

Grazier's Arithmetic

$$1+1=3$$

Mark Kennedy

State Grazinglands Specialist (Retired)

Kennedy Grassland Services, LLC

Houston, MO

With MiG the end product is greater than the sum of all the parts

$$1 + 1 = 3$$

Overview

- Carrying Capacity
- Stock Density
- Paddock Size
 - Permanent
 - Stripgrazing

Some Useful Definitions

- **Stocking rate:** The number of animals or animal liveweight assigned to a grazing unit on a seasonal basis.
- **Carrying capacity:** The stocking rate that provides a target level of performance while maintaining the integrity of the resource base.

Carrying capacity of pasture is determined by four factors

$$\text{Carrying Capacity} = \frac{\text{Forage Production (lb)} \times \text{Seasonal Utilization Rate (\%)}}{\text{Daily Intake (\%)} \times \text{Length of the Grazing Season (days)}}$$

Grazier's Arithmetic

■ Carrying capacity

– Example:

- Stocker operation (buying 500# selling 800#)
- 200 day seasonal grazing (April 1 - Oct. 20)
- 12 paddock system (2-3 day grazing period)
- 8000 lb. total forage production (from history/experience or soil survey)

Grazier's Arithmetic

$$\text{Carrying Capacity} = \frac{\text{Forage Production} \times \text{Seasonal Utilization Rate}}{\text{Daily Intake} \times \text{Length of the Grazing Season}}$$

If: Forage production = 8000 lb/acre/year

Seasonal utilization = 65 %

Daily intake = 3% (.03 lb forage/lb liveweight)

Length of grazing season = 200 days

Grazier's Arithmetic

Then

$$\text{Carrying Capacity} = \frac{8000 \text{ lb/acre} \times .65}{.03 \text{ lb forage/lb liveweight} \times 200 \text{ days}}$$

$$= 867 \text{ lb liveweight / acre}$$

Grazier's Arithmetic

- 867 lbs. per acre/500 lb = 1.73 steers/ac
 - Can we stock 1.73 steers/ac initially?
- Remember, we hope they grow!
- If we expect them to grow to 800 lb. then
- $800 + 500 = 1300/2 = 650$ (avg wt)
 - $867/650 = 1.33$ steers/ac

Cow/Calf Example

$$\frac{8000 \text{ lb/ac} \times .35}{}$$

$$\begin{aligned} &.03 \text{ lb forage/lb liveweight} \times 365 \text{ days} \\ &= 256 \text{ lb liveweight/ac or } 4.68 \text{ ac/cow} \end{aligned}$$

Carrying
Capacity =

$$\frac{8000 \text{ lb/acre} \times .50}{}$$

$$\begin{aligned} &.03 \text{ lb forage/lb liveweight} \times 365 \text{ days} \\ &= 365 \text{ lb liveweight / ac or } 3.29 \text{ ac/cow} \end{aligned}$$

Carrying capacity of pasture is determined by four factors

$$\text{Carrying Capacity} = \frac{8000 \times 160 \times .50}{1200 \times .03 \times 365}$$

Carrying Capacity = 48.7 cows for 365 days
55 cows = 320 days
59 cows = 300 days

Grazier's Arithmetic

- Carrying capacity
- Stock density

Some Useful Definitions

- **Stocking rate:** The number of animals or animal liveweight assigned to a grazing unit on a seasonal basis.
- **Stock density:** The number of animals or animal liveweight assigned to a specific pasture area for a specific time period.
 - Stock density is a powerful tool to manage grassland resources (improve utilization, reduce spot grazing/selectivity, control competition, manure distribution, produce seed/soil contact, open up a sward for overseeding)

Stock density of pasture is determined by four factors

$$\text{Stock Density} = \frac{\text{Forage Availability (lb)} \times \text{Grazing Period Utilization Rate}}{\text{Daily Intake} \times \text{Length of the Grazing Period}}$$

Stock density of pasture is determined by four factors (cont.)

- Available forage (Get out the Grazing Stick)
 - How much forage is available on this acre this day
 - Can be estimated from height
 - If too little, intake will be restricted
 - If too much, quality may be low/intake restricted

Dry matter yield per acre-inch for various pasture types

Stand Density

Forage	60-75%	75-90%	>90%
Tall Fescue + N	250-350	350-450	450-550
Tall Fescue + legumes	200-300	300-400	400-500
Bromegrass + legumes	150-250	250-350	350-450
Orchardgrass+legumes	100-200	200-300	300-400
Bluegrass+ whiteclover	150-250	300-400	500-600
Mixed pasture	200-300	300-400	400-500
Bermudagrass	100-250	250-400	400-550
Caucasian Bluestem	100-200	200-300	300-400
Native Warm Season Grasses	50-100	100-200	200-300
Red Clover/Alfalfa	150-200	200-250	250-300

Stock density of pasture is determined by four factors (cont.)

$$\text{Stock Density} = \frac{\text{Forage Availability} \times \text{Grazing Period Utilization Rate (\%)}}{\text{Daily Intake} \times \text{Length of the Grazing Period}}$$

Stock density of pasture is determined by four factors (cont.)

