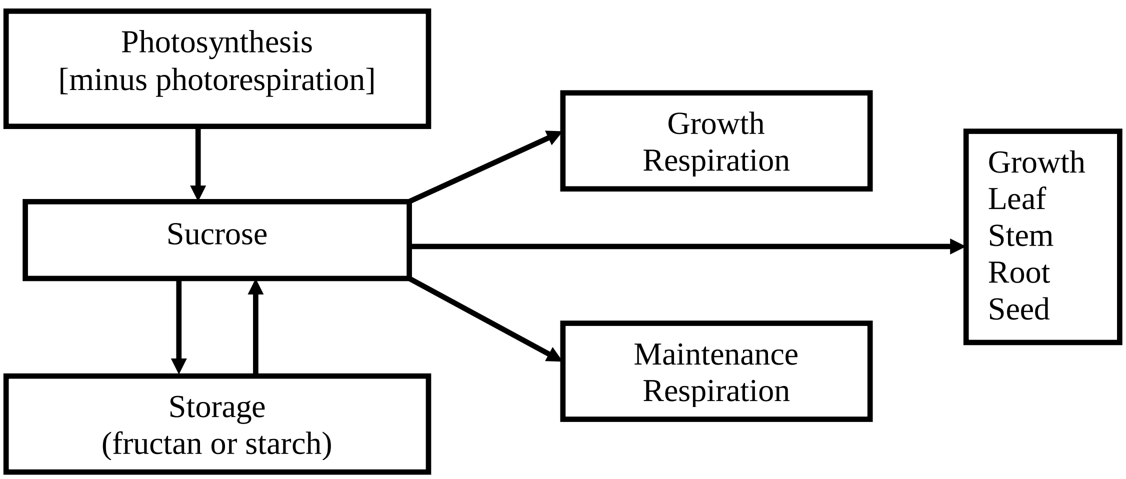
Virginia Technical Note **Agronomy #2**

"Rotational Grazing System Layout Considerations

April 2001

Rotational grazing systems consist of interacting components such as soils, plants, animals, and producer goals. To gain adequate control, larger pastures are subdivided into smaller ones and the livestock are rotated from one to another depending on forage height. Regardless of intensity, only one section of pasture is grazed at a time while other sections recover. The number of consecutive days a section is grazed at one time is a grazing period. The number of consecutive days a section is not grazed is a recovery period.

Appropriate grazing and recovery periods allow forages to renew energy reserves, rebuild plant vigor, maintain diversity, reduce erosion and runoff, improve infiltration, increase soil organic matter, improve manure distribution, and optimize long term forage production. Consequently, forage quality and animal performance are improved allowing realization of producer goals.



Carbohydrates move from leaves where photosynthesis occurs to growing or storage areas. Storage areas serve as both a destination and a source of food for later use. The order of demand for the sugars is leaf growth, storage and tiller development, and root tips. When over half of the top growth is removed, photosynthesis is reduced because many young leaves are removed. Root growth stops quickly and does not recover until the canopy is partially regrown.

Storage carbohydrates provide a buffering effect by:

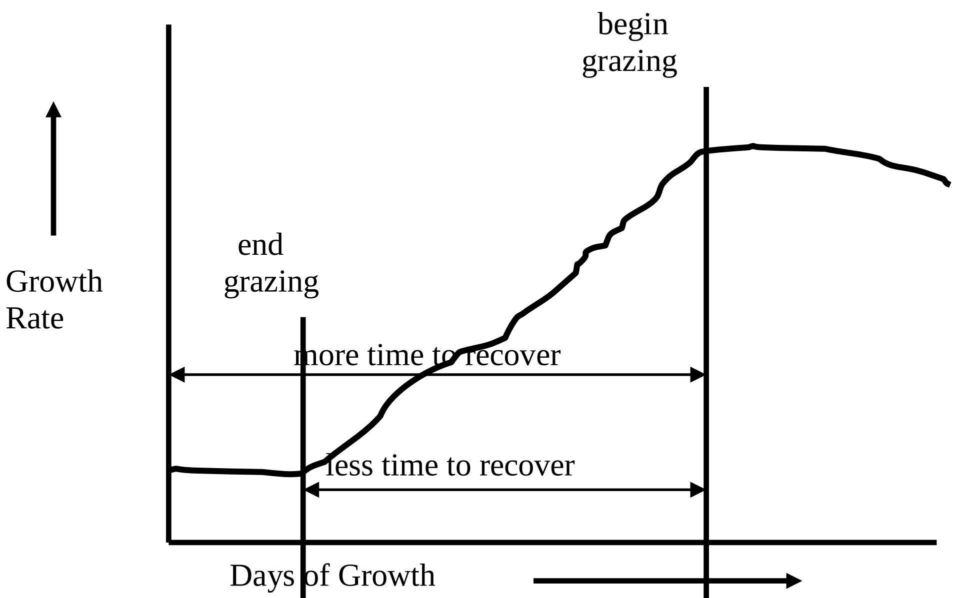
- supporting respiration needs during winter or summer dormancy;
- promoting regrowth of leaves after dormancy;
- promoting flowering and seed formation; and
- contributing to the heat and cold resistance of the plant.

