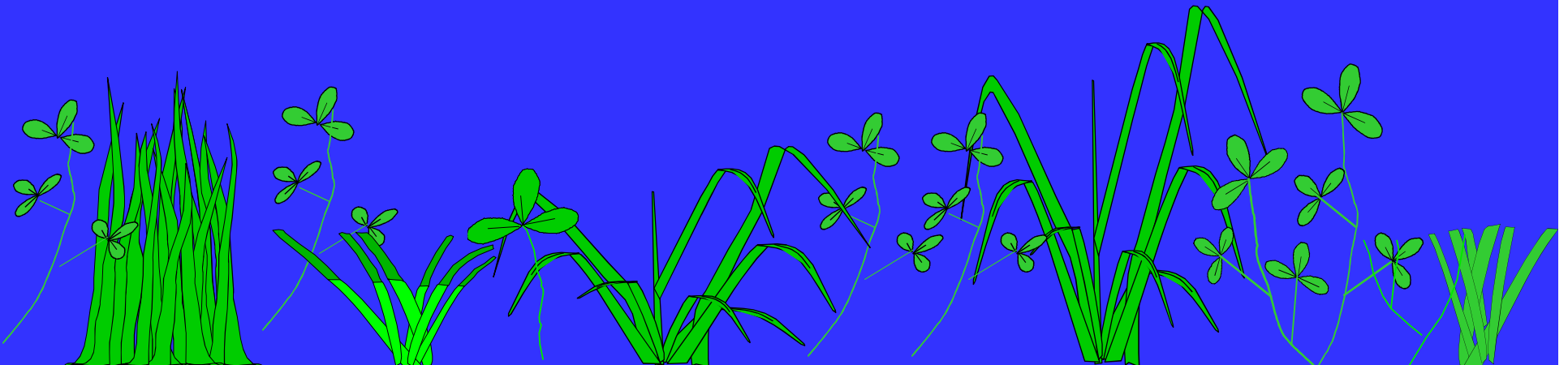


PLANT GROWTH AND FORAGE MANAGEMENT

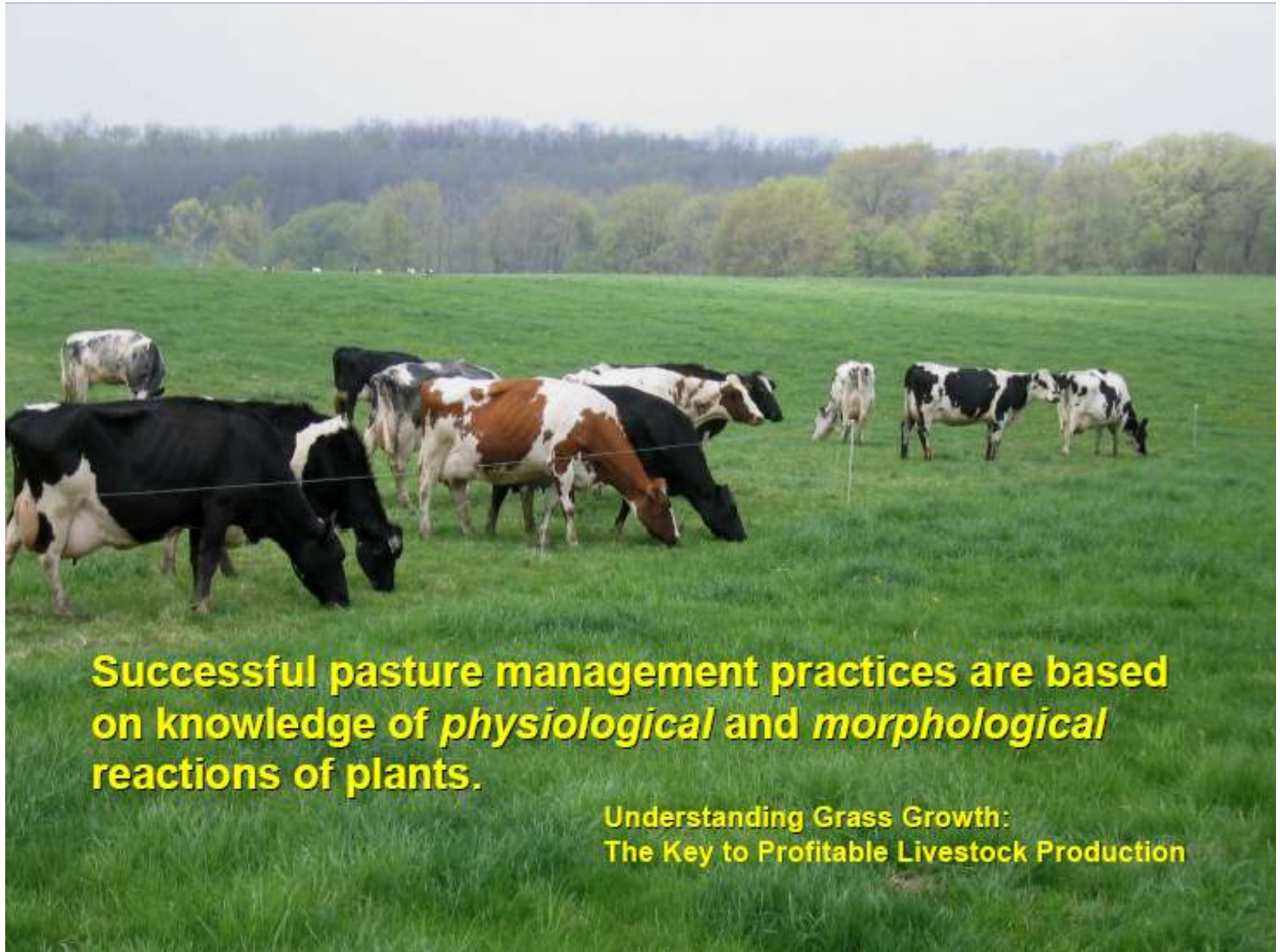
Mark Kennedy and John Turner
State Grassland Conservationists
(RETIRED)

MODNR-SWCP and MFGC/GLCI



Cha-ching!

- Manage Ground Cover:
 - Canopy-growing leaves
 - Litter
- Facilitate healthy, extensive, actively growing roots
- Limit 2nd 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)

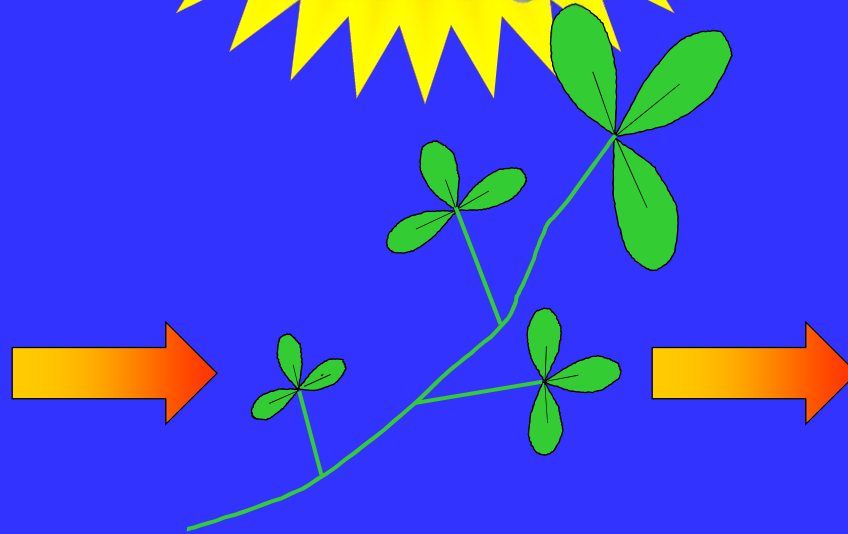


Photosynthesis



Carbon
dioxide

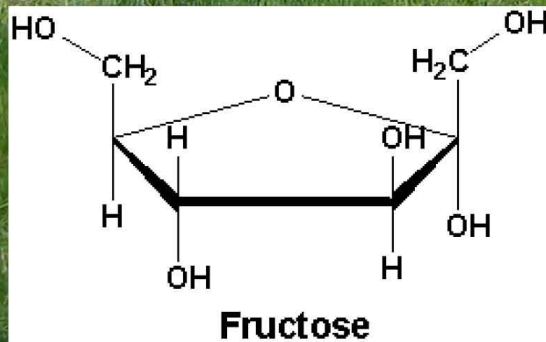
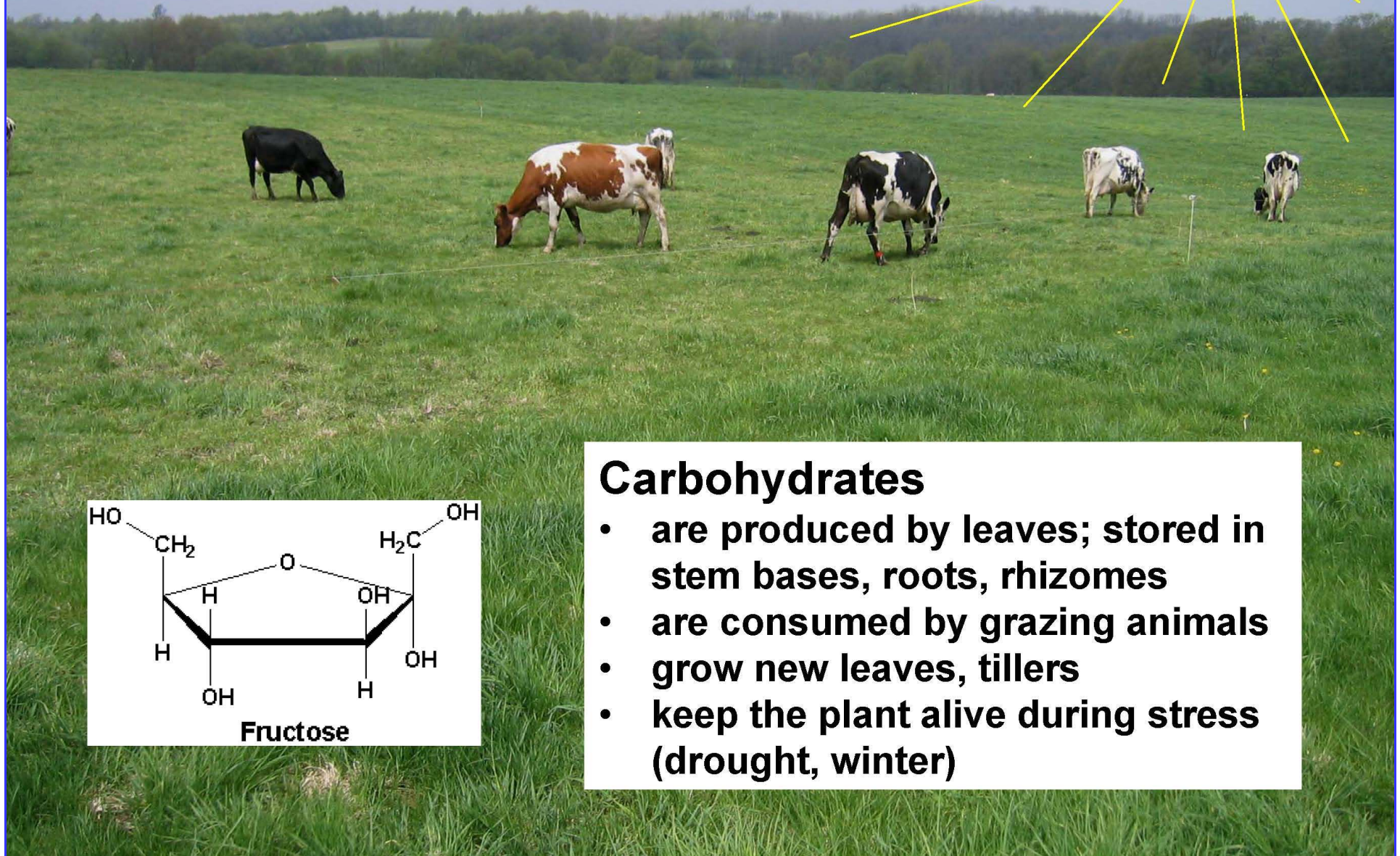
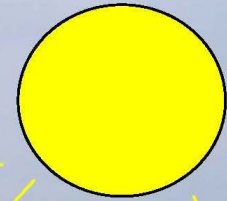
Water



