Cha-ching!

- Manage Ground Cover:
  - Canopy-growing leaves
  - Litter
- Facilitate healthy, extensive, actively growing roots
- Limit 2\textsuperscript{nd} bite opportunities
- Rest for complete recovery
- Nutrient management & distribution
Successful pasture management practices are based on knowledge of physiological and morphological reactions of plants.

Understanding Grass Growth: The Key to Profitable Livestock Production
How Grasses Grow

- 95% of plant nutrients come from the atmosphere
  - (C, H, O)

- 5% of plant nutrients come from the soil
  - (N, K, Ca, P, Mg, S, Cl, Fe, Mo, Zn, B, Cu)
Photosynthesis

Solar energy

Carbon dioxide → Sugars

Water → Oxygen
A quick lesson in physiology.....

Carbohydrates
- are produced by leaves; stored in stem bases, roots, rhizomes
- are consumed by grazing animals
- grow new leaves, tillers
- keep the plant alive during stress (drought, winter)

Fructose
Managing Photosynthesis

Only green, growing leaves capture solar energy, and make livestock feed.
Photosynthesis in leaves remaining after grazing produces most carbohydrates for new leaves.
little or no residual

Plant must move stored carbohydrates from stem base to produce new leaves.
Plants would prefer to grow new leaves by producing carbohydrates with old leaves than by moving stored carbohydrates.

It’s a matter of energy conservation.
Grazing between the 3rd and 5th leaf stage stimulates growth of secondary tillers and development of axillary buds.
The Root System is Almost a Mirror Image of the Top Growth

*Short, weak plants = short, weak roots*
### Corresponding Root Growth

*The Take Half-Leave Half Rule*

<table>
<thead>
<tr>
<th>% Leaf Removed</th>
<th>% Root Growth Stopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
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<tr>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>2 to 4</td>
</tr>
<tr>
<td>60</td>
<td>50</td>
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<tr>
<td>70</td>
<td>78</td>
</tr>
<tr>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>
GRAZE AND REST PASTURE

6 - 8"

3 - 4"

REST FOR GROWTH

THEN USE TO MAINTAIN STRONG ROOT SYSTEM

AND BUILD UP FOOD RESERVES

AND REST AGAIN FOR GROWTH

PROPER HEIGHT

12"
Previous paddock recently grazed:
- low-quality "residual" stubble
- carbohydrates depleted
- canopy removed for light penetration

Next paddock fully rested:
- carbohydrates replenished
- reseeding allowed
- tall canopy present
- leafy growth available
The Grazing Wedge
(Example of REALLY BAD Rotation sequence)
Plant Growth and Management: Plant Persistence

During grazing periods: control stubble height
- not too low—keep growing points
- not too low—good photosynthesis
- not too low—keep roots growing

Between grazing periods: schedule rest periods
- allow photosynthesis
- allow leaves to regrow
- allow “vegetative reproduction” (spreading plants)
Rest Period Needs: Vary with Rate of Growth During Season

- **GRASS**
  - 15 - 20 days
  - 20 - 25 days
  - 25 - 35 days
  - 35 - 45 days

- **LEGUME**
  - 35 - 45 days
  - 30 - 35 days
Plant Growth and Management:

- Example: 12 paddock system
  - Grazing period: 2 day, 3 day, 4 day
  - Rest Period: 22 day, 33 day, 44 day

Flexibility!
Remember:

- Plants only manufacture carbohydrates during daylight hours during their growing season.
- Perennial plants use carbohydrates 24 hours a day, 365 days a year.
- Perennial plants must have stored energy to survive the winter, to begin growth in the spring, and recover after complete defoliation.
Grazing Management Objectives

• Have grazing animals take 1 large bite or mouthful (intake) off of as many plants as possible in a pasture (Utilization)
• Remove the animals from the pasture before any regrowth occurs and by the time 50% of the current growth has been removed (plant persistence/health)
• Have enough pastures to allow sufficient regrowth and rest before being grazed again (rest/plant health) (intake)
Forage Quality and Availability
Types of Forages

- Annual & perennial
- Cool-season (C3) & warm-season (C4)
- Grasses & legumes
- Introduced and Native
Selection Criteria for Forages

• PERSISTENCE

• YIELD DISTRIBUTION

• QUALITY

• INTENDED USE (Whatcha gonna feed it to?)
Yield Distribution

<table>
<thead>
<tr>
<th>Forage Type</th>
<th>Optimum Growing Temperature (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool season grasses</td>
<td>60 – 80</td>
</tr>
<tr>
<td>Legumes</td>
<td>70 – 90</td>
</tr>
<tr>
<td>Warm season grasses</td>
<td>80 – 95</td>
</tr>
</tbody>
</table>
Forage Production Growth Curves