Rotations should be based on forage height. Rotations based on rigid time schedules compromise the benefits rotational grazing offers. Flexibility is key!

Guidelines for Beginning and Ending Heights for Rotational Grazing

Forage Crop	Maximum Height to Begin Grazing (Inches)	Minimum Height to End Grazing (Inches)	Comments/Remarks
Fescue (EI)	6 - 8	3 - 4	ending heights vary with season of growth; start lower and end higher in spring for faster rotations due to faster growth
Fescue (EF)	6 - 8	3 - 4	sensitive to grazing pressure, consider haying only in yr of establishment
Orchardgrass	6 - 8	3 - 4	less competitive that EI fescue; well suited for legume renovation due to bunchy growth habit
Bluegrass	4 - 6	1 - 2	tolerates closer grazing due to low growth habit; low yielding but very good quality; well suited to renovation with white clover
Reed Canarygrass	10	3 - 4	choose low alkaloid varieties; hard to establish but aggressive afterwards, very good summer growth
Switchgrass	18 - 24	10 - 12	allow higher ending height at end of grazing season; must rotationally graze
Eastern Gamagrass	16 - 24	8 - 10	very hard to establish, must rotationally graze
Caucasian Bluestem	8 - 10	3 - 4	increase ending height at end of grazing season, must rotationally graze
Alfalfa	bud to 10% flower	3 - 4	allow sufficient regrowth for carbohydrate replenishment, do not continuously graze; allow 30 - 45 day recovery prior to first killing frost
Hybrid Bermudagrass	4	2	grazing heights must be observed for acceptable quality
Pearl Millet	24	8 - 12	no prussic acid, can get nitrate poisoning under drought/frost stress; no regrowth
Foxtail Millet	24	8 - 12	has prussic acid, can get nitrate poisoning under drought/frost stress, no regrowth
Sorghum-Sudan	24	8 - 12	has prussic acid, can get nitrate poisoning under drought/frost stress, some regrowth

Characteristics associated with various forage heights.



<u>Phase One</u>
- high quality
- low availability
- slow regrowth
- over/under stocking (spot grazing)
- erosion, runoff
- more weeds
- lower organic
- less plant available water
- worst yield over the season

<u>Phase Two</u>
- high quality
- high availability
- faster regrowth
- correct stocking rate
- better ground cover
- less erosion, runoff
- more infiltration
- higher organic matter
- higher plant available water
- best yield over the season
- sustainable economically and environmentally

<u>Phase Three</u>
- low and high quality
- high availability
- slow regrowth
- under stocking (spot grazing)
- wasted forage
- less yield over the season

Rotational grazing may be practiced at different intensities. Systems can range from 2 to 30 or more paddocks. Systems with a small number of fields (6 or less) are more difficult to manage for achieving the benefits rotational systems offer.

Intensive grazing systems involve a higher level of management with more paddock numbers, shorter grazing periods, and longer recovery periods. Generally, the more intensive the management, the greater the livestock production per acre. However, do not compromise gain per animal.

General Planning Guidelines

An understanding of producer goals and knowledge of the existing inventory are necessary prerequisites to planning an effective grazing system.

Producer Goals

Producers may need assistance to translate generalities into tangible goals. Do not list goals for them. The planned grazing system must meet the producer's goals in order for the system to work. Do not suggest things that are contradictory to their goals.