Oxygen

Sugars

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)

Managing Photosynthesis

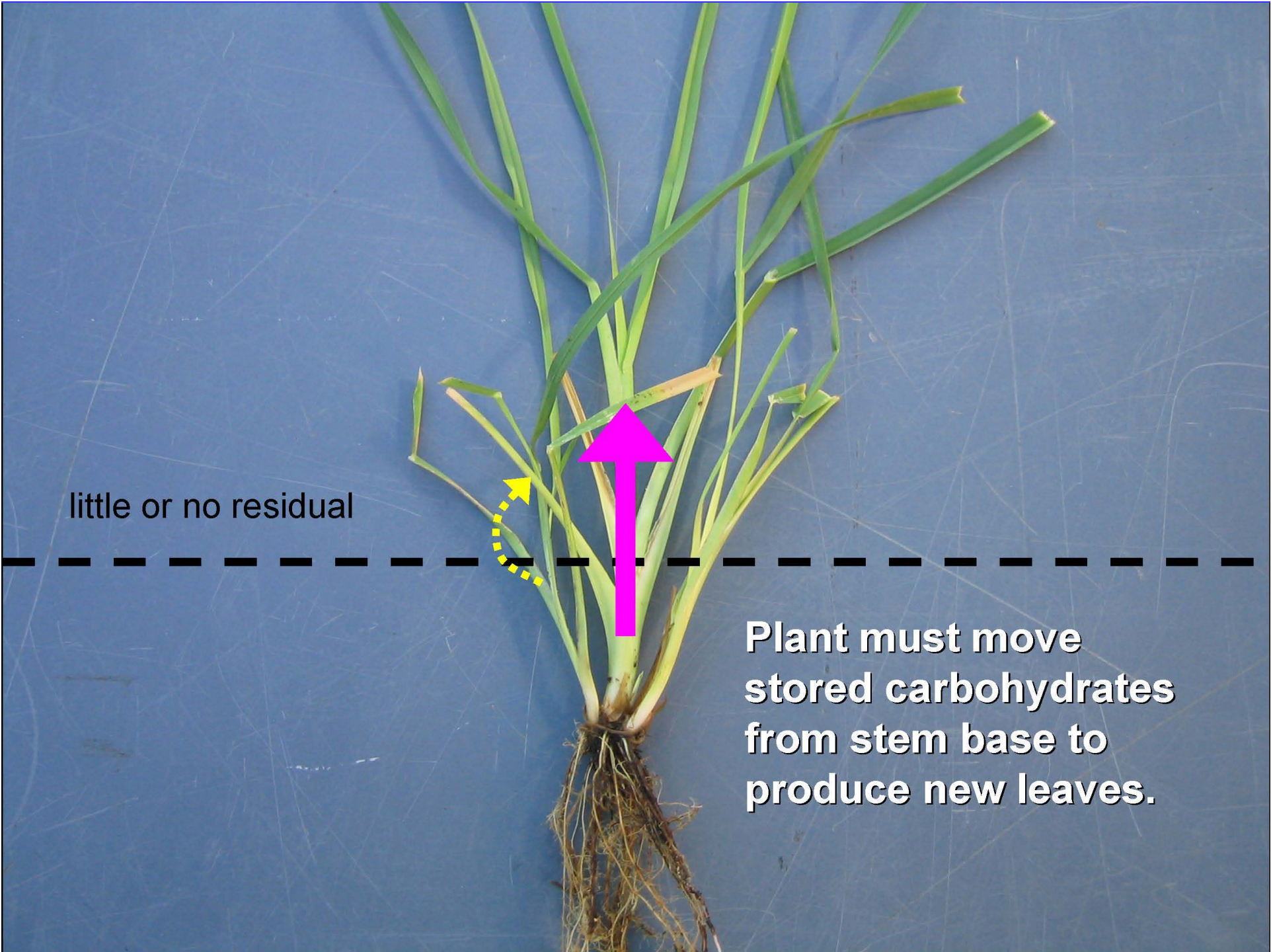


Only green, growing leaves capture solar energy, and make livestock feed.

adequate residual



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.

adequate residual



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



primary tiller
(produce seedhead
in spring)

axillary bud

secondary tillers

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

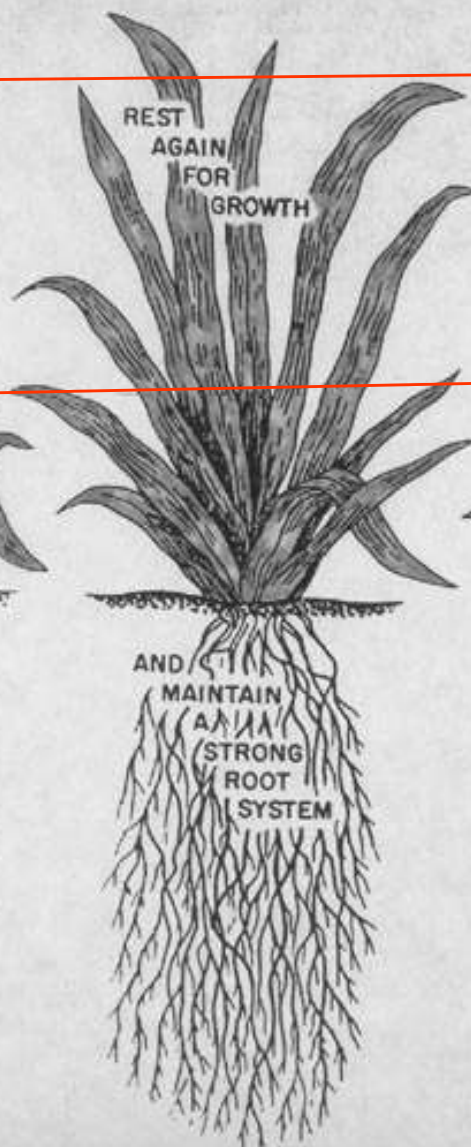
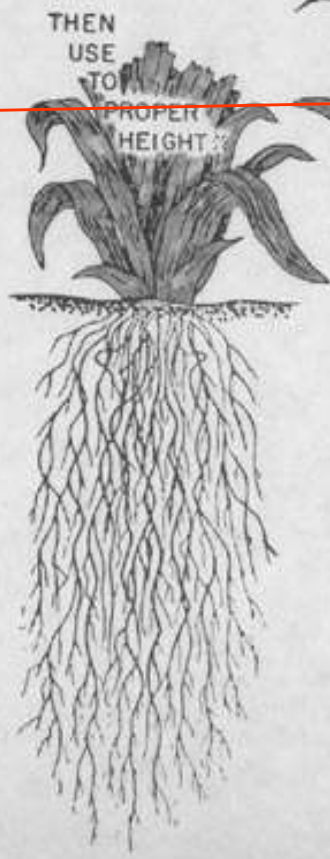
The Take Half-Leave Half Rule

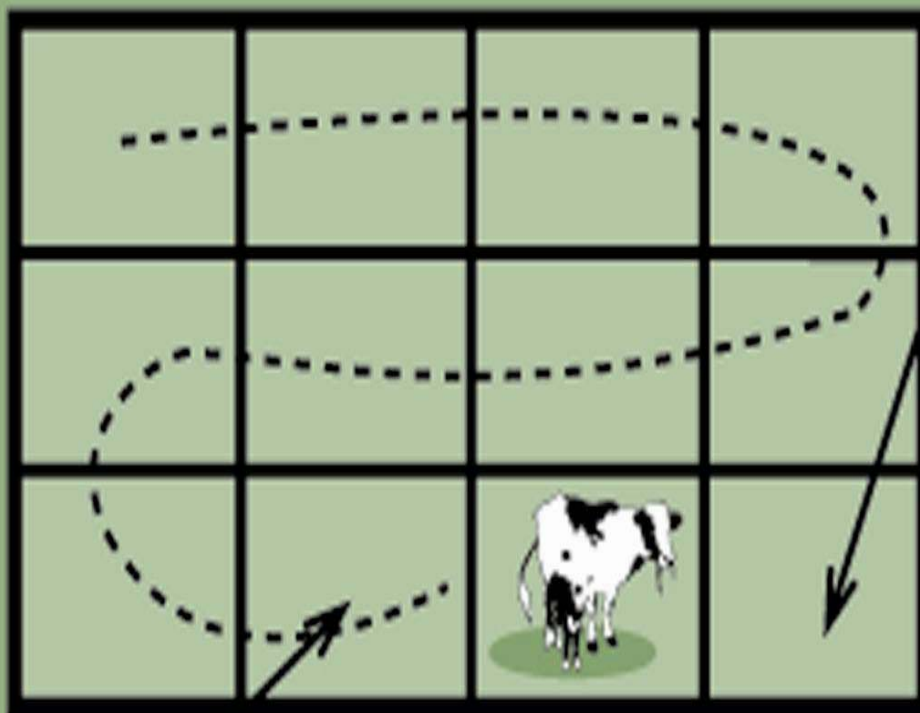
% Leaf Removed	% Root Growth Stopped
10	0
20	0
30	0
40	0
50	2 to 4
60	50
70	78
80	100
90	100

GRAZE AND REST PASTURE

12"

6 - 8"





Previous paddock
recently grazed:

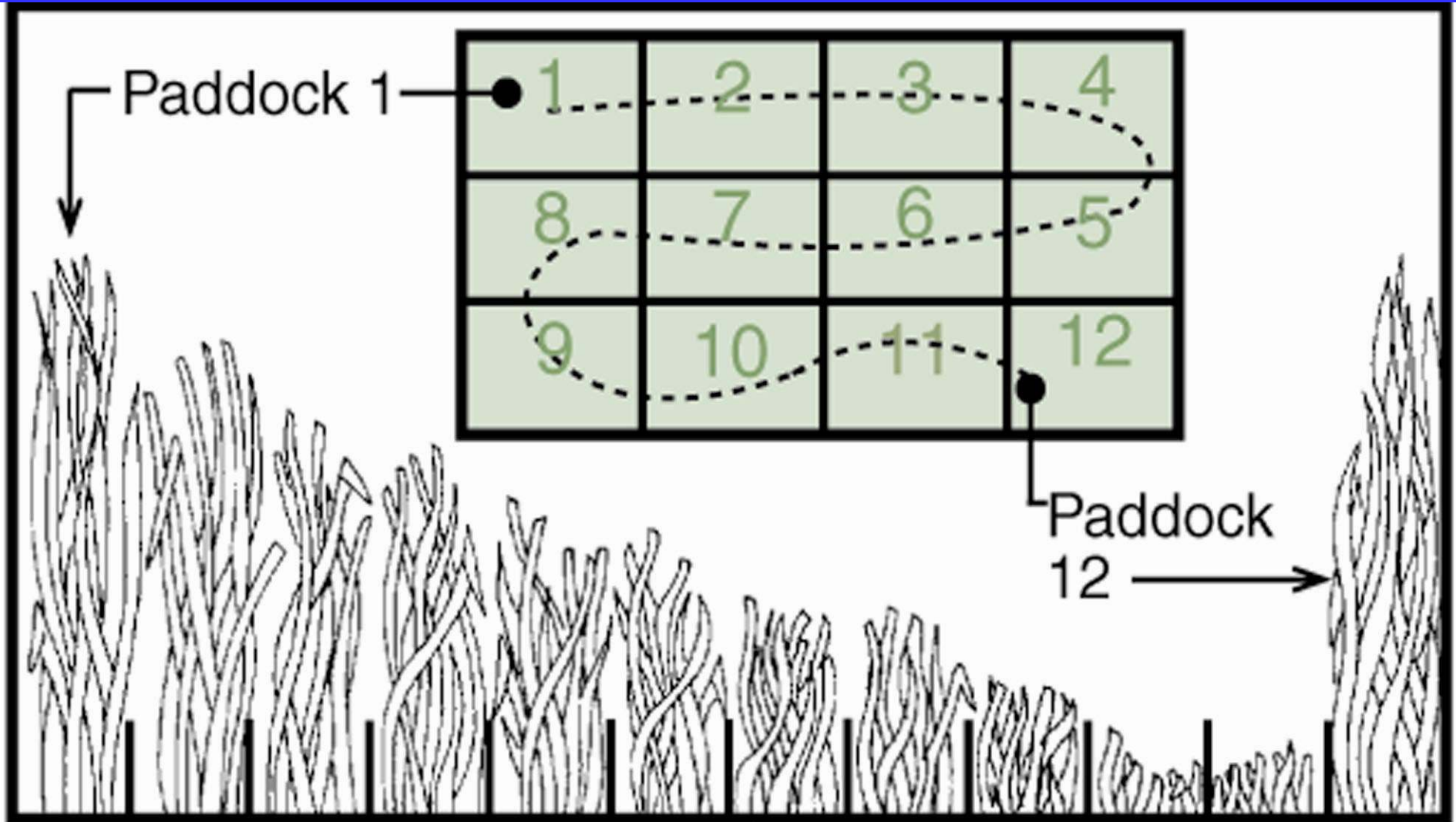
- low-quality "residual" stubble
- carbohydrates depleted
- canopy removed for light penetration