- Temporal utilization rate
 - Take half, leave half
 - Utilization greater than 50% stops root growth
 - Length of grazing period is critical factor
 - As utilization increases, intake decreases

Corresponding Root Growth

% 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

Stock density of pasture is determined by four factors (cont.)

$$\text{Stock Density} = \frac{\text{Forage Availability} \times \text{Grazing Period Utilization Rate}}{\text{Daily Intake (\%)} \times \text{Length of the Grazing Period}}$$

Grazier's Arithmetic

■ Forage Intake Rate

in % of body weight

Dry Cow 2 - 2.5%

Lactating Cow 3 - 4%

Dairy Cow 2.5 - 3.5% + grain

Stockers 2.5 - 3.5%

Sheep 3.5 - 4%

Horse 2.5 - 4%

Stock density of pasture is determined by four factors (cont.)

$$\text{Stock Density} = \frac{\text{Forage Availability (lb)} \times \text{Grazing Period Utilization Rate (\%)}}{\text{Daily Intake (\%)} \times \text{Length of the Grazing Period (days)}}$$

Stock density of pasture is determined by four factors (cont.)

- Length of the grazing period
 - Stock density increases with shorter grazing periods
 - Animals are concentrated on smaller areas for a shorter amount of time
 - Selectivity decreases
 - Utilization increases
 - Animal intake increases with shorter grazing periods
 - Animals with high nutrient requirements should be moved more often

Grazing period Needs

- Economic potential of grazing enterprises
 - Pasture-based dairy 0.5 – 1 day
 - Dairy replacements 1 – 2 days
 - Beef stockers 1 – 3 days
 - Sheep and goats 2 – 5 days
 - Cow-calf ◀◀ 2 – 5 days

Grazier's Arithmetic

$$\text{Stock Density} = \frac{\text{Forage Availability} \times \text{Grazing period Utilization Rate}}{\text{Daily Intake} \times \text{Length of the Grazing Period}}$$

If: Available forage = 2400 lb/acre (8" @ 300 lb./in)

Temporal utilization = 50 %

Daily intake = 3% (.03 lb forage/lb liveweight)

Length of grazing period = 1 days

Grazier's Arithmetic

Then

$$\begin{aligned} \text{Stock Density} &= \frac{2400 \text{ lb/acre} \times .50}{.03 \text{ lb forage/lb liveweight} \times 1 \text{ days}} \\ &= 40,000 \text{ lb liveweight / acre} \end{aligned}$$

Grazier's Arithmetic

- 40,000 lb liveweight/ac/ if moving daily or
- 20,000 lb /ac if moving every *2 days*
- 13,333 lb /ac if moving every *3 days*

Stock Density



$$\text{Stock Density} = \frac{50,000 \text{ lbs Beef (40 cows)}}{10 \text{ acres}} = 5000 \text{ lbs live weight / acre}$$

$$\text{Stock Density} = \frac{50,000 \text{ lbs Beef (40 cows)}}{1 \text{ acre}} = 50,000 \text{ lbs live weight / acre}$$

$$\text{Stock Density} = \frac{50,000 \text{ lbs Beef (40 cows)}}{1/4 \text{ acre}} = 200,000 \text{ lbs}$$

Grazier's Arithmetic

- Carrying capacity
- Stock density
- Size of paddock

$$Ac = \frac{\text{Total Liveweight (lb)}}{\text{Stock Density (lb/A) X Grazing Period (days)}}$$

Grazier's Arithmetic

Size of paddock:

If we have 100 steers weighing 650 lb,
and stock density of 40,000 lb/A

Then....

$100 \text{ hd} \times 650 \text{ lb/hd} = 65,000 \text{ lb in herd}$

$65,000 \text{ lb} / 40,000 \text{ lb/acre} = 1.62 \text{ acre}$

if moving daily, 2 days = 3.24 acres

Paddock Size – Permanent Paddocks

$$\text{Ac.} = \frac{\text{Daily Intake} \times \# \text{ Head} \times \text{Grazing Period}}{\text{Forage Available} \times \text{Utilization Rate}}$$

$$\text{Intake} = .03 \times 1200 = 36 \text{ lbs/hd/day}$$

$$\text{Ac} = \frac{36 \times 40 \times 5}{2400 \times 50\%} = \frac{7200}{1200} = 6.0 \text{ acre}$$

$$\text{Density} = 1200 \times 40/6 = 8000 \text{ lb/ac}$$

Grazier's Arithmetic

Stockpiling/Stripgrazing

- VERY practical example:
- Figure paddock (or strip) size needed for a herd of dry beef cows on stockpiled fescue

$$\text{Ac.} = \frac{\text{Daily Intake} \times \# \text{ Head} \times \text{Grazing Period}}{\text{Forage Available} \times \text{Utilization Rate}}$$

Grazier's Arithmetic

- How much will they eat?
- 1200 lb dry cow needs?

Grazier's Arithmetic

■ Forage Intake Rate

in % of body weight

Dry Cow

2 - 2.5%

Lactating Cow 3 - 4%

Dairy Cow 2.5 - 3.5% + grain

Stockers 2.5 - 3.5%

Sheep 3.5 - 4%

Horse 2.5 - 4%

Grazier's Arithmetic

- How much will they eat?
- 1200 lb dry cow needs 2.5% of body weight per day
- $1200 * 2.5\% = 30 \text{ lb}$
- How many head? Use 40
- How long is the grazing period?
Use 2 days

Grazier's Arithmetic

- How much forage is available?
- Tall fescue + N
- Average height is 10 inches

Grazier's Arithmetic

Forage	60-75%	75-90%	>90%
Tall Fescue + N	250-350	350-450	450-550
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Grazier's Arithmetic

- How much forage is available?
- Tall fescue + N
- Average height is 10 inches
- At 400 lb/in. we have 4,000 lb.
- What is the temporal utilization rate?