What is perceived as a problem may be a symptom. For example, a producer may see reduced forage production as a problem when actually it is the lack of a sound grazing management system.

Inventory

Completing an initial inventory of the farm is critical to planning. Determine the personnel involved, basic resources, soils, plants, animals, and facilitating resources (water, fences, and equipment). Determine if the goals are achievable with the available resources.

Personnel

Identify the decision maker(s) and their roles. It is important that everyone knows and agrees to the goals.

Who will do the work? Is the decision maker(s) or manager a full or part time operator? If they work full time off the farm or if other farm enterprises (row crops) claim priority, there may be less time and labor available for very intensive grazing systems. However, keep in mind that once an improved grazing system is installed and operating, it may actually take less labor than the previous system because management is being substituted for labor.

Basic Resources

Determine the land resources available to meet goals. Distinguish owned land from rented land because the two have different options available to them. Is hay produced elsewhere and brought to the farm? Does this free up on farm hayfields for grazing?

Locate and identify problem areas such as eroding areas, gullies, noxious weeds, and brush encroachment that may prevent the attainment of goals and make plans to address them.

Balance the animal and plant resources available to achieve sustainable optimum production from the grazing system.

Soils and Fertility

A sound knowledge of the soils on the farm helps determine it’s potential. The plant available water holding capacity (texture), nutrient supplying ability (cation exchange capacity), and yield potential are determined from a knowledge of the soils. Forage plants can be properly matched to the soil and paddocks laid out more effectively.

Determine fertility from a soil test. Correct pH first as it affects availability of fertilizer nutrients. Then correct fertility (based on the soil test) on the most productive fields first.

Plants
Estimate actual yield from a farm visit and potential yield from a soil survey or Virginia Agricultural land Use and Evaluation System, "VALUES". Over stocking damages the forage base as well as all other components of a grazing system such as soils (erosion, reduced infiltration, compaction), livestock (reduced gains or weight loss, prolonged breeding time periods) and consequently, producer goals.

Animals
Determine the kind and number of livestock. Does the forage quantity and quality meet their needs? Is the stocking rate sustainable? Forage quality need is an important consideration in designing a grazing system (number of paddocks, type of forages). Complete an inventory of supply and demand to determine a sustainable stocking rate.

Facilitating Resources
Water - Determine the existence and location of existing watering sources and place them on a map. Are the quantity, quality, and location of existing watering sources adequate to meet goals? Are they adequate in a drought? Is there a backup plan for wells? If not, an improved watering system needs to be planned.

Fence
Determine the kind and condition of existing fences and locate them on a map. Do not allow existing fences to lock in a poor system. Move them if necessary. Improved grazing is possible due to new technology in permanent and temporary electrical fencing.

Equipment
Are handling facilities adequate and in a good state of repair? Locate them on a map. Locate and list any repairs needed for barns and sheds.

Inventory Summary
With a good inventory, decision making to meet goals becomes more effective. Develop several management alternatives based on available resources and evaluate each in the context of goals. Planning on paper is much more cost effective than developing the land without a firm understanding of available resources and realistic land potential.

<u>Preliminary Planning</u>
Do as much planning on paper as possible. Use aerial photos and soil maps of the farm. Clear plastic overlay sheets and erasable markers allow changes to be made easily as understanding and goals become clearer.

Strive to maintain flexibility for future changes. If four fields are desired, attempt to arrange them and watering locations so further subdivisions can be made. Size watering system components for all future planned development.

Try to locate waterers so the distance livestock travel is 800 feet or less. Beef cows graze pastures more severely within 800 feet of water and undergraze elsewhere which reduces overall forage utilization.

When to Begin

Consider beginning an improved grazing system in the fall. Spring is a difficult time to start due to rapid forage growth. Fall is also the time to create the necessary conditions for the following spring ("stagger effect" or "grazing wedge").

Paddock Considerations

Paddock design considerations are number, shape, soils, and topography.

Number of Paddocks

A useful "formula" to determine paddock numbers in the planning stage is:

$$\frac{\text{recovery period}}{\text{grazing period}} + \text{number of herds in the system} = \text{number of fields/paddocks}$$

recovery period = number of consecutive days a paddock is allowed to recover each time
grazing period = number of consecutive days a paddock is grazed each time
number of herds in the system = number of herds rotated through the system

Recovery Periods by Type of Forage

Type of Forage	Cool Season of the year	Warm Season of of the Year
Cool Season Forages	2-3 weeks	5-7 weeks
Warm Season Forages	5-6 weeks	4-5 weeks

Recommended Grazing Periods for Rotational Grazing Systems

Kind of Livestock	Number of Days
Lactating Dairy Cows	1/2 to 2
Milking Sheep or Goats	1 to 2
Growing Stock (steers, heifers, lambs)	3 to 4
Beef Cow/Calf, Ewe/Lamb	3 to 7
Most Adult Non-Lactating Stock	4 to 7

Example:
Cool season perennial grasses often need a recovery period of 14 to 20 days in the spring and 35 to 45 days in the summer. Grazing periods should be short enough to prevent regrazing of newly emerging tillers. Tillers begin regrowth very quickly and reach grazing height in 3 days in the spring and 5 to 7 days in the summer. If it is decided to allow 40 days recovery at one time, then the recovery period is 40 days. If the number of days grazing at one time is seven, then the grazing period is 7 days. The number of herds is one.

Using the above information, the formula would work this way:

40 days recovery period + one herd = 7 fields or paddocks
7 days grazing period

A stocker operation might be more intensive due to the needs of the animals. Perhaps the grazing period is three days. Then the "formula" is:

40 days recovery period + one herd = 14 paddocks
3 days grazing period

Grazing dairies are more intensive still. many producers move cows to a fresh paddock after each milking. In this case the "formula" is:

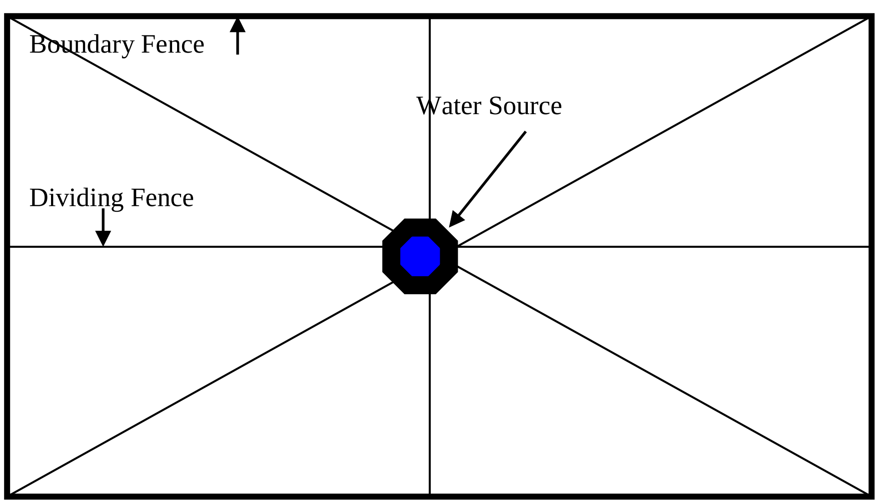
40 days recovery period + one herd = 81 paddocks
0.5 days grazing period

Instead of 81 paddocks, grazing dairies often have a smaller number of larger fields arranged so they can be broken with temporary electric fence and watered with pressurized portable watering systems using quick couplers. Each new area of pasture is sized based on actual conditions at the time of turnout. This allows haying, fertilizing, or weed control due to more manageable fields.

Paddock Shape

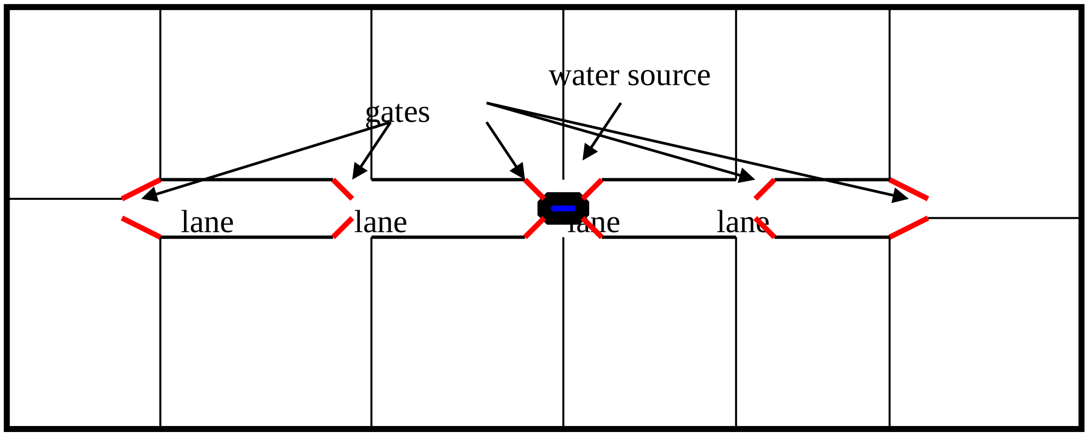
Attempt to keep paddocks as near to square as possible. This improves grazing and manure distribution. However, when paddocks are small and distance to water is short, the shape of the paddock is less critical.

A typical pie shape paddock layout.



This type of layout is not recommended due to poor grazing distribution and consequently, lower utilization rates. Also, such fields are difficult to use for other purposes such as hay or row crops.

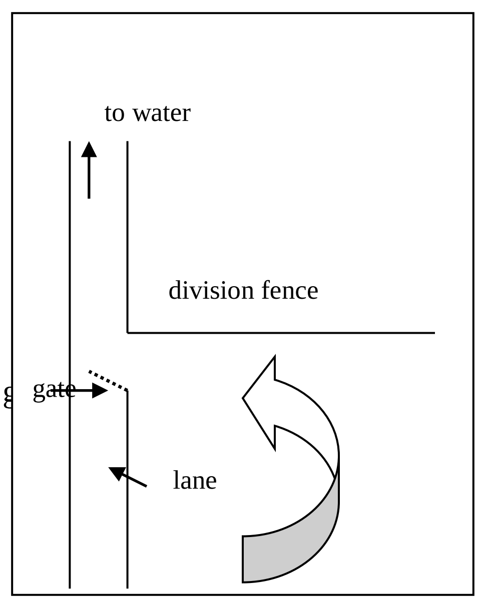
Lane to a central waterer improves paddock shape and rotation flexibility.

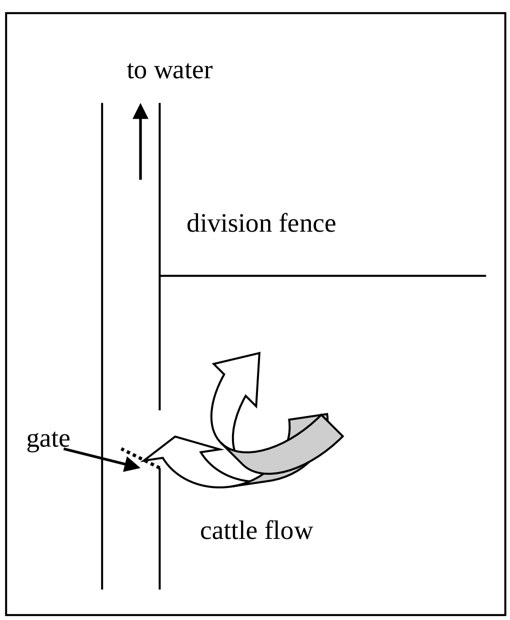


Soils and Topography

Follow landscape lines for major boundaries for better forage to soil matches. Deep, fertile, well drained soils might have an alfalfa-orchardgrass mixture while on an eroded slope, fescue-red and/or white clover might be best. On level land, hay or occasional row crops might be planted. Paddocks should be of similar grazing capacity, not similar size. Paddocks on better soils are smaller than those on worse soils.

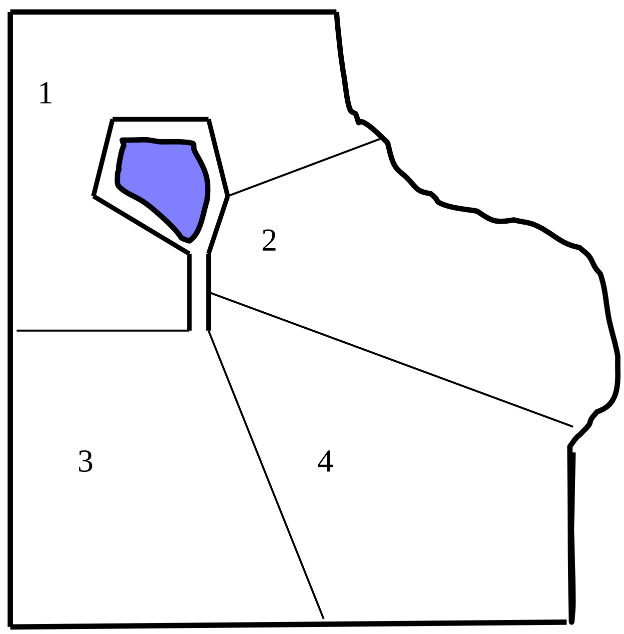
Place gates in paddock corners that facilitate natural movement.





If water is available to each paddock, then use alleyways for animal rotation only. This places less stress on the alleyways compared to also using them for machinery traffic. Place gates for machinery at other points in the fence.

A simple four field rotation using a lane for water access.

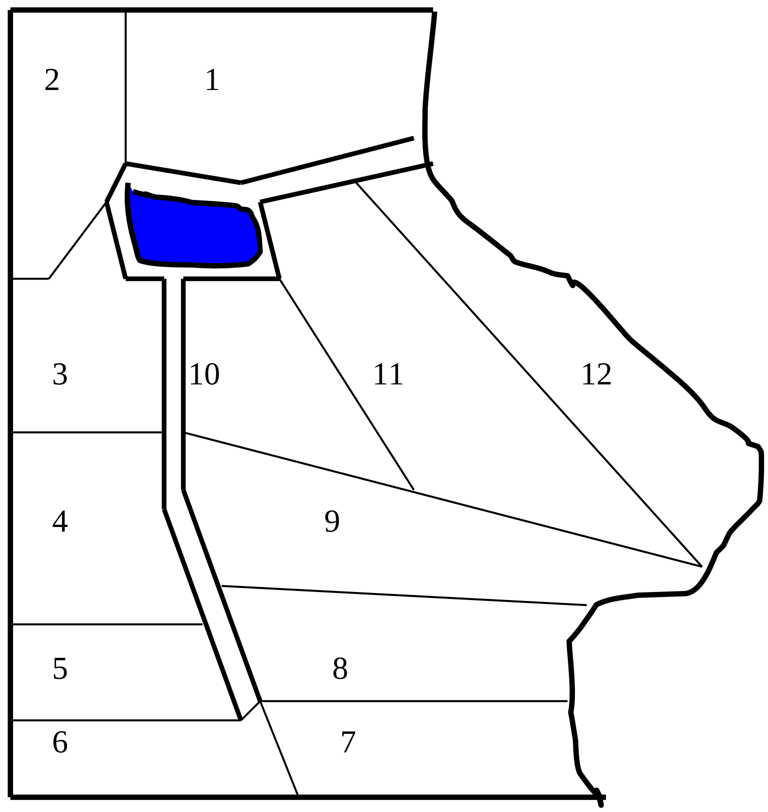


If a 40 day recovery period is desired, each grazing period is about 13 days.
(40 day recovery period/13 day grazing period = 3.1 + 1 herd = 4 fields)
If a seven day grazing period is maintained, the recovery period is 21 days.
(21 day recovery period/7 day grazing period = 3 + 1 herd = 4 fields.)

- Emerging tillers are regrazed.
- Depending on stocking rate, forage utilization is lower versus more fields.
- Manure is less well distributed versus more fields. Some will be in the lane.
- Forage quantity and quality is lower than with more fields.
- Due to long distances to water from some fields, forage utilization is lower.
- Erosion is likely in the lanes since it is used as a primary access to water.
- There is flexibility for future subdivisions, if desired.
- Paddocks have variations (slope, aspect, soil) within them due to their size.

In the spring when regrowth is faster, a 21 day recovery period and a 7 day grazing period may be adequate. However, when temperatures rise and regrowth slows, a 21 day recovery period is too short. To maintain a 40 day recovery period, the grazing period must be 13 days, far too long to prevent the newly emerging tillers from being regrazed. In fact, a grazing period this long will increase the amount of time needed for recovery.

A more intensive grazing rotation using 12 paddocks.