Next paddock fully rested:

- carbohydrates replenished
- reseeding allowed
- tall canopy present
- leafy growth available

The Grazing Wedge

(Example of REALLY BAD Rotation sequence)



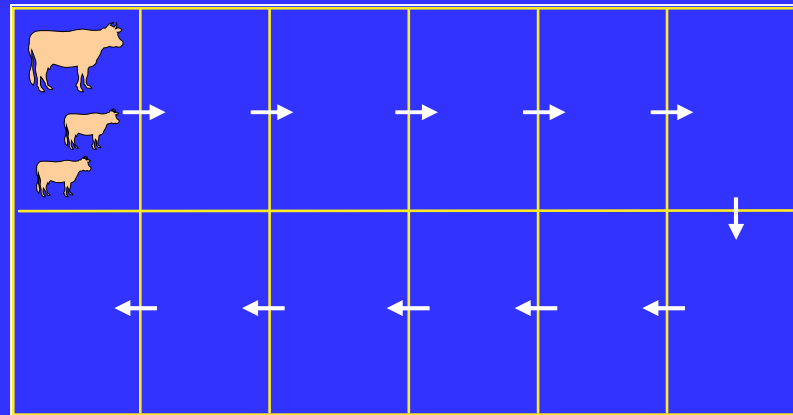
Plant Growth and Management: Plant Persistence

During grazing periods: control stubble height

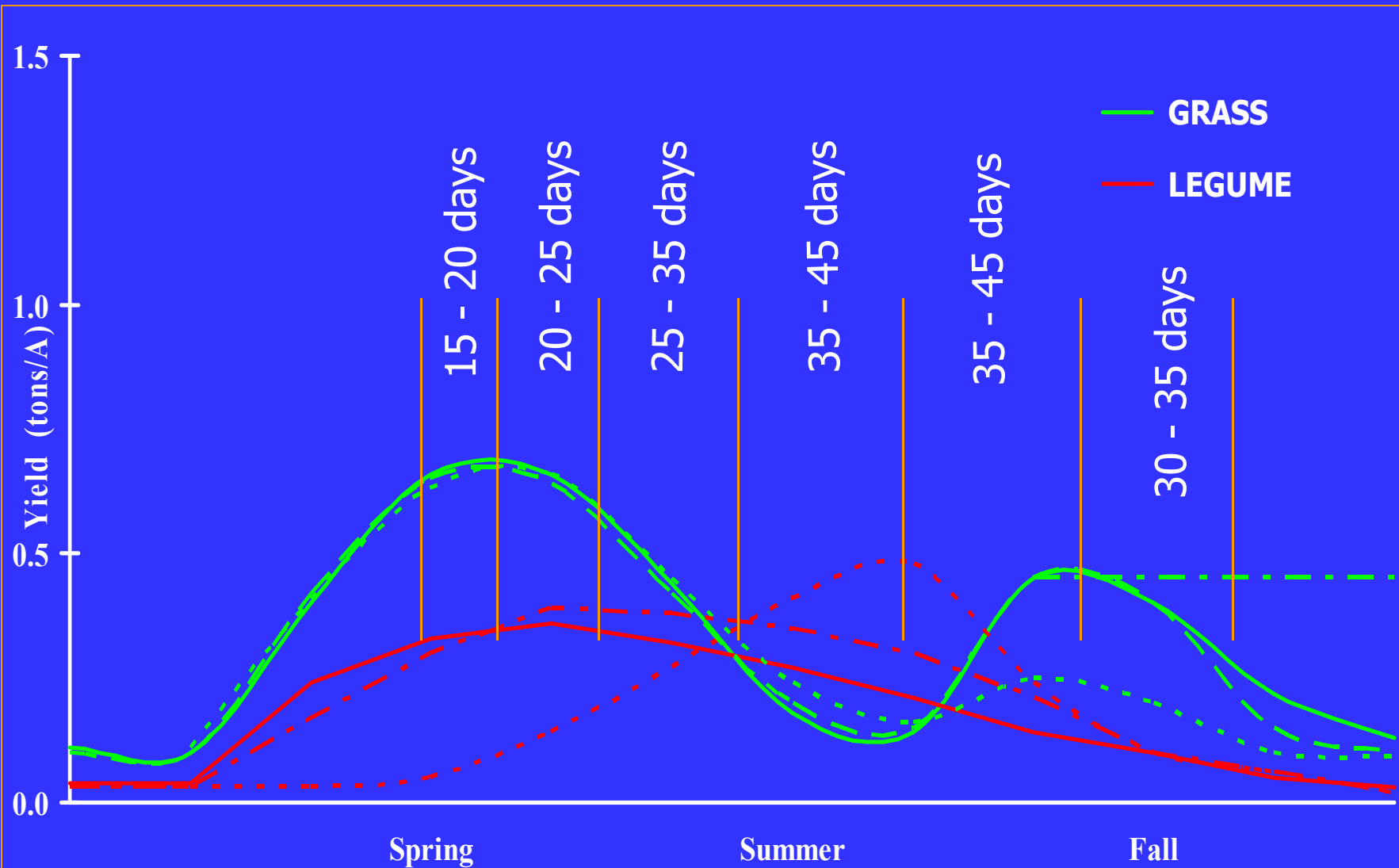
- not too low—keep growing points
- not too low—good photosynthesis
- not too low—keep roots growing

Between grazing periods: schedule rest periods

- allow photosynthesis
- allow leaves to regrow
- allow “vegetative reproduction” (spreading plants)

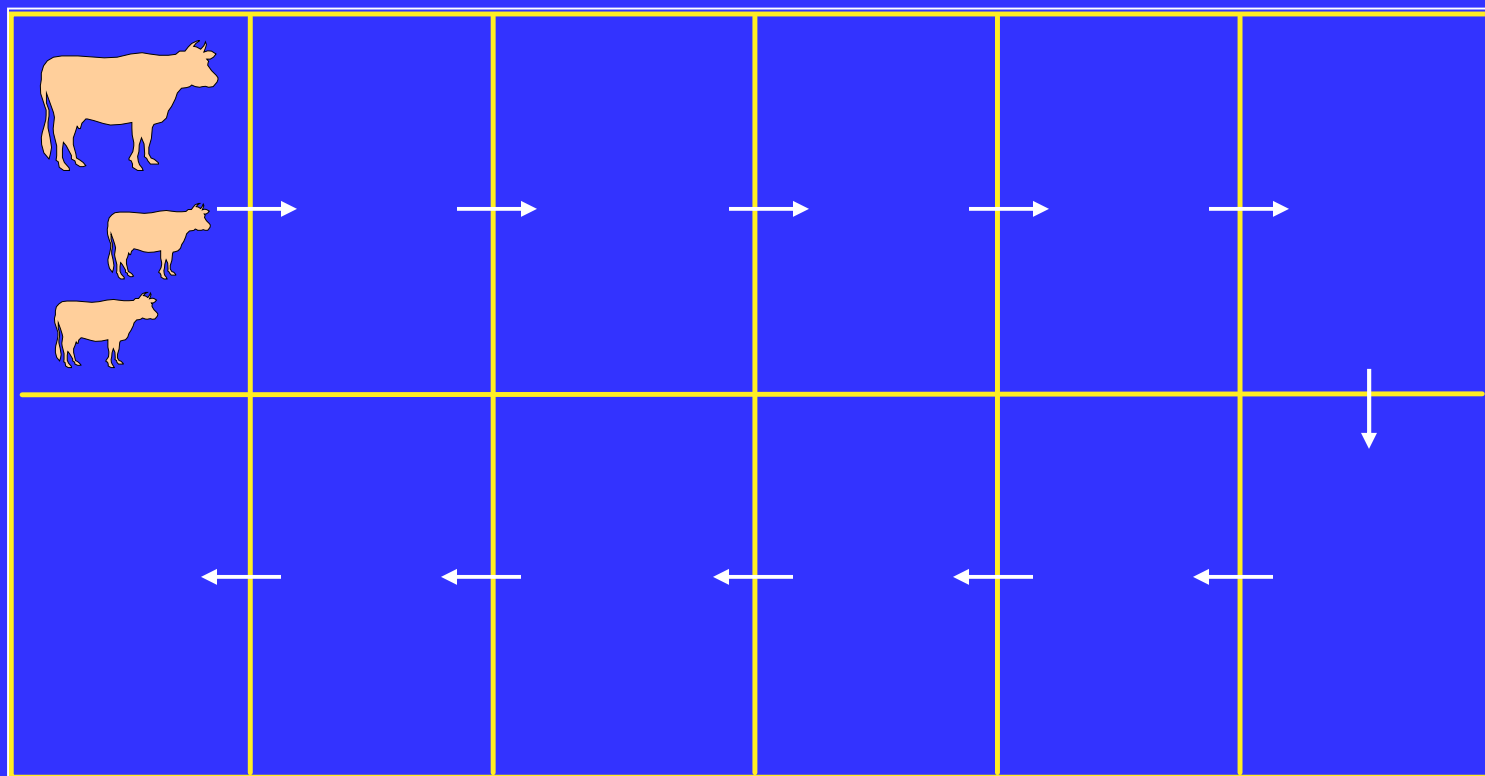


Rest Period Needs: Vary with Rate of Growth During Season



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!**



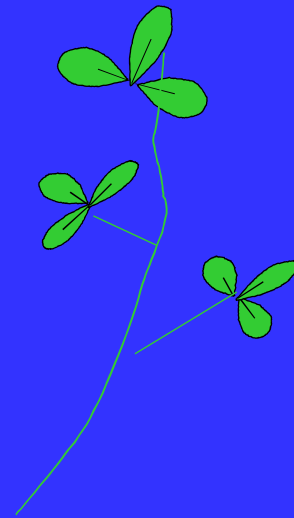
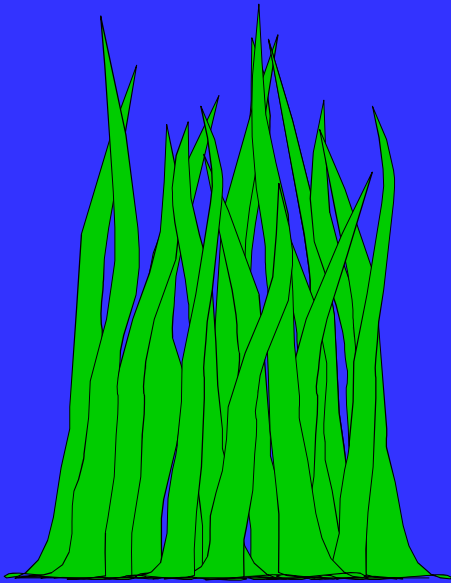
Remember:

- 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

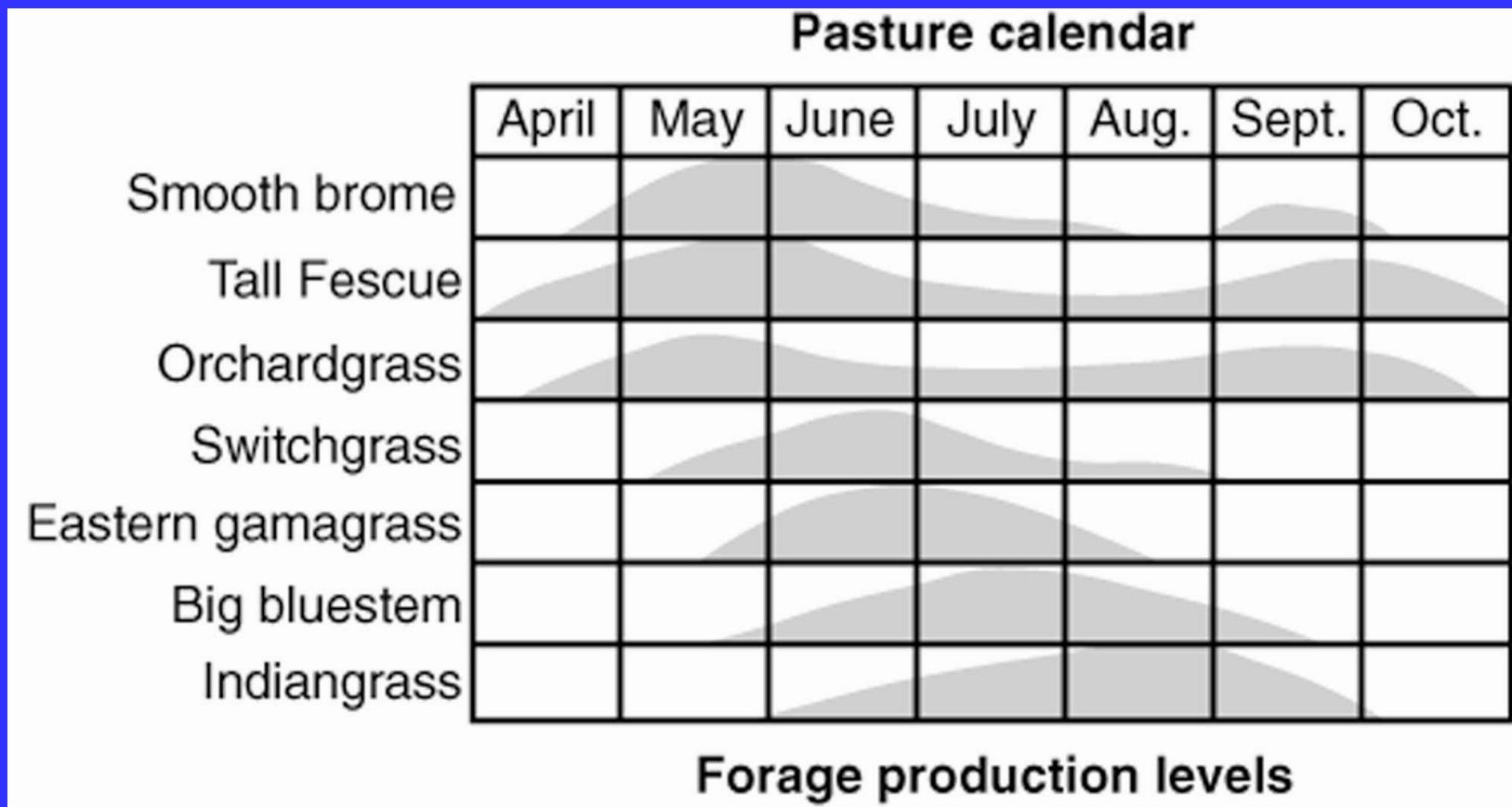
Selection Criteria for Forages

- PERSISTENCE
- YIELD DISTRIBUTION
- QUALITY
- INTENDED USE (Whatcha gonna feed it to?)

Yield Distribution

<i>Forage Type</i>	<i>Optimum Growing Temperature (F)</i>
Cool season grasses	60 – 80
Legumes	70 – 90
Warm season grasses	80 – 95

