Graziers' Math
(Planning a Pasture Grazing System)

By Kevin Ogles. ENTSC Grazing Specialist

Graziers' Math
(Planning a Pasture Grazing System)

The planner and farmer need to know:

1. **How much feed (DM) does the herd/flock need per day?**
2. **How much of the year is grazing planned for (days)?**
3. **How much feed can my pasture supply (DM) with current and proposed management?**
4. **How much will Utilization Rate (grazing efficiency) affect the pasture supply?**
5. **How do I work out the rotational system details?**

Graziers' Math

Some basic math formulas will give us this information:

- **Forage-Animal Balance**
- **Paddock Sizing**
- **Maximum number of animals to put on a paddock**
- **Maximum number of days to graze a particular paddock**

Graziers' Math Foundations
Calculating Animal Demand

Forage **Intake Rate** in % of body weight

• Dry Cow	1.5 - 2.0%
• Lactating Beef Cow	2 - 3%
• Dairy Cow	3 - 4% + grain
• Stockers	2.5 - 3.5%
• Sheep	3.5 - 4%
• Horse	2 – 2.5%
• Bull	1.5 – 2%

Information from several East U.S. Land Grant Universities

Grazing Utilization Rate (Grazing Efficiency)

# Paddocks	Grazing Period	Utilization Rate
1	Continuous(>21d)	30-35%
3-4	15-21 Days	45-50%
5-8	5-14 Days	60-65%
12-24+	0.5-4 Days	75-80%**

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

Livestock type	Grazing Period (Days)	Paddock #
Dairy	0.5 – 1	20 - 80
Dairy Heifer	1 - 2	20 - 40
Stockers	1 - 3	16 - 32
Cow/calf, Sheep, Goats, Horses	2 - 5	8 - 16

Manure Distribution (Cow Pies)

Rotation Frequency	Years to Get 1 Pie/sq. yard
Continuous	27
14 day	8
4 day	4 – 5
2 day	2
1 time a day	??
2-6 times a day	??

University of MO and NC State University research

Know the Difference!
Make Sure the Land Manager Knows It Also

Stocking rate: The number of animals or animal live weight assigned to the total grazing unit on a seasonal basis.

Forage-Animal Balance: The stocking rate that provides a target level of performance while maintaining the integrity of the natural resources base. (Also called **carrying capacity**)

Stock density: The number of animals or animal live weight assigned to a specific pasture area for a specific time period.

The Forage /Animal Balance of Pasture is Determined by 4 factors

$$\text{BALANCE (MUST} \geq 1) = \frac{\text{PASTURE SUPPLY}}{\text{ANIMAL DEMAND}}$$

$$\text{PASTURE SUPPLY} = \textbf{Yearly Forage Production (lb)} \times \textbf{Seasonal Utilization Rate/ Grazing Efficiency (\%)}$$

$$\text{ANIMAL DEMAND} = \textbf{Herd Intake Per Day} \times \textbf{Length of the Grazing Season (days)}$$

The Forage /Animal Balance of Pasture is determined by 4 factors

1 or > = $\dfrac{\text{PASTURE SUPPLY}}{\text{ANIMAL DEMAND}}$

PASTURE SUPPLY

Yearly Forage Production lbs./ac. x Total acres X **Utilization Rate/ Grazing Efficiency (%) Use Chart**

ANIMAL DEMAND

1 animal wt. lbs each x % of BW intake X No. of Head = Total lbs. Needed, i.e. Herd Intake Per Day X **Length of the Grazing Season (days) or Whole Year (days)**

The Forage /Animal Balance Equation Can Be Used to Determine This Farm's Forage – Animal Balance

$$\geq 1 = \frac{\text{PASTURE SUPPLY}}{\text{ANIMAL DEMAND}}$$

PASTURE SUPPLY: _____ lbs./ac. X ___ acres X _____ %

ANIMAL DEMAND: ____ lbs each X ___% X ___ Head X _____ days

Grazier's Math

Using the F-A Balance Basic Equation with the Inventory Data and Grazing Stick Measurements - One Can Calculate:

- Paddock Size
- Days of Grazing Available in a Paddock
- No. of Animals to Put on a Paddock

Graziers' Math:
How many paddocks do I need?

- $\frac{\textit{rest period}}{\textit{grazing period}} + 1 = \textit{paddock \#}$

- *It depends*
  - *length of grazing period desired*
    - *producer goals, livestock performance*
  - *length of rest period needed*
    - *plant type, plant growth, season, moisture*

NASS Reports:

Most Livestock Operations in Vermont are beef cow/calf operations.

The average herd size is 11 cows with an average pasture size of 30 acres.

We will say that the average mature beef cow will weigh 1000 pounds for our exercise.

We will use these as our basis for doing our Forage Animal Balance today

Graziers' Math

Paddock Size in Acres:

Animal Wt. X B.W. % Intake X No. of Head X Grazing Period (Days in the Paddock)

DIVIDED BY

Inches in Ht.-Min. Grazing ht. left X Pounds per acre inch X Utilization Rate/Grazing Efficiency

Calculate the Paddock Size for this farm:

Graziers' Math

Maximum Animals to Put on a Paddock:

Inches in Ht.-Min. Grazing ht. left X Pounds per acre inch X Paddock Size X Utilization Rate/Grazing Efficiency

DIVIDED BY

1 (Avg.) Animal's Wt. X B.W. % Intake X Grazing Period (Days on Paddock)

Let's Calculate it for this average Vermont farm:

Graziers' Math by Paddock

Days of Grazing Available*:

Inches in Ht.-Min. Grazing ht. left X Pounds per acre inch X Paddock Size X Utilization Rate/Grazing Efficiency

DIVIDED BY

Animal Wt. Avg. X B.W. % Intake X No. of Head

Calculate how many Days can we graze our herd on a known size paddock and its production on the day we start grazing it: