FL651.0906 Typical agricultural waste management systems.

(a) Rotational grazing systems for nutrient removal by confined grazing operations.

Rotational grazing systems are key components of waste management systems. This is because when grazing is utilized to supplement animal diets, both producers and their natural resource concerns benefit from nutrient removal through grazing, better distribution of manure, increased water quality, reduced runoff, and increased soil health. A poorly designed and managed grazing system will limit the amount of forage produced and consumed by the animals and thereby limit the amount of nutrient uptake by plants. In addition, a poorly designed and managed grazing system will have more denuded areas that can increase soil and water runoff, increased nutrient runoff, and soil erosion.

Rotational grazing systems for confined operations need sufficient numbers and size of paddocks to:

1) allow for uniform grazing by cattle, and
2) allow for sufficient rest periods following grazing events to allow forage to have a sufficient re-growth interval to reach a minimum grazing height before the next grazing event.

All grazing plans need to specify (1) the length of the grazing period, (2) length of the recovery period, (3) the number of paddocks needed for each herd, and (4) the size of the paddocks.

Use the following criteria when planning the rotational grazing system for nutrient application sites:

- Recovery period of a minimum of 21 days between grazing events or the time necessary for the plants to reach the minimum stubble height to begin grazing as shown in Florida Conservation Practice Standard Prescribed Grazing, Code 528.
- Grazing period should not exceed 5 days total length (maximum).
- At a minimum, the number of paddocks to allow for sufficient re-growth following any given grazing event.
- The stocking density should not exceed the maximum pounds of animal per acre shown in Table FL-9-1 for the length of the grazing period.

Table FL9-1 – Recommended Maximum Stock Density [1/]

Grazing Period (days)	Max. Stock Density (lbs. animals / acre)	No. of 1,200 lbs. Cows/ac.
1	84,000	70
2	38,400	32
3	24,000	20
4	18,000	15
5	14,400	12

[1/] Based on forage consumption of 1% of body weight for 1,200 lbs. animal.

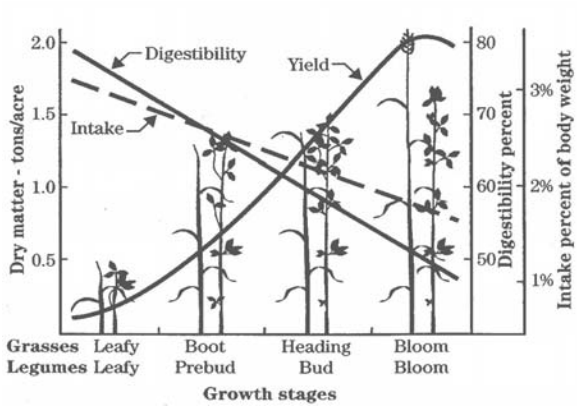
(1) Design and Layout of a Rotational Stocking System [2/]

In planning a rotational grazing system, one of the first steps is to evaluate the resource base. The forage types, soils, topography, water, shade, environmentally sensitive areas, and physical facilities should be carefully inventoried and delineated on a map before a management plan is developed. It is essential to know what limitations are imposed upon the planned system by the natural resource base as well as limitations of capital, labor, and management expertise.

Nutrient removal through forage uptake and consumption by animals is the key to the process where rotational stocking is used. To get high levels of nutrient uptake and removal by grazing animals the forage must be kept in the vegetative stage of growth. Forage in this stage of growth has the highest concentration of nutrients and is easily digested and utilized by grazing animals. Mature forages will have high forage yield, however animal intake and nutrient utilization will decline due to lower forage quality from lignifications of cell walls. Figure FL9-1 (same as Figure 5-19 from the National Range

[2/] Adapted from NRCS Alabama Guide Sheet No. AL 528.

Figure FL9-1 Growth stages of grasses and legumes and their effect on intake, digestibility, and dry mater production (from Blaser, et al. 1986)



and Pasture Handbook) illustrates the relationship between forage maturity and intake.

To keep forage vigorously growing, it is recommended that the grazing system design allow the animals remove forage re-growth to the recommended stop grazing height quickly (< 5 days). Rest periods should be no longer than are necessary for the forages reach minimum start grazing heights. Animals should be allowed to regraze a rested paddock shortly after it reaches the desired start grazing height.

There are several guidelines that may be used to help make the system more efficient and work smoother. Those guidelines for developing rotational stocking systems are listed below.

(a) Grazing Periods

"Ideally, grazing periods should be long enough to harvest the forage that exists in a paddock when livestock are turned in, but should not be so long that damage to the plant occurs from uncontrolled defoliation. Short grazing periods also prevent forage from being damaged or wasted through increased amounts of trampling and fouling with manure or urine." [3/]

Cattle take about three days to establish a strong grazing pattern within an individual paddock. If the animals are allowed to remain in a paddock longer than three days, spot grazing and pronounced cattle trails will begin to develop. When the cattle return to the paddock in future grazing cycles, the grazing pattern will be established and they will follow the previous pattern.

Another reason to keep the grazing period short is to reduce the amount of regrowth that is grazed. If grazing events take longer than 5 days to graze forage to minimum stop grazing heights, consider increasing cattle numbers of decreasing paddock size.

(b) Stock Density

The number of animals should be manipulated so the forage is removed uniformly over the paddock. Low stock densities will usually result in spot grazing and can promote high intensity areas. Stocking densities of 40 to 50 dairy cows per acre have been grazed successfully on bermudagrass (*Cynodon dactylon*) and stargrass (*C. nlemfuensis*) in Florida. In these instances, the grazing period has been 24-hours long or less and an adequate recovery period has been provided.

(c) Paddock Configuration

Uniformly sized paddocks with parallel sides are most desirable (i.e., keep the paddocks as square as possible). This shape facilitates grazing distribution and uniform use. Avoid irregular shaped paddocks, as they can create denuded areas and/or ungrazed areas.