Grazing Efficiency

- Grazing Efficiency - Total season

<u># Pastures</u>	<u>Grazing Period</u>	<u>Utilization Rate</u>
1 pasture	Continuous	30%
4 pasture	7-10 days	35%
8 pasture	3-5 days	50%
12 pasture	2-4 days	65%
24 pasture	1-2 days	70 + %

Grazier's Arithmetic

- How much forage is available?
- Tall fescue + N
- Average height is 10 inches
- At 400 lb/in. we have 4,000 lb.
- What is the utilization rate?
- Use 70 %

Grazier's Arithmetic

$$\text{Ac.} = \frac{\text{Daily Intake} \times \# \text{ Head} \times \text{Grazing Period}}{\text{Forage Available} \times \text{Utilization Rate}}$$

$$\text{Ac} = \frac{30 \times 40 \times 2}{4000 \times 70\%} = \frac{2400}{2800} = .86 \text{ acre}$$

You can develop a “shortcut” for your operation AFTER you’ve gone through this calculation.

Overview

- Carrying Capacity
- Stock Density
- Paddock Size
 - Stockpiling
- Paddock Numbers

Grazier's Arithmetic:

How many paddocks do I need?

- *It depends*

- *length of grazing period desired*

- *producer goals, livestock performance*

- *length of rest period needed*

- *Changes seasonally*

- *rest period*

grazing period + # herds = paddock #

Grazier's Arithmetic: Grazing period Needs

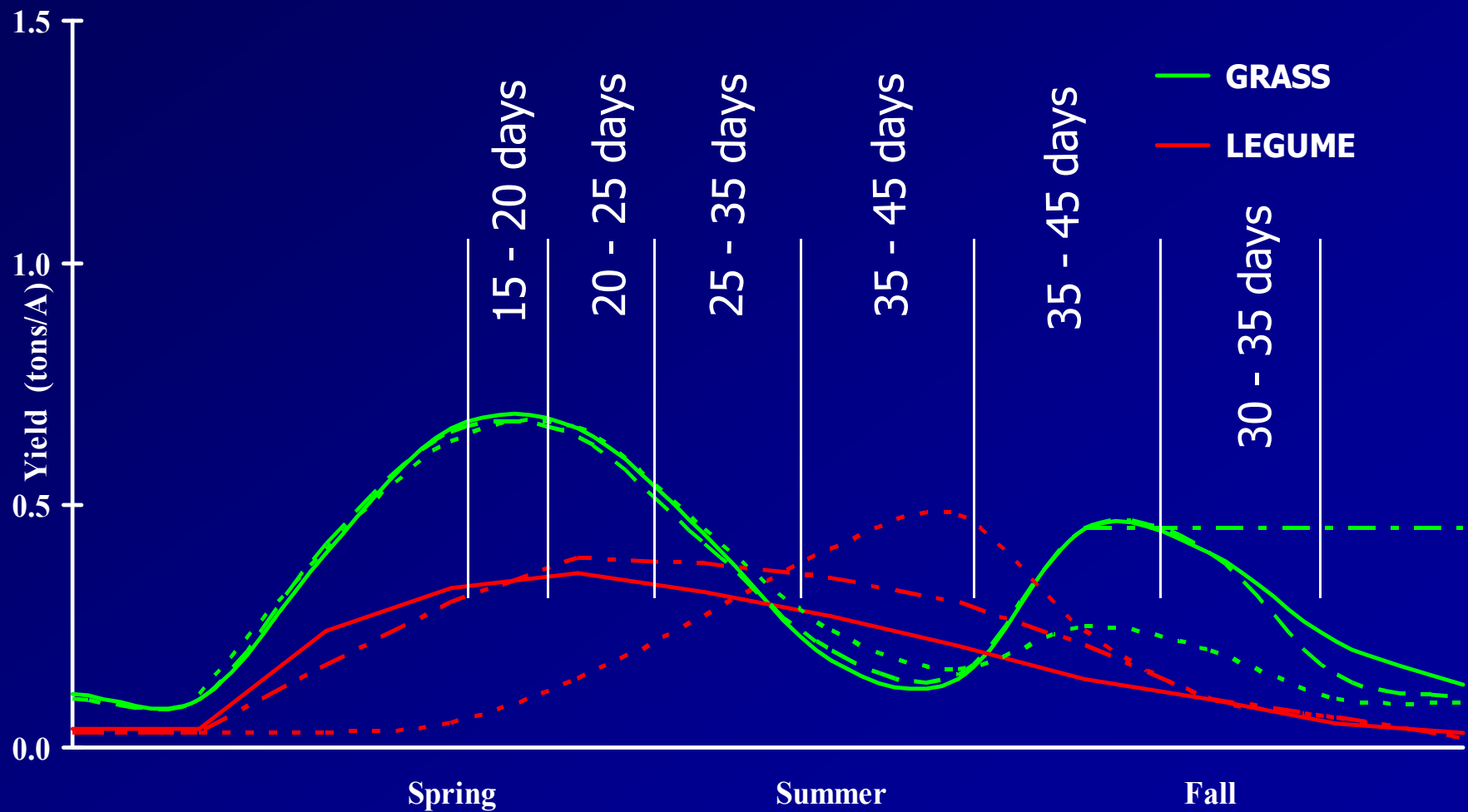
■ Plant based:

- 2 - 5 days fast growth
- 5 - 9 days moderate
- 9 - 12 slow growth

■ Animal performance:

- .5 - 1 day dairy cows
- 1 - 2 days
growing/fattening
- 2 - 5 days lactating
beef cattle, sheep,
horses
- 4 - 7 days dry animals

Rest Period Needs: Grazing Season



Grazier's Arithmetic:

How many paddocks do I need?

■ Paddock Number = $\frac{\text{rest period}}{\text{grazing period}} + 1$

■ Ex:

$$\frac{20 \text{ day rest period - spring}}{3 \text{ day grazing period}} + 1 = 8$$

$$\frac{40 \text{ day rest period - summer}}{3 \text{ day grazing period}} + 1 = 14$$

Grazier's Arithmetic:

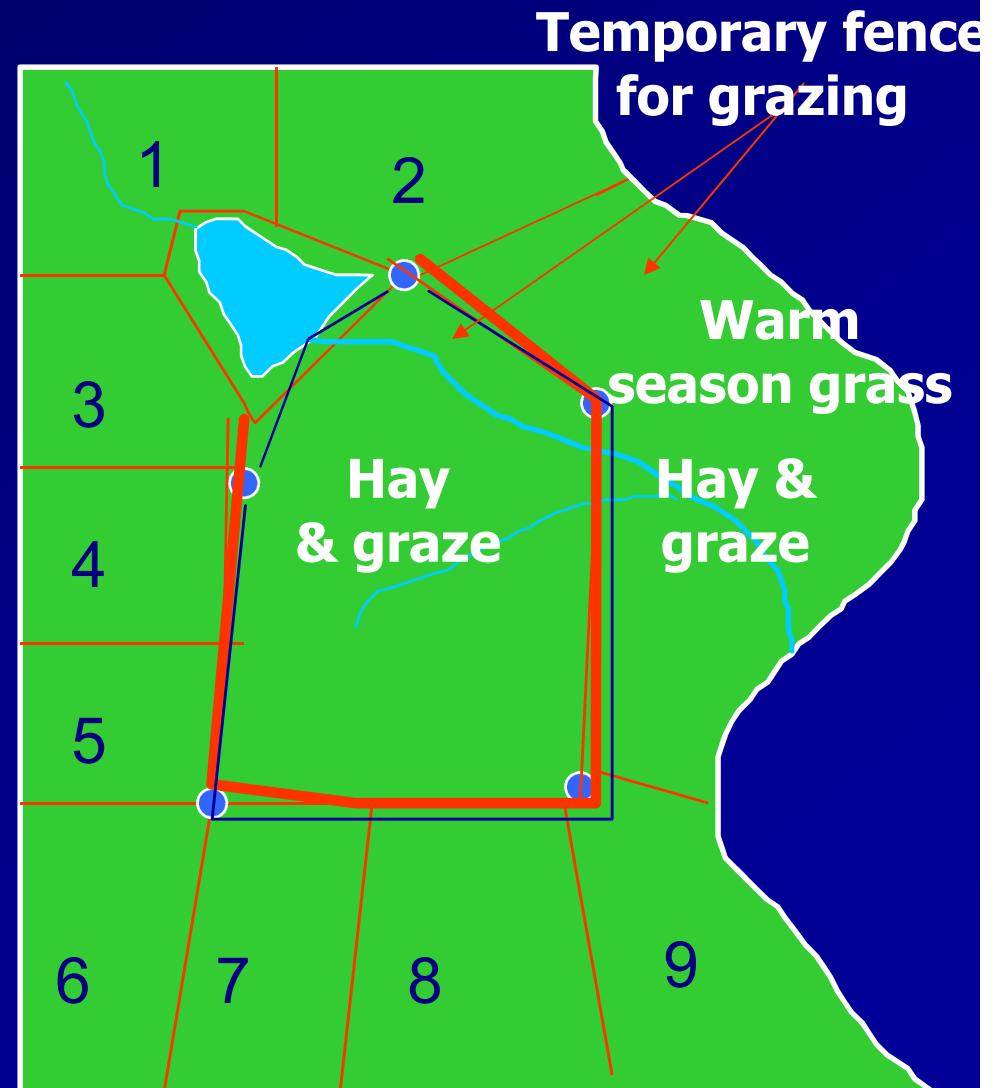
How many paddocks do I need?

■ Or:

$$\frac{40 \text{ day rest period}}{5 \text{ day grazing period}} + 1 = 9$$

Fixed/Flexible System Design

- 9 paddock fixed system
- Flexible paddock numbers in hayfields and/or warm season grass
- Water available in every paddock
- Alleyway for ease of livestock movement
- Very flexible, workable system



Optimum Paddock #'s based on Livestock Type (Rule of Thumb)

Livestock type	Grazing Period (Days)	Paddock #
Dairy & Beef Finishing	0.5 – 1	20 - 80
Dairy Heifer & Stockers	1 - 3	16 - 40
Cow/calf, Sheep, Goats, Horses	2 - 5	8 - 16

Stockpiling:

*The managed accumulation of
new growth*

Keys to Success

- Growing the stockpiled fescue
- Proper utilization of stockpile

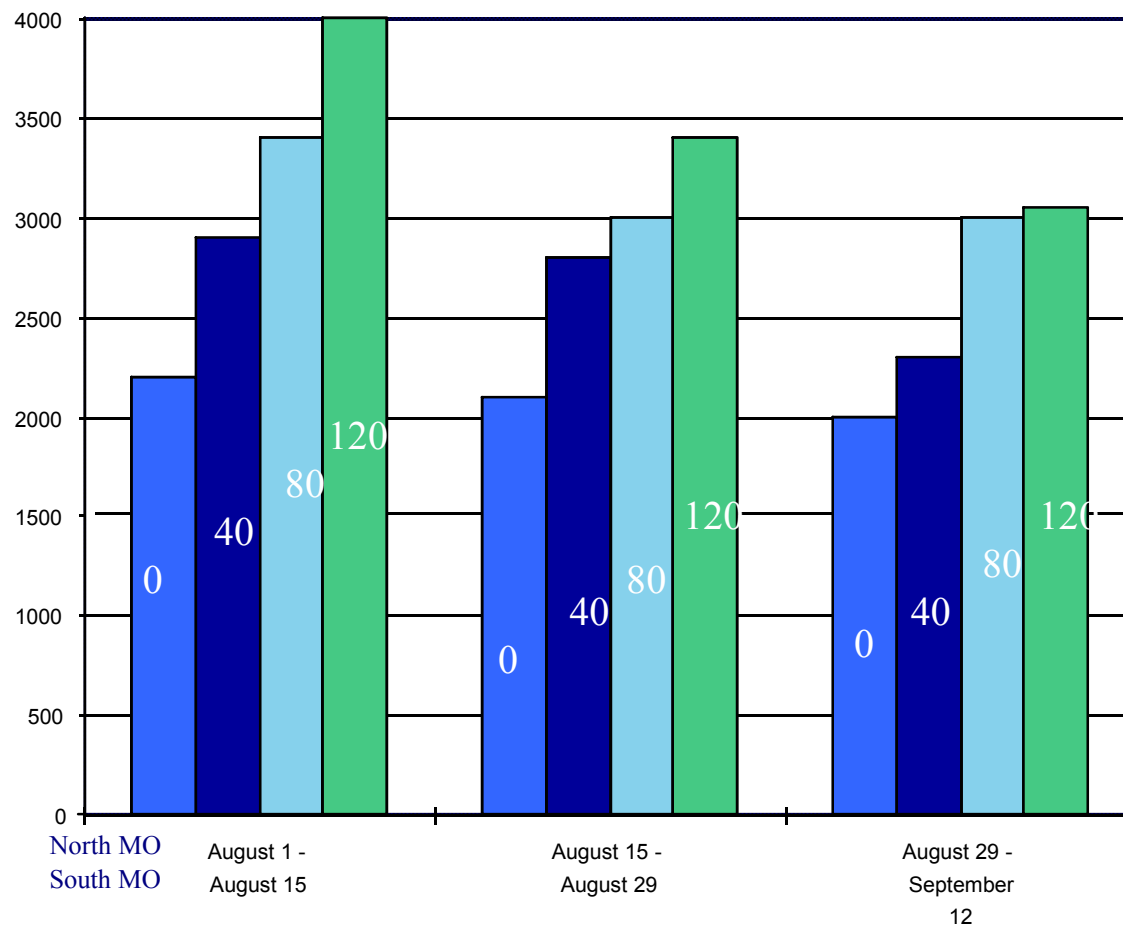


Stockpiling Recipe

- Start with fescue pastures that have 3 to 6 inches of leaf in mid to late August or 60 to 90 days prior to the end of the growing season.
- Apply 40 - 60 lbs. N
- Defer grazing until growth stops (late Nov to early Dec.) or until needed
- Utilize all other pastures in rotation for fall grazing until fully utilized and grass growth stops

Impact of rate and timing of nitrogen fertilization on dry matter yield of stockpiled tall fescue.

Yield
(lbs/A)



North MO
South MO

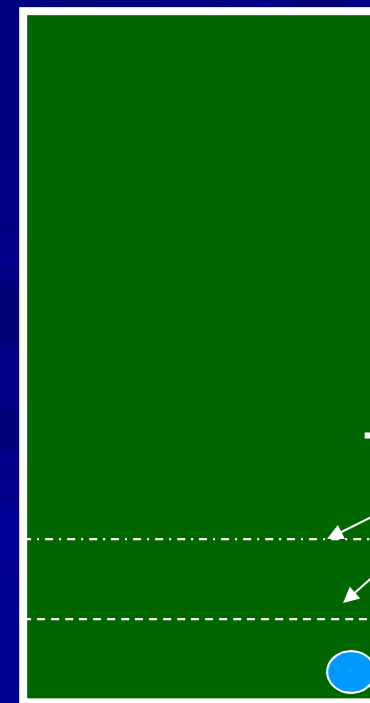
How much can you afford to stockpile?