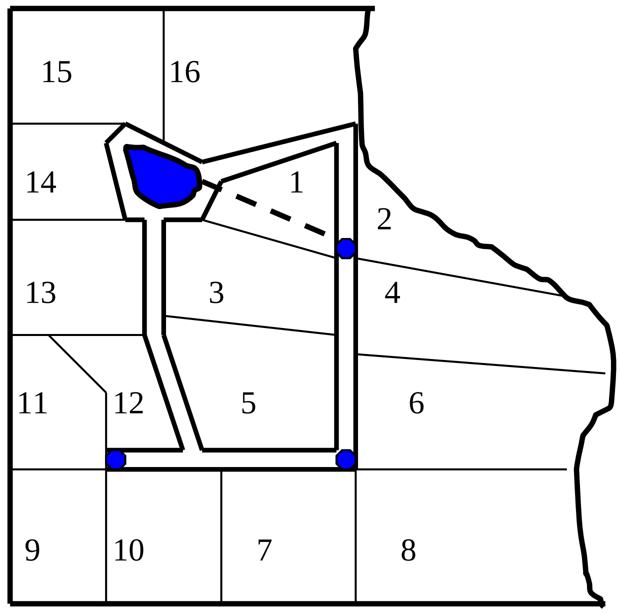


To maintain a 40 day recovery period, each grazing period must be 3 to 4 days.
(40 day recovery period/3.6 day grazing period + one herd = 12 paddocks)

- Newly emerging tillers are not regrazed due to a shorter grazing period.
- Forage utilization is higher (less waste, higher sustainable carrying capacity).
- Manure distribution is better but some will still be deposited in the lane.
- Forage quality is better due to legumes and vegetative stage when grazed.
- Cattle have to walk long distances to water from some paddocks.
- Erosion may occur in the lanes since they serve as primary access to water.

Twelve fields allow for adequate recovery periods during the summer. In the spring, fewer fields can be used as regrowth is generally faster. This can be managed by selecting appropriate (level, fertile) fields for haying excess forages and bringing them into the rotation when more recovery time is needed, by altering stocking rate from spring to summer, or by substituting a warm season perennial forage in some fields to even out the forage growth curves across the season.

An intensive rotation system with all 16 paddocks having access to water.



With a 40 day recovery period, the grazing period will be 2 to 3 days.
(40 day recovery period/2.6 day grazing period = 15 + 1 herd = 16 paddocks)

- Newly emerging tillers will not be regrazed, even in the spring.
- Forage yields will be higher (if not overstocked) due to healthier plants.
- Forage quality is better due to vegetative grasses and legume persistence.
- Forage utilization and manure distribution will be at their best.
- Cattle have shortened access to water in each paddock
- Erosion within lanes will be minimal as they are used for rotation only.
- lanes provide flexibility for choosing which paddock to graze nest.
- Paddocks are more squarely shaped and have less variation in them.

Maximum control and flexibility are achieved. Forage yields approach their potential due to improved plant health and quality will be optimum due to vegetative forages and better legume persistence. Improved manure distribution will reduce the need for fertilizer.
It is best to initially divide fields with temporary fencing so changes can be made based on experience. Once a layout is determined, interior fencing consisting of one or two strands of electrified high tensile fence can be installed if desired.

Pasture Calendar

In order to evaluate and improve a rotational grazing system, it is helpful to draw up a pasture calendar that spans the entire year and subdivided into monthly and weekly sections. Record timely observations of your pasture and animals, management plans, and new ideas. Observations/questions to think about are:

Animals
Match animal needs with forage production.
Record health problems related to grazing.
Keep track of stocking rates. Is spot grazing prevented?
Are livestock developing "camp" areas? How can this be avoided?
Are the livestock gaining or losing body condition score? Why?
Is production per acre or per head at desired levels? Is supplement needed?

Pasture
Keep track of rest and grazing periods. How is the pasture responding to these?
Are pastures being "set back"? Getting ahead? How do you respond?
How much grazing is available at any point in time?
How much residual forage is left after a grazing period? Is it adequate?
How long does it take for the pasture to regrow?
How will the mid summer slump be dealt with?
How can the grazing season be extended?

Summary

In order to plan an effective grazing system, a close working relationship with the decision makers is necessary. Goals must be determined and then the system planned to meet those goals. A knowledge of existing conditions allows better management decisions. A forage supply - demand inventory is a good tool for evaluating existing conditions. Begin planning on paper where changes can be made as goals and understanding change. Then evaluate the system continuously for improvement opportunities.