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth brome</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall Fescue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switchgrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern gamagrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big bluestem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiangrass</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Forage production levels
Cool Season Grasses

- **Perennials**
  - Tall fescue
  - Orchardgrass
  - Smooth Bromegrass
  - Timothy
  - Reed Canarygrass
  - Perennial Ryegrass
  - Kentucky Bluegrass
  - Canada Wildrye

- **Annuals**
  - Cereal Rye
  - Oats
  - Wheat
  - Triticale
  - Annual Ryegrass
Yield Distribution: growing season

Yield (tons/A)

- Spring
- Summer
- Fall

Typical cool season
Yield Distribution

Seasonal "gaps" in forage supply
Legumes

• Bi-annual – Perennial
  – Alfalfa
  – Red Clover
  – White Clover
  – Birdsfoot trefoil
  – Alsike clover
  – Crown Vetch
  – Kura Clover

• Annual
  – Annual Lespedeza
  – Crimson Clover
  – Hop Clover
Yield Distribution: Legumes

- Cool-season Grass
- Red & White Clover
Yield Distribution: Legumes

*Cool-season Grass*
*Red & White Clover*
*Annual Lespedeza*
Yield Distribution: Diverse Cool Season/Legume Mix

- Tall Fescue
- Orchardgrass
- Smooth Bromegrass
- Stockpile
- Red & White Clover
- Annual Lespedeza
- Birdsfoot Trefoil

Yield Distribution:

- Spring
- Summer
- Fall
HIGHLY DIVERSE PASTURE

* Longer growing season
  higher quality diet
  resistant to stress

* However - there must be an intensive management system in place to maintain diversity*
Adding Warm Season Grasses

Seasonal "gaps" in forage supply
Predominant Warm Season Grasses in the Midwest

- Native WSG
  - Big Bluestem
  - Indiangrass
  - Switchgrass
  - Eastern Gamagrass
  - Others
    - little bluestem
    - sideoats grama
    - dropseeds

- Introduced WSG
  - Bermudagrass
    - common types
      - Guymon, Wrangler, Cheyenne, Vacquero
    - hybrids
      - Numerous
  - Old World Bluestems
    - Caucasian
    - Plains
    - WW Spar
    - King Ranch
Native & Introduced WSG Comparison

• Native WSG
  – Provide wildlife habitat
  – Well adapted
  – Require longer rest periods + height
  – Require moderate levels of N
  – More cost-share opportunities
  – Less sensitive to climate
  – Deeper rooted

• Introduced WSG
  – Provide good late summer forage
  – Higher stocking rates
  – Require shorter rest periods & height
  – Require high levels of N to meet yield goals
  – May invade native grasslands?
  – More sensitive to climate
<table>
<thead>
<tr>
<th>Species</th>
<th>Crude Protein</th>
<th>DOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Bluestem</td>
<td>5.37 – 16.71</td>
<td>59.61 – 71.89</td>
</tr>
<tr>
<td>Indiangrass</td>
<td>5.91 – 14.61</td>
<td>56.18 – 69.85</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>6.43 – 16.18</td>
<td>58.70 – 68.56</td>
</tr>
<tr>
<td>Eastern Gamagrass</td>
<td>5.73 – 16.31</td>
<td>58.56 – 68.74</td>
</tr>
<tr>
<td>Bermudagrass</td>
<td>9.25 – 16.28</td>
<td>62.44 – 75.29</td>
</tr>
<tr>
<td>Caucasian Bluestem</td>
<td>7.53 – 21.53</td>
<td>55.69 – 73.31</td>
</tr>
<tr>
<td>Broomsedge</td>
<td>10.1 – 13.88</td>
<td>60.19 – 67.66</td>
</tr>
</tbody>
</table>
Annual Warm Season Grasses

- Crabgrass
- Sorghum/Sudan
- Sudangrass
- Pearl Millet
- Browntop Millet
- Corn
- Grain Sorghum/Milo
Yield Distribution: growing season

Yield (tons/A)

- Cool-season Grass
- Caucasian Bluestem
- Bermudagrass

Graph showing yield distribution for different seasons:
- Spring
- Summer
- Fall
Yield Distribution: growing season

Yield (tons/A)