- 1000 lb. cow eats 10,950 lbs./year
- 50% utilization – 21,900 lbs. needed on offer
- 7000 lb./ac total production
- 3.2 acres needed per cow per year
 - 1.6 acres needed/cow April – June
 - 3.2 acres needed/cow July – August
 - 2.0 acres needed Sept. – Nov
 - 1 – 1.2 acres left to stockpile
 - $4000 \text{ lb.} \times .70 = 2800/30 \text{ lb. intake} = 93 \text{ cow days grazing}$

Utilizing the stockpiled forage

- Treat as “hay on the stump”
- Allocate out in 1 to 3 day feed supplies by stripgrazing
 - improves utilization
 - From 35% for 2 weeks to 70%+ for 3 days or less
 - stretches forage supplies
 - 40% more grazing days per acre
 - helps maintain quality
 - Cows aren't damaging frozen plant tissue

Perimeter Fence



Temp Fence

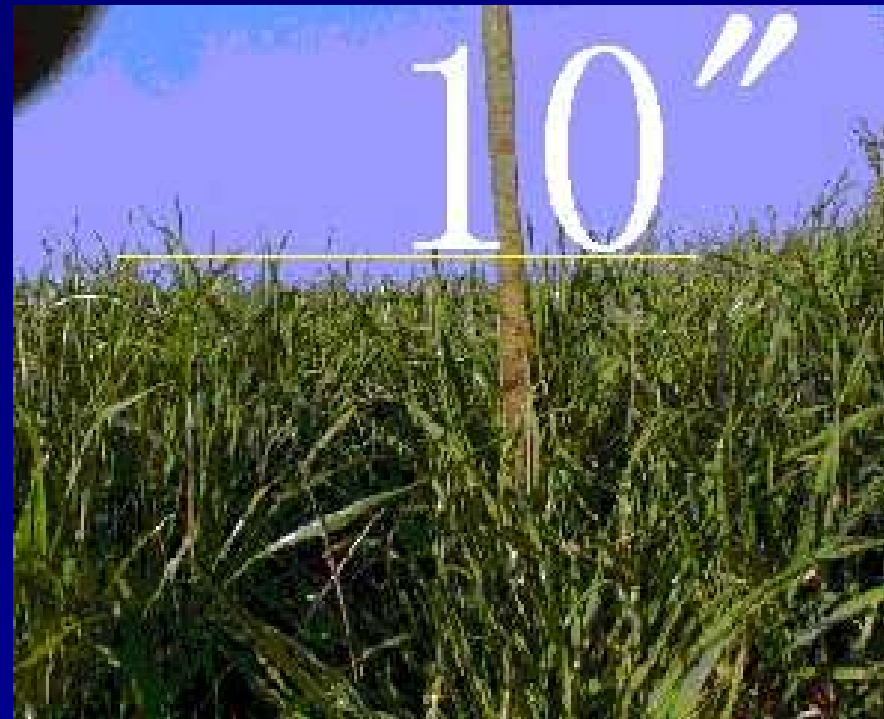
Winter Water

- ❑ 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, factor in 70% utilization if moving every 2 days, calculate size strip required



Economics - average conditions

- 26# per cow per day
- \$70 per ton good grass hay
- \$.58 per pound for nitrogen @
60#/ac=\$34.80/ac
- 60# should give 10" growth @ 300# per inch = 3000#/ac



Haying

- $\$70 / 2000\# = \$.035$ per pound
- $\$.035 \times 26\# = \$.91$ per cow per day
 - *if you factor in a 20% wastage this bring the cost up to \$1.09 per cow per day*



Stockpile Fescue, Stripgrazing

- 3000# @ 70%
utilization = 2100#
- $\$34.80/\text{ac} / 2100 =$
 $\$.016$ per pound
- $\$.016 \times 26\# = \$.43$
per cow per day
- $2100\# / 26\# = 80$
aud/ac