Forage Production Growth Curves



Cool Season Grasses

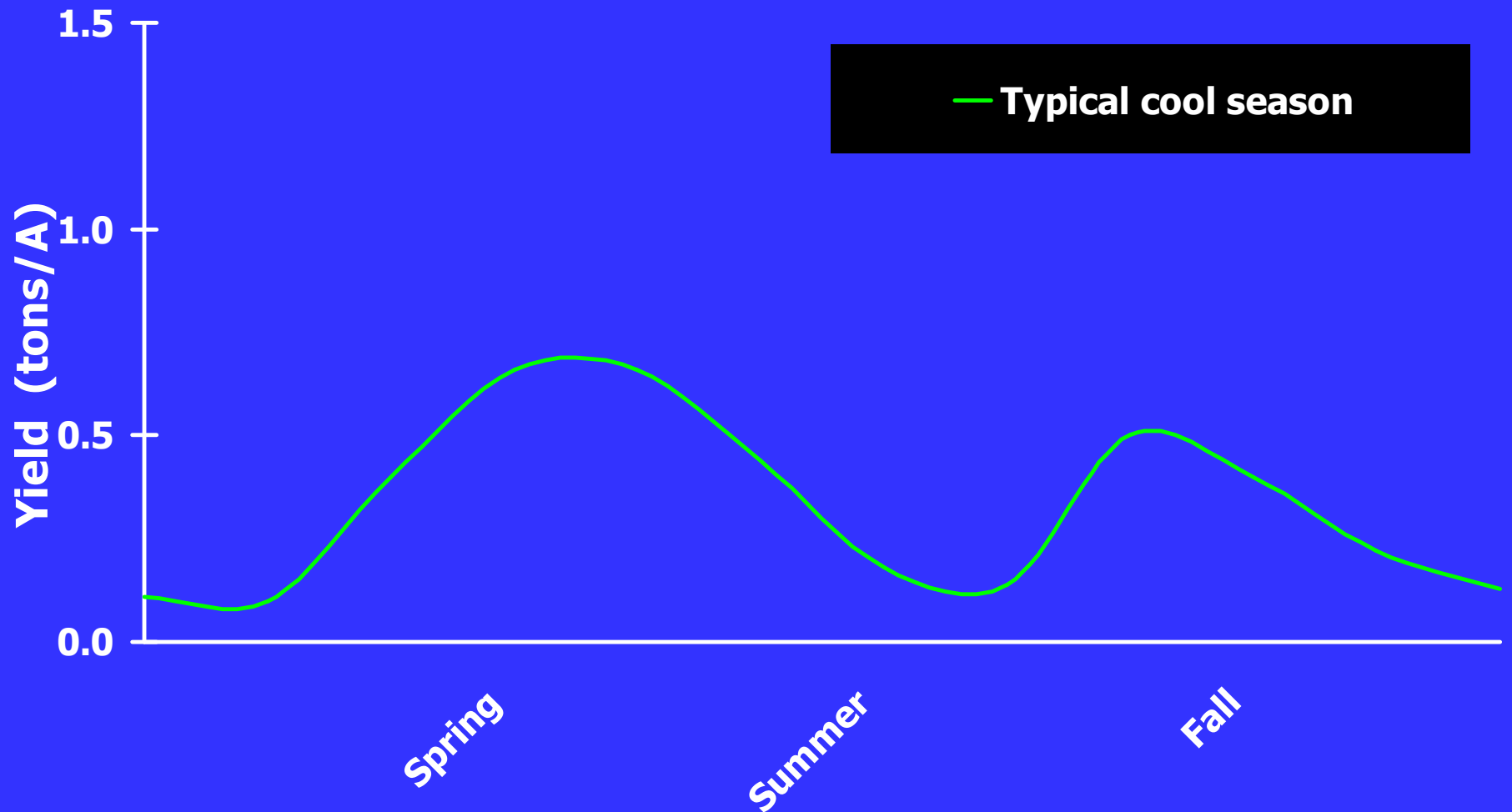
- Perennials

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

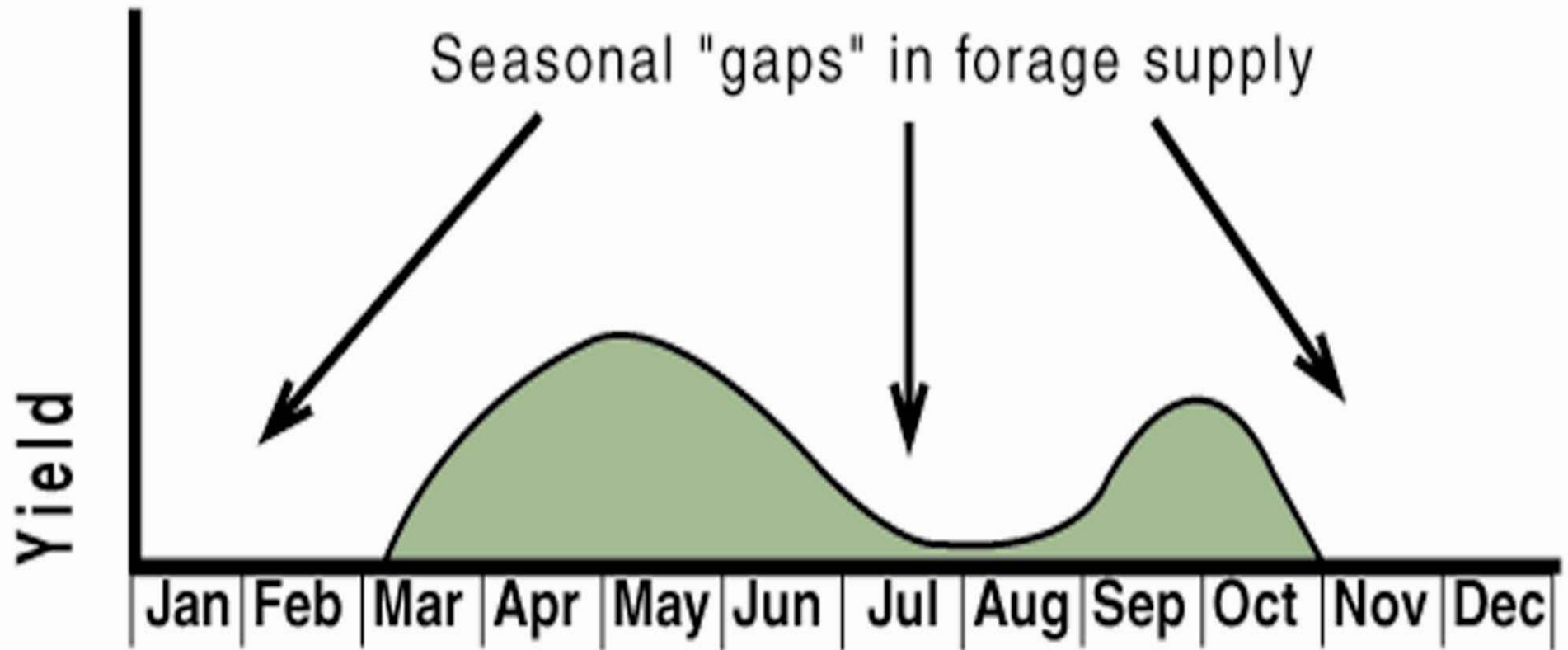
- Annuals

- Cereal Rye
- Oats
- Wheat
- Triticale
- Annual Ryegrass

Yield Distribution: growing season



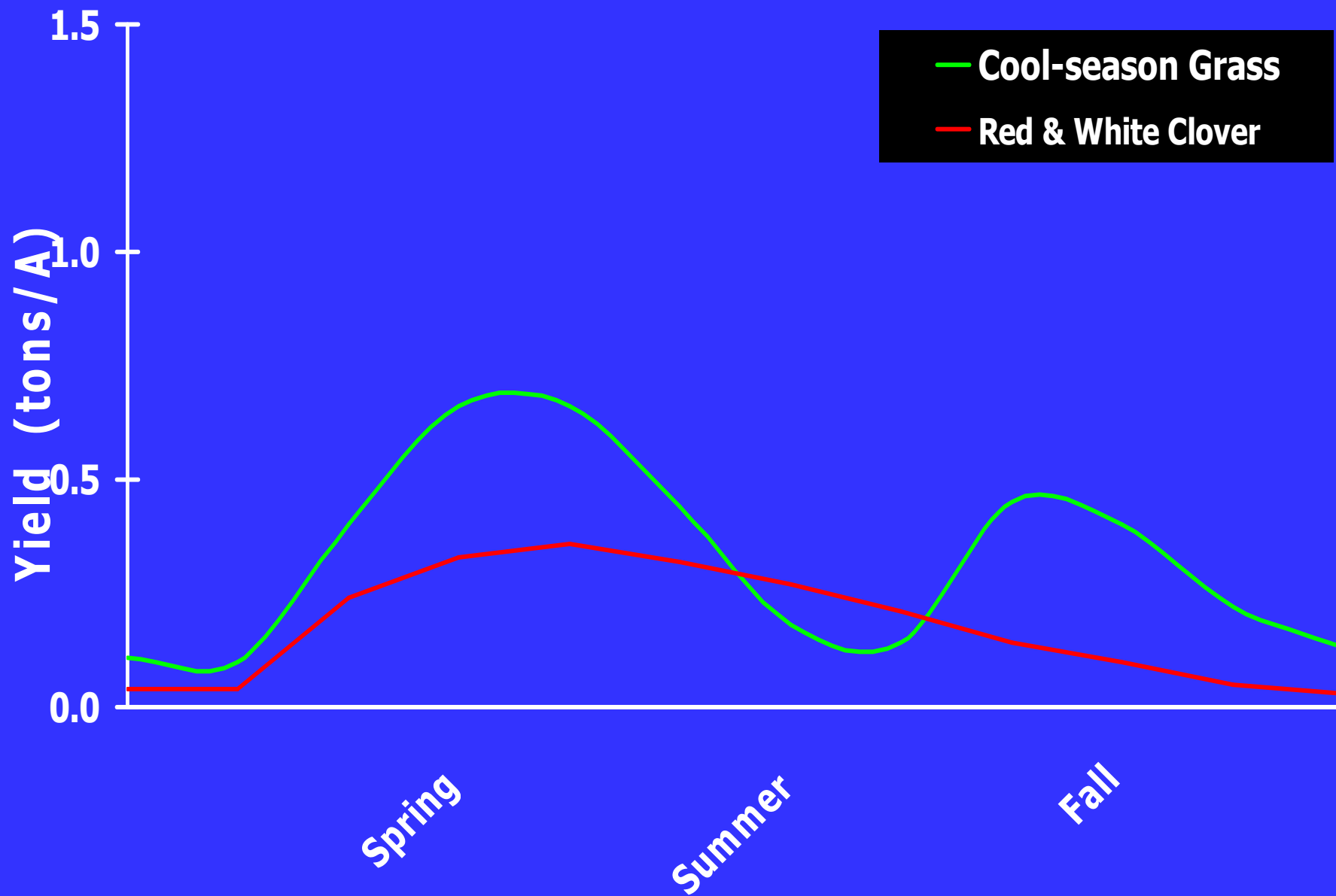
Yield Distribution



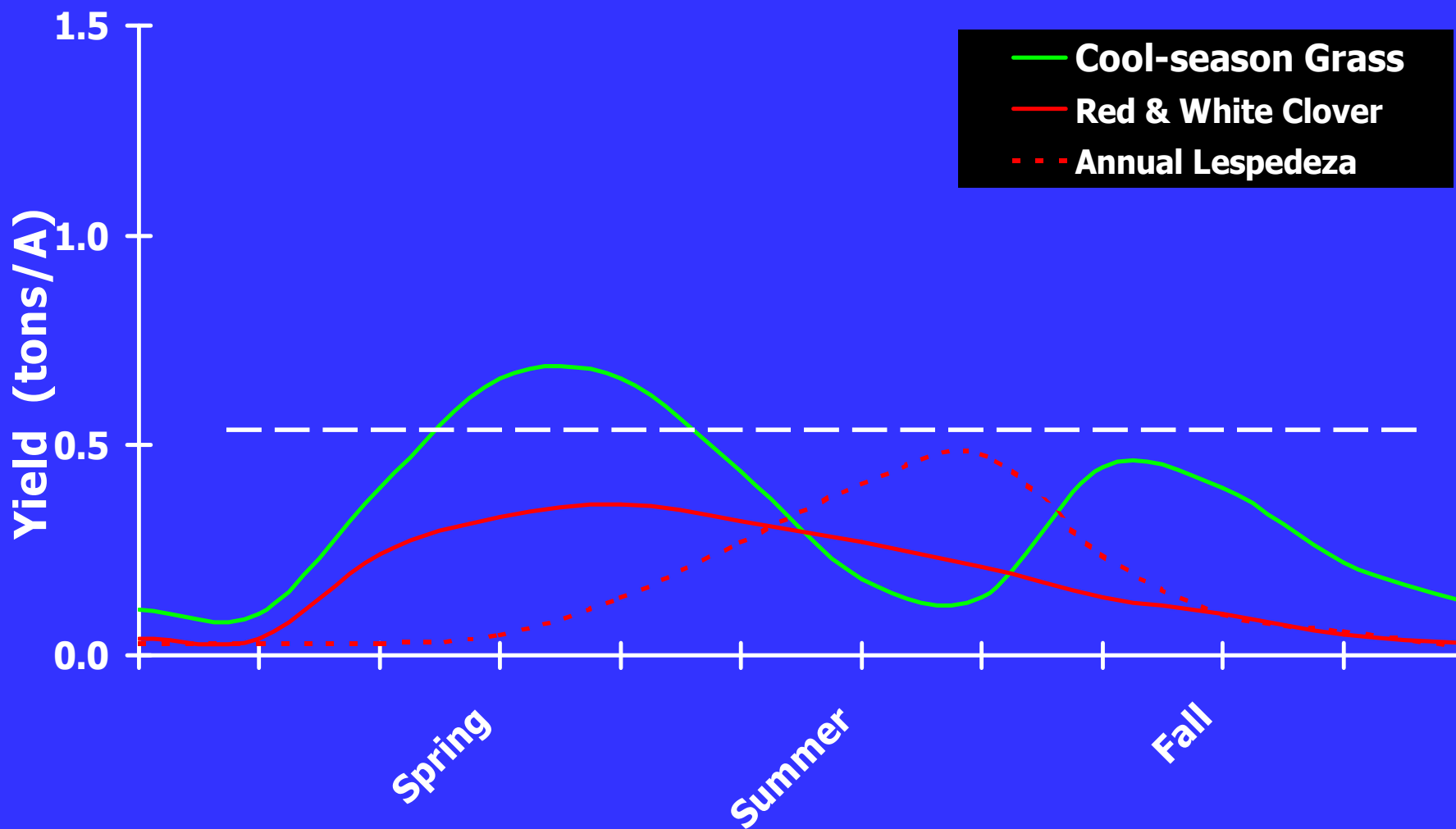
Legumes

- 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



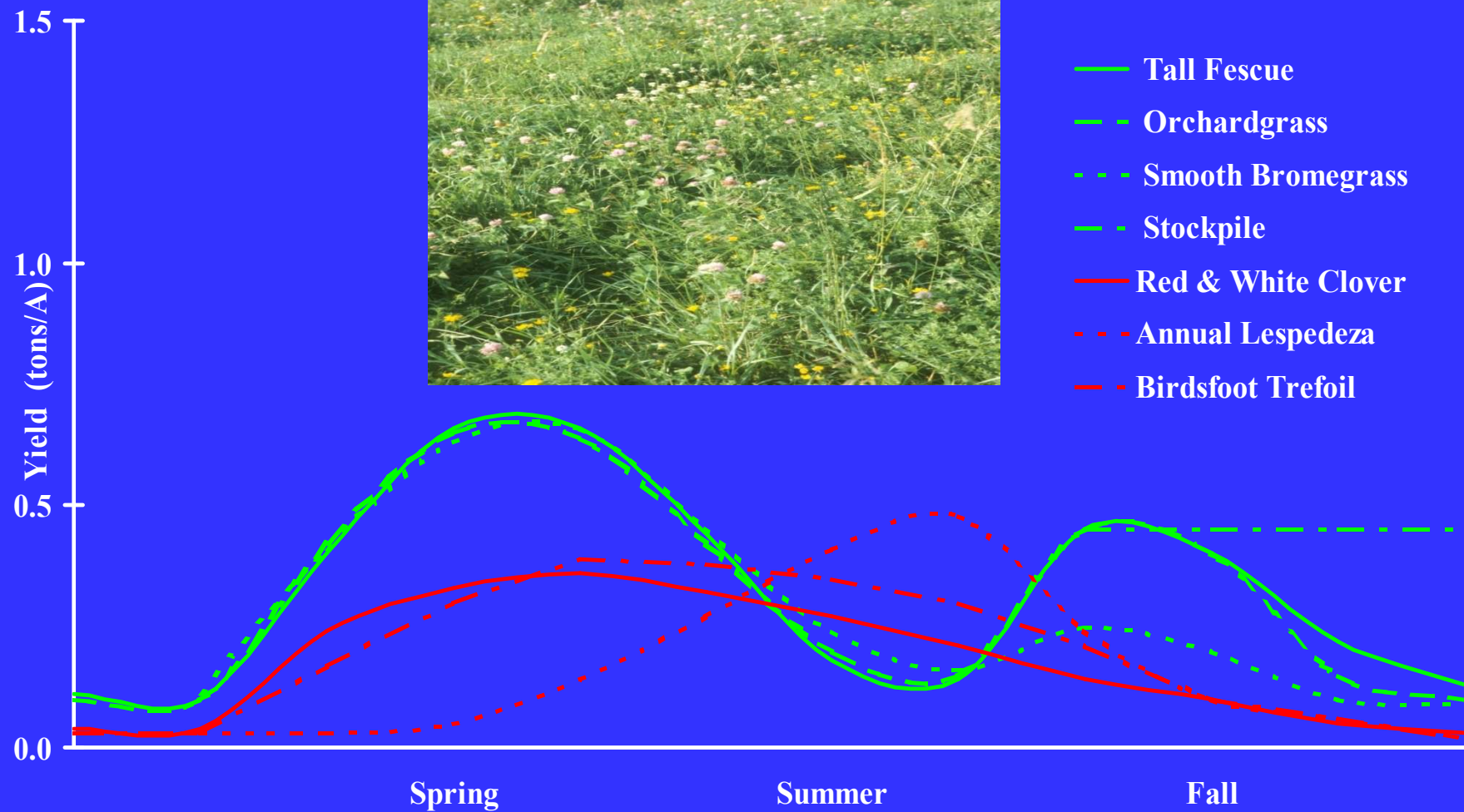
Yield Distribution: Legumes



Yield Distribution: Diverse Cool Season/Legume Mix



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



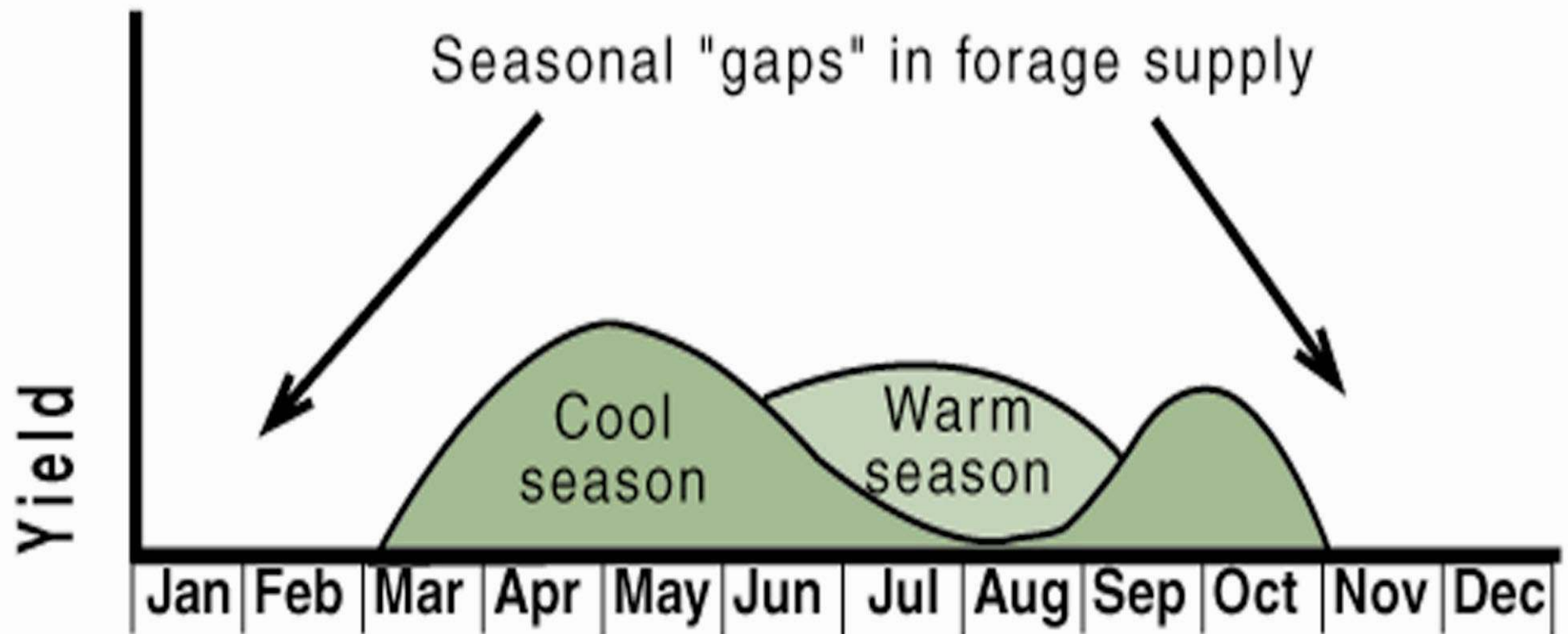