- Tall Fescue
- Big bluestem/indiangrass
- Eastern gama/Switchgrass

Spring, Summer, Fall
Adding Stockpiled Tall Fescue

Short seasonal "gaps" in forage supply

Yield

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

Cool season

Warm season

Stockpile
Stockpiled Tall Fescue
One of Missouri’s Biggest Advantages

The managed accumulation of new growth
Stockpiling

- Start with fescue pastures that have 3 to 6 inches of leaf in early August
- Apply 40 - 60 lbs. N on Aug. 10 (*North MO*), if stand is dense & vigorous and moisture adequate apply up to 80 lbs. N
- Defer grazing until growth stops (late Nov to early Dec.) or until needed
- Utilize all other available pastures first
- Consider feeding hay simultaneously to “stretch” supply of both and manage placement of supplemental nutrients.
Move polywire to expose 1 to 3 days worth of grazing at a time ... greatly increases utilization and preserves quality.

Calculate forage available per acre, figure daily herd intake requirement, use 70% utilization if moving every 2 days, calculate size of strip required
Seasonal Costs

- Haying: $0.65 - $0.78/day x 80 days = $52 - $62

- Stockpile + Stripgraze: $0.37/day x 80 days = $29.60

ABOUT HALF
Stockpiled Tall Fescue Crude Protein

![Graph showing the percentages of stockpiled tall fescue crude protein over months.](image)
Stockpiled Tall Fescue

DOM

![Graph showing months (November, December, January, February, March) and corresponding DOM values (52, 54, 56, 58, 60, 62, 64, 66, 68)]
So…What forages should I plant?

- For the first 3 years plant fence posts and water lines
- Manage grazing and see what happens naturally
- Find gaps in forage supply and pastures that didn’t respond to management (weak links)
- Then… plant forages to fill the gaps
Selecting Forages:

• There are no “silver bullets”
• Choose a forage that:
  – best complements your present forages,
  – fills needed gaps,
  – meets your goals and management system,
  – and fits within your budget
• Stock properly and manage intensively
Factors affecting forage quality

- Plant maturity
  - Vegetative > Reproductive growth
Factors affecting forage quality

- Plant maturity
  - Growth stage
  - Length of rest period—the longer the rest, the lower the quality
Plant Growth Phases

Phase 2 shows Voison’s “Blaze of Growth”
Rest Period Needs

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Yield (tons/A)</th>
<th>Rest Period Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fescue</td>
<td></td>
<td>15 - 20 days</td>
</tr>
<tr>
<td>Clover</td>
<td></td>
<td>20 - 25 days</td>
</tr>
<tr>
<td>Annual Lespedeza</td>
<td></td>
<td>35 - 45 days</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td></td>
<td>35 - 45 days</td>
</tr>
<tr>
<td>Stockpile</td>
<td></td>
<td>30 - 35 days</td>
</tr>
<tr>
<td>Birdsfoot Trefoil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Spring**
- **Summer**
- **Fall**
Factors affecting forage quality

- Plant maturity
- Species
Factors affecting forage quality

- **Species**
  - Legumes > grasses
Factors affecting forage quality

- **Species**
  - Legumes > grasses
  - Annuals > perennials
Factors affecting forage quality

- Species
  - Legumes > grasses
  - Annuals > perennials
  - Cool-season > warm season
("General Rule")
Factors affecting forage quality

- Plant part
  - Leaves vs stems
Factors affecting forage quality

- Plant part
  - Leaves vs stems
  - First bite vs second bite
3 Factors Affecting Forage Quality

Note – 2\textsuperscript{nd} and 3\textsuperscript{rd} bites must occur before regrowth to avoid severe damage to the plant

1. Maturity

2. Species

3. Plant Part

\textsuperscript{1\text{st}} bite: leaves with low fiber
High quality

\textsuperscript{2\text{nd}} bite: medium quality

\textsuperscript{3\text{rd}} bite: stems with high fiber – low quality – leave for regrowth
Tools for improving pasture quality

- Grazing Management
Tools for improving pasture quality

- Grazing management
- Burning (comes at a cost, use sparingly)
Tools for improving pasture quality

- Grazing management
- Burning (use sparingly)
- Mechanical harvest or clipping (costly)
Tools for improving pasture quality

- Grazing management
- Burning (use sparingly)
- Mechanical harvest or clipping
- Fertilization (costly, use strategically)
Tools for improving pasture quality

- Grazing management
- Burning (use sparingly)
- Mechanical harvest or clipping
- Fertilization
- Interseeding/Overseeding desirable species (consider site and cultivar suitability)
Tools for improving pasture quality

- Grazing management
- Burning (use sparingly)
- Mechanical harvest or clipping
- Fertilization
- Interseeding/Overseeding desirable species
- Total renovation (very costly, evaluate economically, seek help, DO IT RIGHT)