Seasonal Costs

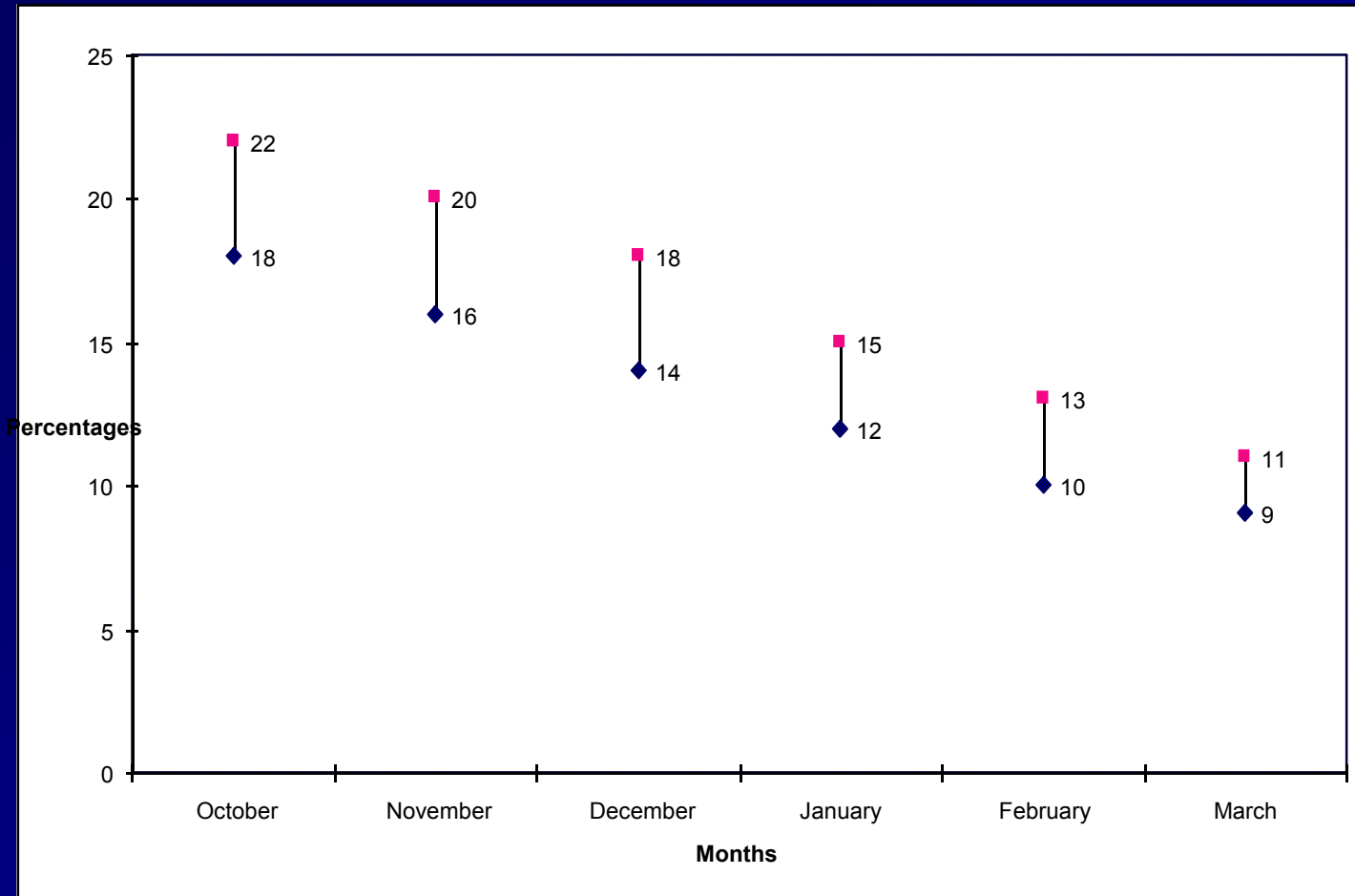
➤ Haying: \$.91 - 1.09/day
x 80 days = \$73 - \$87