HIGHLY DIVERSE PASTURE

*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



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

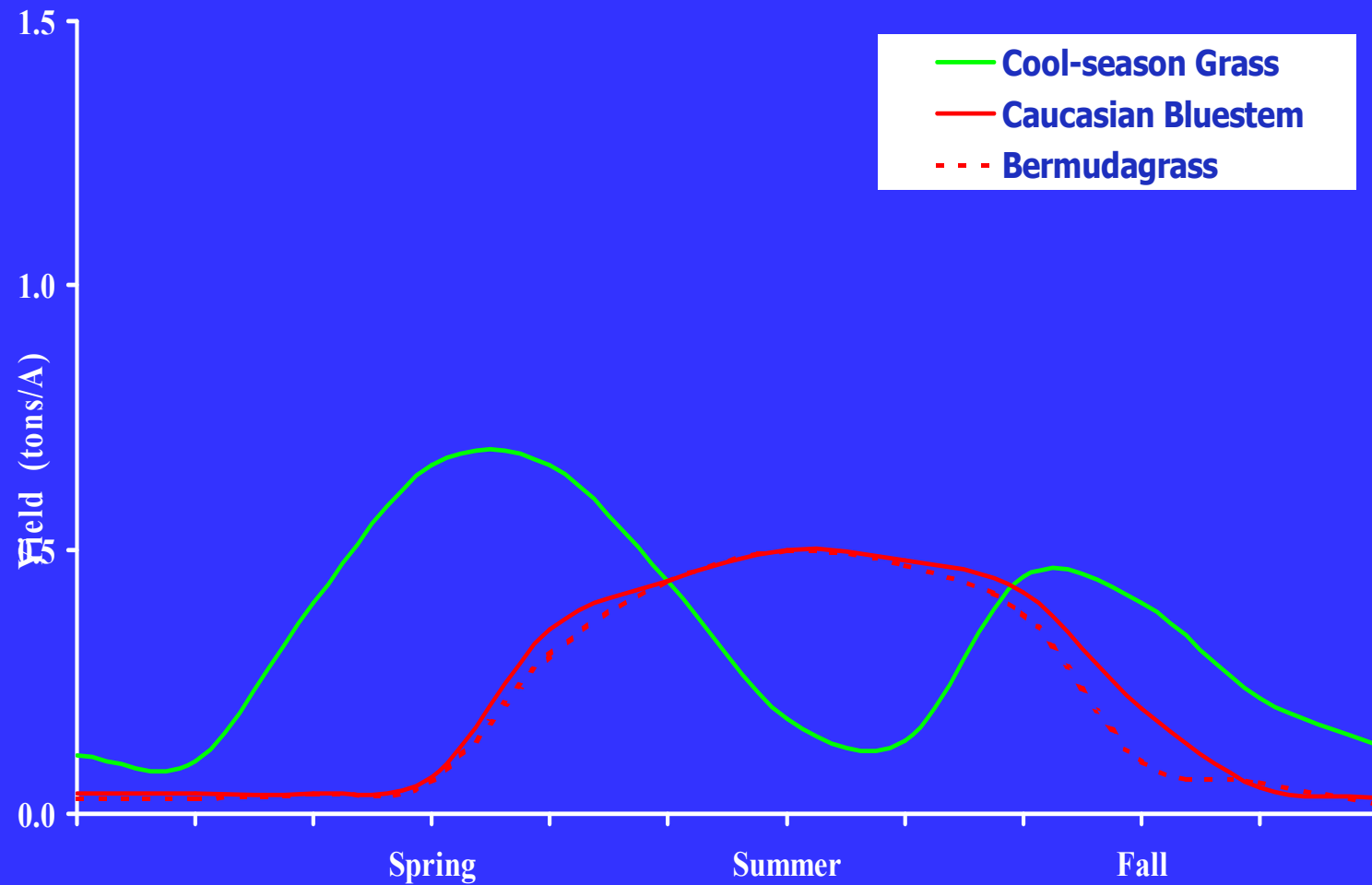
Warm Season Grass Quality Southern MO Data (1994-2004)

Species	Crude Protein	DOM
Big Bluestem	5.37 – 16.71	59.61 – 71.89
Indiangrass	5.91 – 14.61	56.18 – 69.85
Switchgrass	6.43 – 16.18	58.70 – 68.56
Eastern Gamagrass	5.73 – 16.31	58.56 – 68.74
Bermudagrass	9.25 – 16.28	62.44 – 75.29
Caucasian Bluestem	7.53 – 21.53	55.69 – 73.31
Broomsedge	10.1 – 13.88	60.19 – 67.66

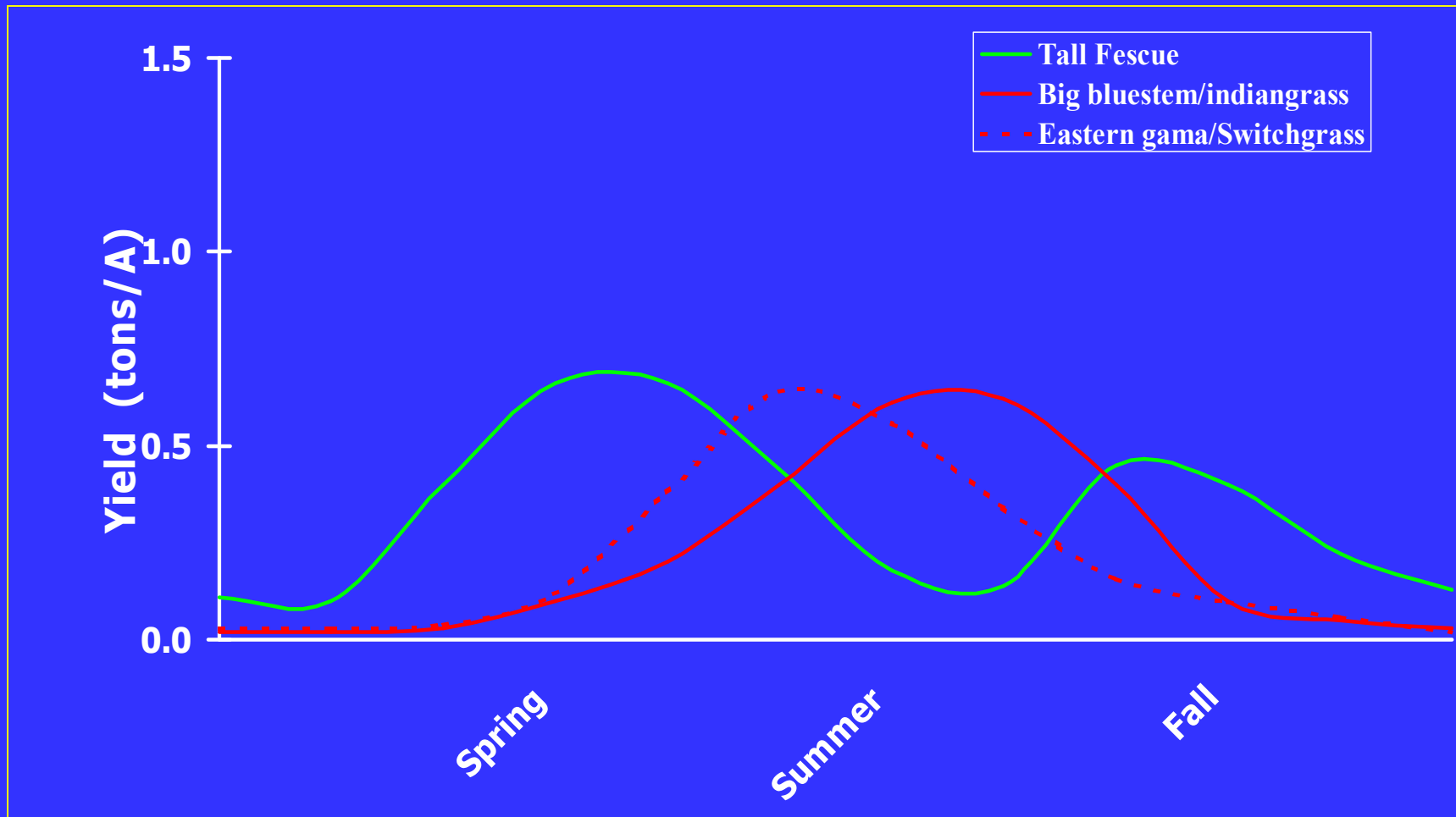
Annual Warm Season Grasses

- Crabgrass
- Sorghum/Sudan
- Sudangrass
- Pearl Millet
- Browntop Millet
- Corn
- Grain Sorghum/Milo

