Degree of Lignification

3) Secondary Compounds or “Anti-quality” factors
   - Plants may contain secondary compounds or toxins that reduce forage quality or adversely affect the herbivore.
     - Alkaloids
     - Terpenes
     - Tannins
     - Glycosides
     - Nitrates
     - Soluble Oxalates

Comparative Nutritive Value of Plant Parts
- Fruits, seeds, root-crowns and flowers are more nutritious than leaves or stems.
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- Leaves are more nutritious than stems.
  - Why?
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Maturation Effects on Nutritive Quality of herbaceous plants

- Most range plants are highly nutritious when young.
- As plants mature, nutritive value decreases.
  Why?
    - Increased structural CHO’s
    - Lignification
    - Increasing Stem:Leaf Ratio
- Leaching of nutrients by rain in dormancy.

Comparative Nutritive Value of Grasses, Forbs, and Shrubs

- What is browse?
  - The portion of shrubs used for forage.
  - Generally, leaves & current season’s twigs.
- In shrubs, current season’s growth is generally more nutritious than old growth.
  Why?
  - Leaching of nutrients by rain in dormancy.

Seasonal Trends of Nutrients - graph adapted from Parker 1969

- Why are forbs more nutritious than grasses and browse?
- During dormant season - browse are important for nutrients.
- The importance of shrubs for nutrient value during growing season may be more important that was once believed. New research shows browse may be more important than we once believed.

Seasonal Trend of Energy - graph revised from Parker 1969

- During growing season - grasses, forbs, and shrubs all provide good amounts of energy.
- During dormant season - grasses provide a stable source of energy.

Tropical (warm season) versus Temperate (Cool Season) Grasses

Environmental Influences of Plant Nutritive Quality:

- Temperature:
  - Higher temperatures decrease water soluble CHO's and protein levels.
  - Lignification and maturation occur more quickly at elevated temperatures.

- Moisture:
  - Moderate moisture stress increases the nutritive value of plants by delaying maturation.
  - Severe moisture stress hastens translocation of nutrients to the roots and senescence.

- Range Site:
  - Fertile soils may delay maturity and increase leaf:stem ratios.
  - High level of soil Nitrogen may increase protein content of plants.

Anti-Quality Agents:

- Most common in shrubs and forbs. (Rarely a problem in grasses).
- Resist Digestion
  - Compounds that are not digestible.
  - Reduce overall forage value.
- Inhibit Digestion
  - Bind nutrients to make them indigestible.
  - Kill rumen microbes to reduce digestive function.
  - Toxins - cause illness or death (i.e., alkaloids, tannins, terpenes).

Recap:

- Forbs are important sources of protein and carotene during the growing season.
- Shrubs are important to maintain phosphorus and protein levels in winter (dormant season).
- Grasses are important sources of energy (structural CHO's) throughout the year.
- Forbs and shrubs may contain anti-quality agents which decrease their nutritive value.

In Summary - Plant Management for Animal Nutrition

- Monocultures provide high quality at one time of year. This may be useful in management such as spring grazing areas.
- A variety of forage classes on range provide nutrients throughout the year.