➤ Stockpile + Stripgraze:
.43/day x 80 days =
\$34.40

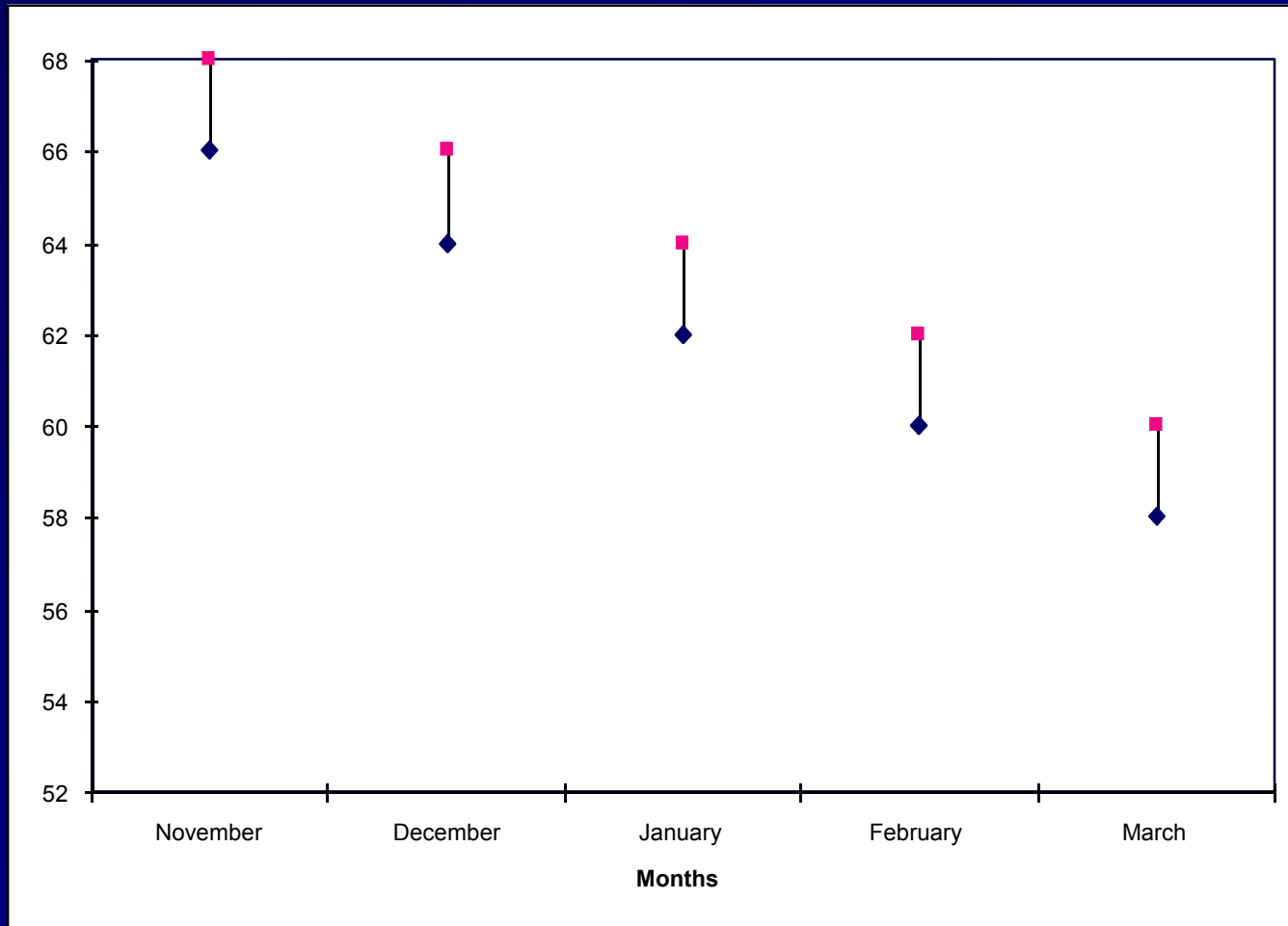
**\$38.60 – 52.60/cow
savings/year**



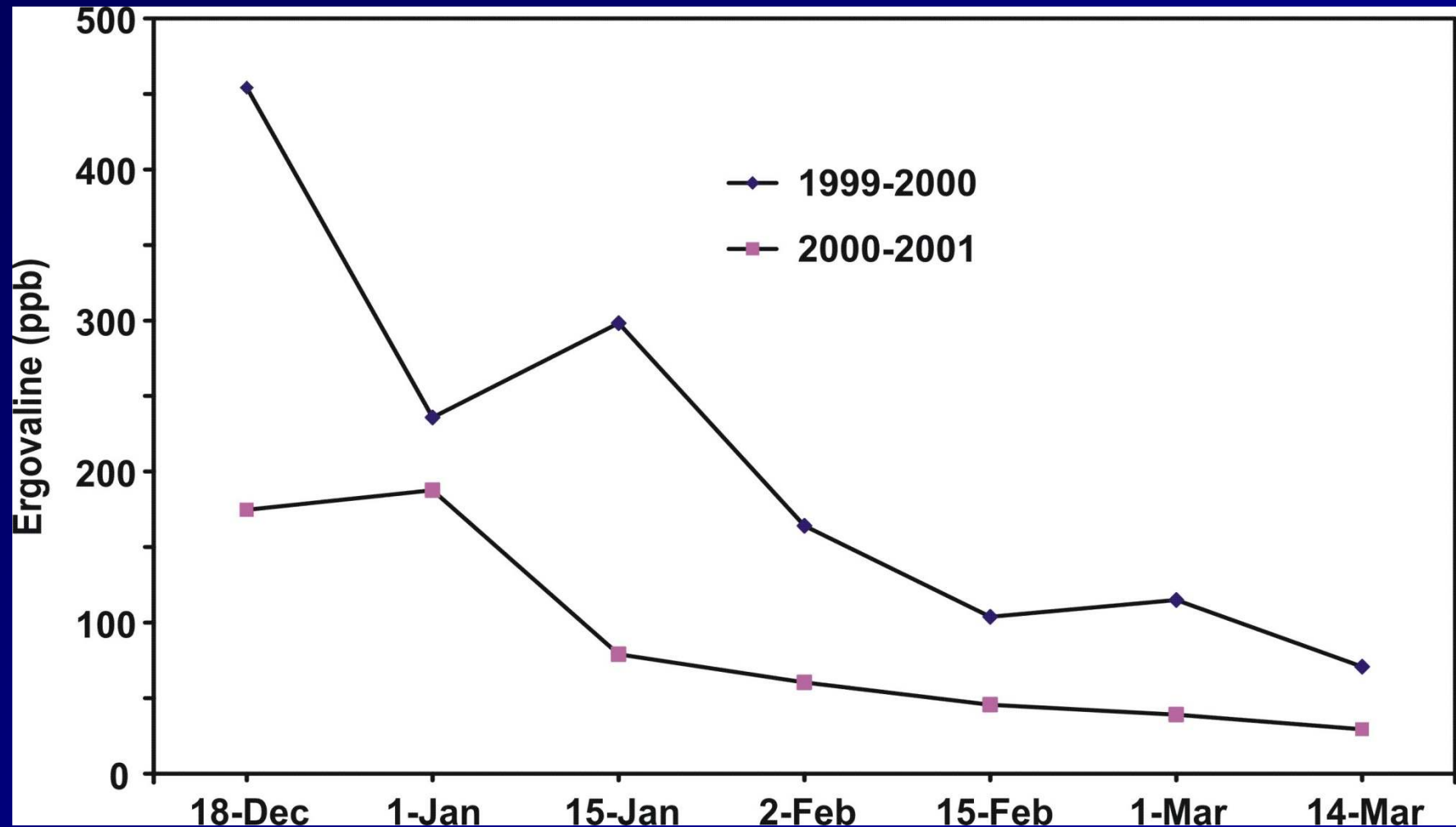
Stockpiled Tall Fescue Crude Protein



Stockpiled Tall Fescue D O M



Ergovaline concentration in stockpiled, endophyte-infected tall fescue.



Kallenbach, Missouri, 1999 - 2001

Advantages of Stockpile Grazing

- Reduced Labor
- Reduced Costs
- Reduced Time
 - Putting up hay and feeding out hay
- High Quality Forage
 - Usually better than grass hay

Advantages

- Hay cost/day = \$0.78
- Stockpile/stripgrazed cost/day = \$0.33
- \$0.45/cow/day difference
- 100 cow herd = \$45/day difference
- 2 day strips = \$90 cost savings
- If it took 30 minutes every other day to move the wire then you're getting paid \$180/hour for your labor/management



The end