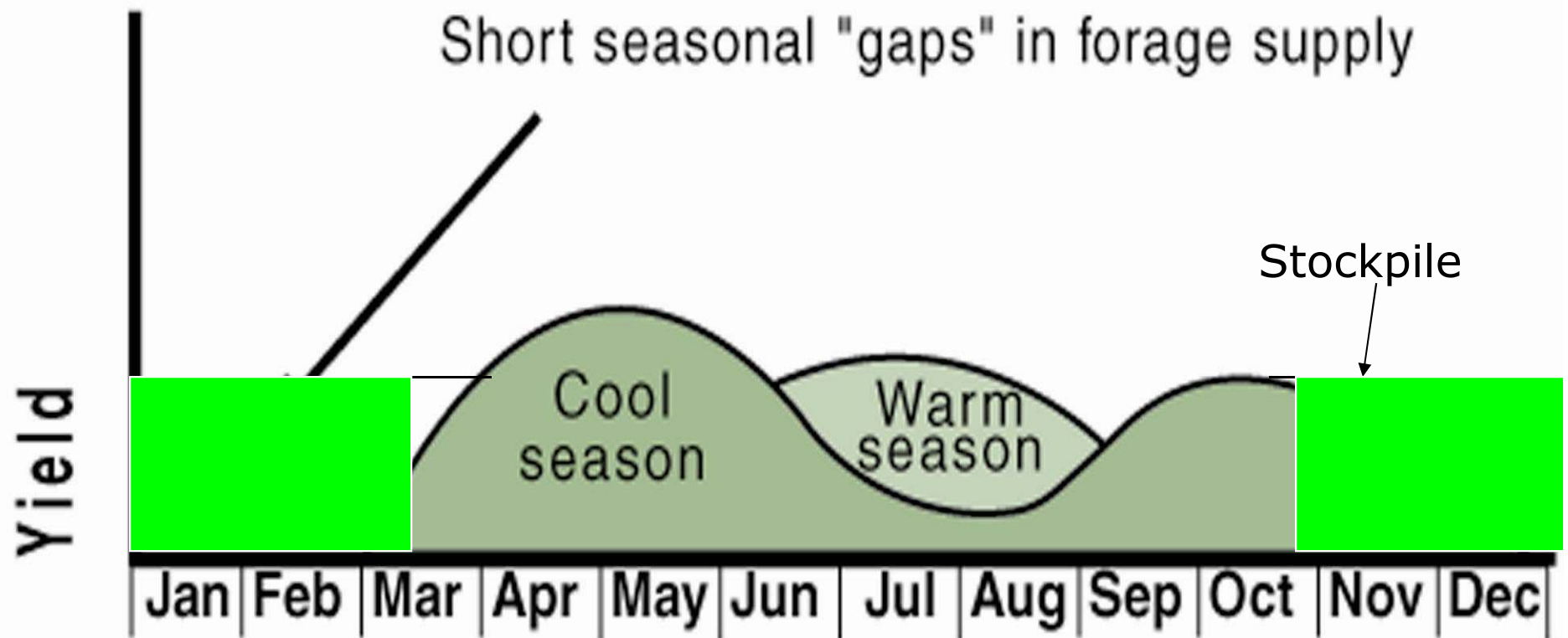
Yield Distribution: growing season



Yield Distribution: growing season



Adding Stockpiled Tall Fescue



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

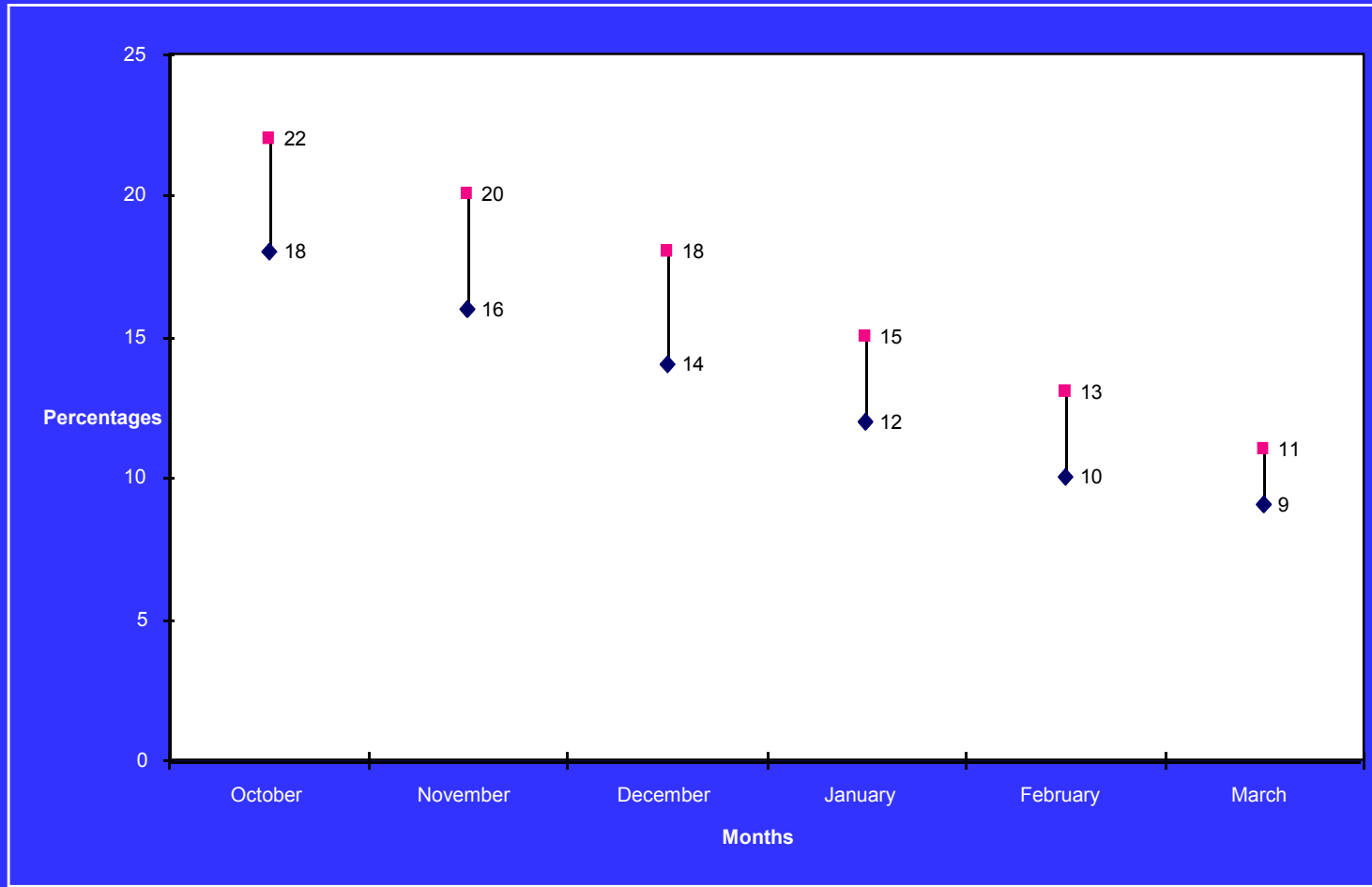
- Haying: $.65 - .78/\text{day} \times 80$
days = \$52 - \$62



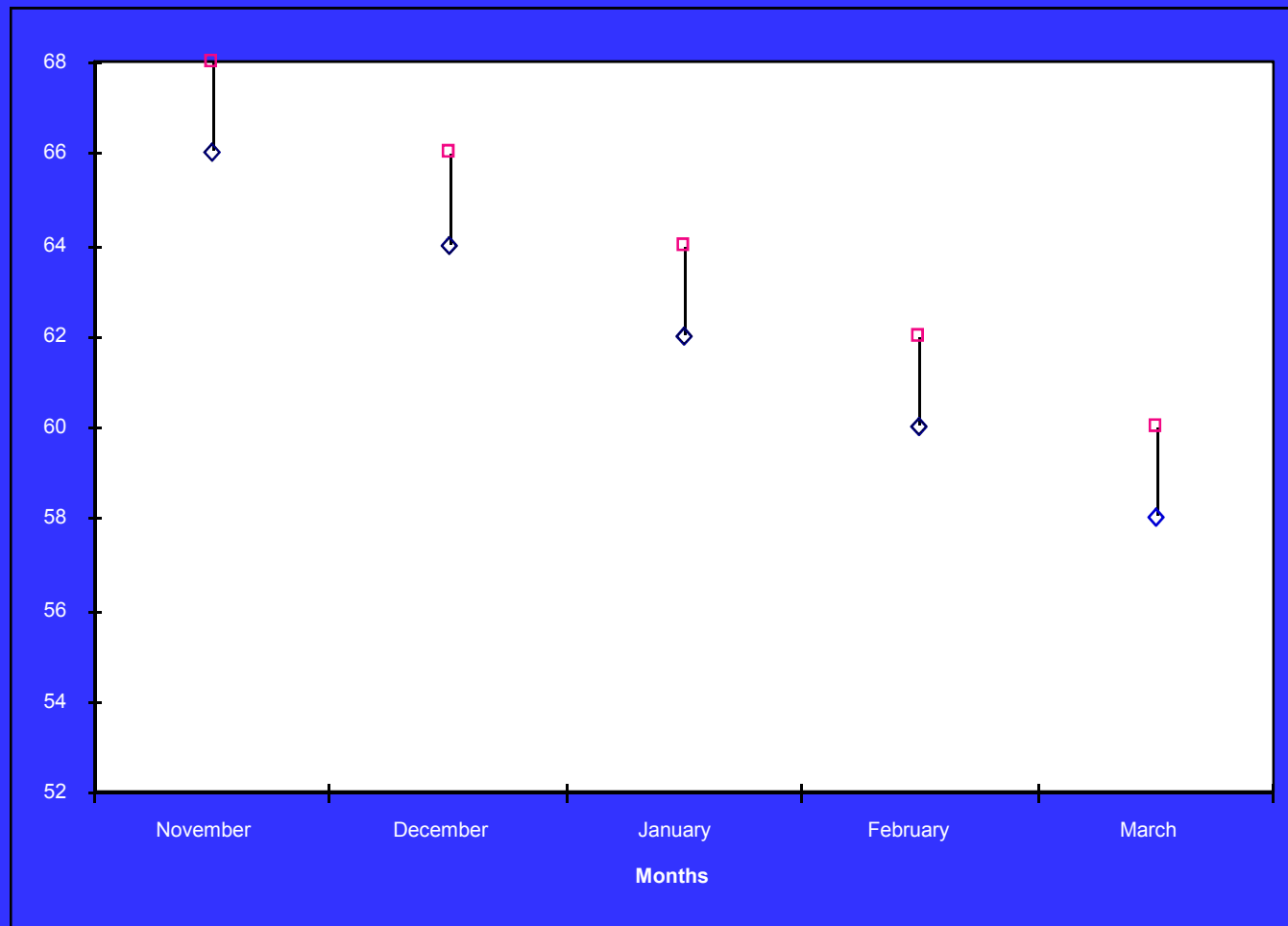
- Stockpile + Stripgraze:
 $.37/\text{day} \times 80$ days = \$29.60
ABOUT HALF



Stockpiled Tall Fescue Crude Protein



Stockpiled Tall Fescue DOM



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

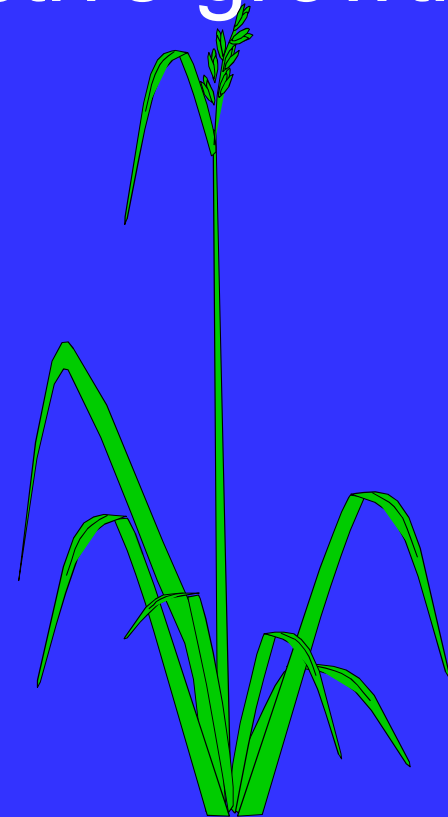
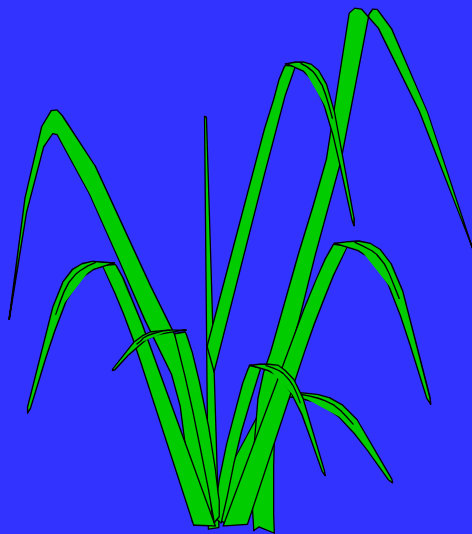
Selecting Forages:

- 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



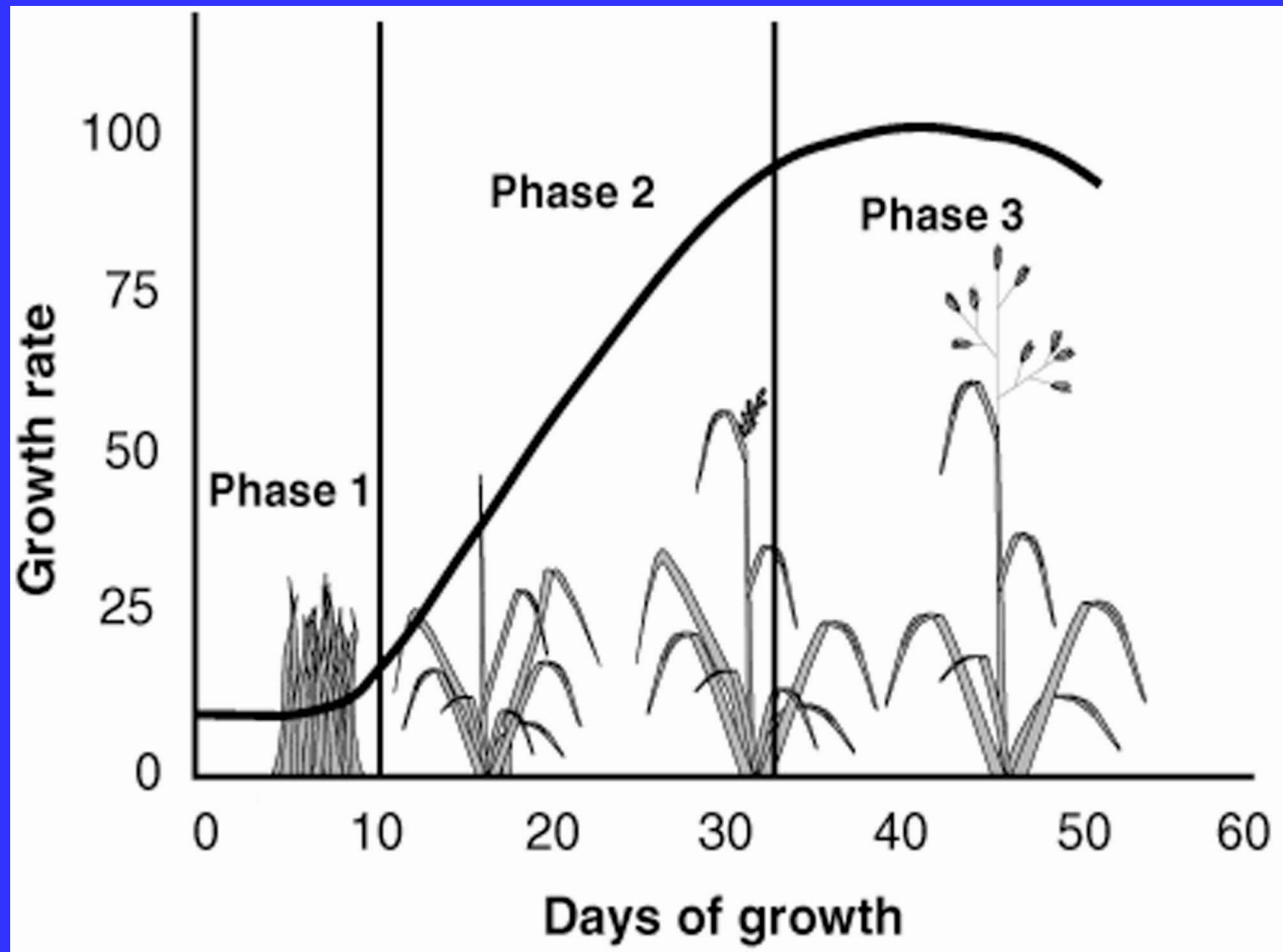
Factors affecting forage quality

◆ Plant maturity

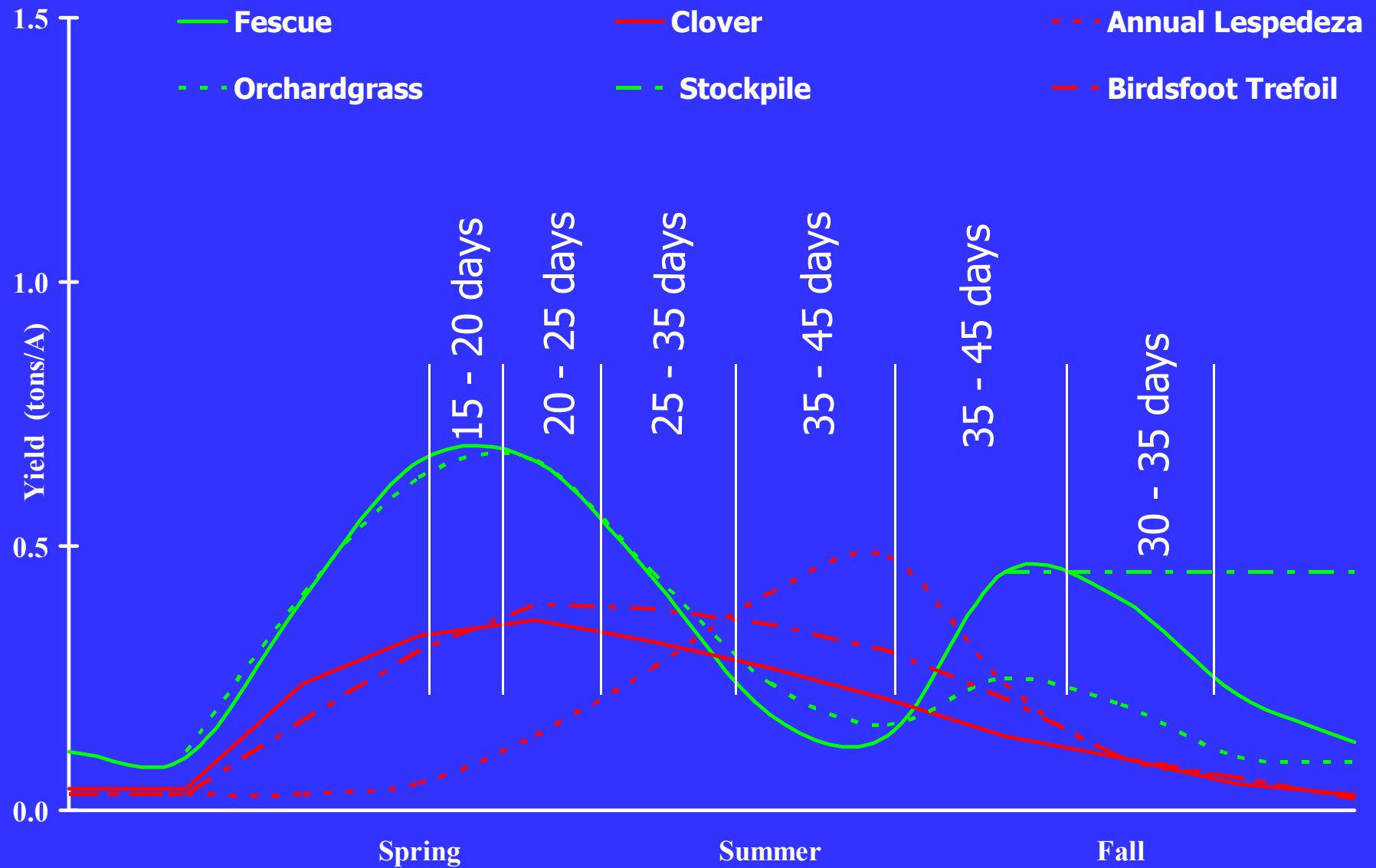
- Growth stage
- Length of rest period—the longer the rest, the lower the quality

Plant Growth Phases

Phase 2 shows Voison's "Blaze of Growth"



Rest Period Needs



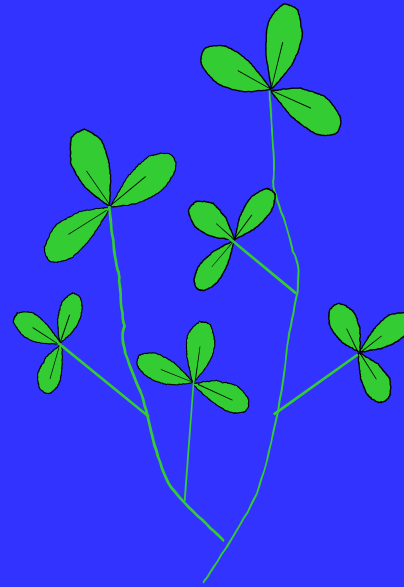
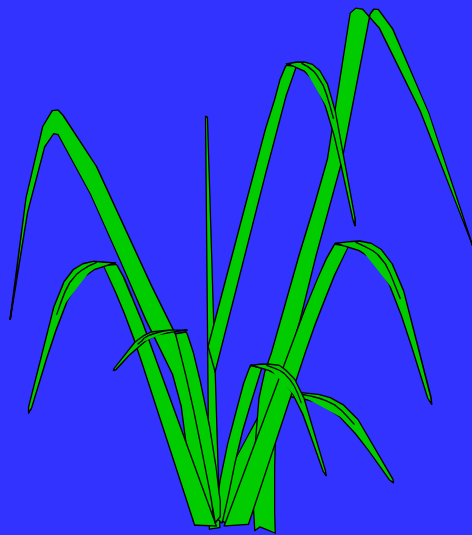
Factors affecting forage quality

- ◆ 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

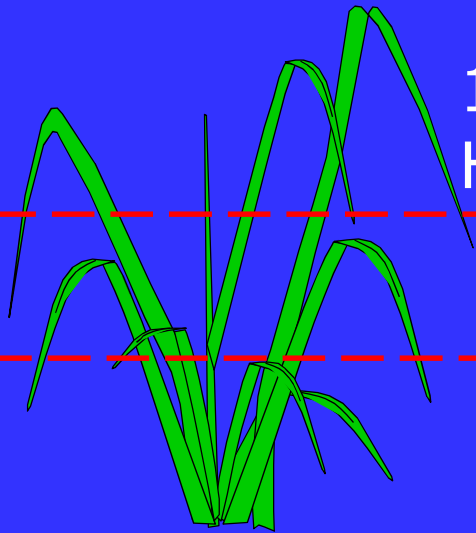
3 Factors Affecting Forage Quality

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

1. Maturity

2. Species

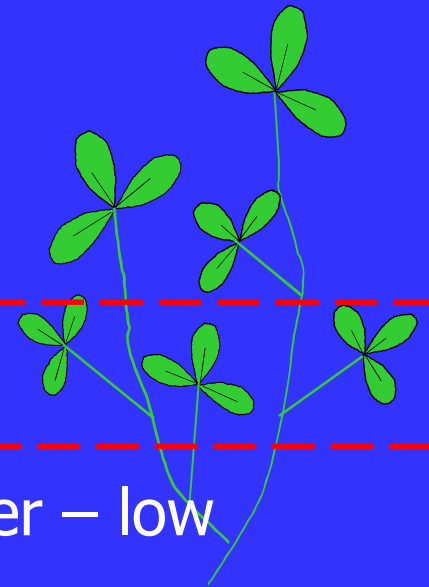
3. Plant Part



1st bite: leaves with low fiber
High quality

2nd bite: medium quality

3rd 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)