(d) Distance to Water

Grazing animals need to drink on a regular basis. As a consequence, they tend to stay within a short traveling distance to the water source. Water is essential for the cow to properly digest the forage consumed. When water intake is limited, forage intake will be reduced. Consumption of water is greater and forage utilization is more uniform when water is available in every paddock and the travel distance is less than 800 feet. As a general rule water should be located within 300 feet of the area where lactating cows are grazing to prevent a reduction in milk production.

(e) Location of Water Troughs or Tanks

Locating water troughs or tanks near the center of the paddock will encourage cattle to graze uniformly through the pasture. As a result the nutrient deposition will be spread over a larger area.

[3/] Emmick, D. L., and D. G. Fox. 1993. Prescribe Grazing Management to Improve Pasture Productivity in New York, Cornell University.

(f) Portable Water Troughs and Feeders

Using portable water troughs and feeders when possible will allow the trough or feeder to be moved frequently and prevent denuded areas from occurring. It is recommended that the feeders be moved to a new location for each grazing period. Avoid placing the feeders or troughs near shade or cooling ponds, as this will reduce the distribution of animals and nutrients on the pasture.

(g) Paddock Production

It is important to keep the animals diet as uniform as possible to ensure consistent performance. For this reason paddocks should be sized on their potential to produce forage. If this is not possible, the length of the grazing period should be adjusted to compensate for the difference in production.

Paddocks on the most productive soils will be smaller than the average and paddocks on the least productive soils will be larger than the average. Paddock boundaries, which follow the contours and changes in the soil type, allow for more uniform production. Livestock grazing patterns will often follow the forage production patterns of the pasture. If there are several soil types with differing productive potentials uneven grazing may occur. Fences should be planned with the stocking rate and animal production in mind, and not simply to divide the fields into equally sized units. See Florida Forage Suitability Groups for forage production and growth curves for soils, EFOTG Section II.

(h) Animal Trails and Walkways

If lanes are needed they should be used only to facilitate the movement of animals to fresh paddocks, working pens, cooling ponds, and milking parlors. When lanes are used each day to access a fresh paddock or a common water source, loss of vegetation, erosion, and potential mud problems can occur. In this situation, the lane may have to be surfaced with limerock, gravel or other materials that are resistant to animal traffic. If surfacing the lane is not possible, consider having additional lanes so one can be rested while the other is being used.

(i) Number of Paddocks

The optimum number of paddocks will depend on the forage species, animal type, and performance goals, forage resistance to grazing damage, regrowth habit of the forage, and economic goals.

The ideal system is to have the animals harvest the younger, high quality leaves and leave the older, lower quality leaves at the base of the plants for photosynthesis to maintain the root system and support regrowth.

The number of paddocks required for a particular grazing cycle is determined by a combination of:

1) the recovery period required by the forage species to attain the minimum stubble height to begin grazing, and
2) the maximum number of days the animals should be left on the paddock to meet the performance goals.

In Florida, the typical length of time for most forage species to reach their minimum stubble height to begin grazing is 21 to 35 days. This will vary depending on the forage species, environmental conditions, season of year, and management. The recovery period may be reduced if the plants attain the minimum stubble height to begin grazing as shown in the Florida Conservation Practice Standard Prescribed Grazing, Code 528, or on the Florida Grazing Stick.

If the forage growth rate exceeds the animal's ability to consume it, some paddocks may be dropped from the rotation and harvested as hay or haylage or left as stockpiled forage.

With a grazing period of three to five days and a recovery period of 21 to 35 days, six to eight permanent paddocks are usually sufficient for a grazing system. The number of paddocks can be calculated using the following equation.

Number of Paddocks =

$$\frac{\text{Recovery (rest) Period}}{\text{Days of Grazing}} + 1$$

Additional paddocks may be needed when establishing forages. The forages will require a period of nonuse to become established. This period may last 12 – 16 weeks or longer.

Options for providing the establishment period include:

- Increase the confinement time and reduce the grazing time the animals are on pasture.
- Dropping some paddocks from the rotation and increasing the time the length of the grazing period on others.
- Use temporary fencing to create additional paddocks.

Another consideration when determining the number of paddocks is the increased input cost for fencing and increased management needed to make the grazing system work. Producers who have four to five permanent paddocks with water near the center of each, can use temporary electric fencing to further divide the paddocks. These temporary fences can be used until the producer is certain where to install permanent fences.

(2) Basic Rotational Grazing Rules to Remember

- Stocking systems are basically systems to feed animals and harvest nutrients from an area.
- Use the higher quality parts of the forage plants for grazing. Rotate the animals to the next paddock before they begin to graze the new regrowth (i.e. approximately 5 days)
- To maximize forage production and nutrient uptake, always try to maintain sufficient leaf area for photosynthesis to keep a healthy root system. A rule of thumb for keeping sufficient leaf area is to maintain 50 percent of the forage growth for photosynthesis or not graze lower than the recommended minimum stubble height. The minimum stubble height is shown in Table 1 of the Florida Conservation Practice Standard Prescribed Grazing, Code 528.
- Match the rotation time to the forage growth rate. The rotation among paddocks must not be based on fixed time schedule. Instead it should be based on the available forage and rate of forage growth. During periods of rapid forage growth, the grazing period should be short. When forage growth is slow, the rotation should be slowed down. Maintaining a rigid rotation schedule is the recipe for failure.

(3) Summary of Rotational Grazing System

- Keep grazing periods short.
- Keep stock density high.
- Keep the paddocks as square as possible.
- Keep water within 600 to 800 feet of the animals.
- Locate the water troughs or tanks near the center of the paddock.
- Use portable water troughs, and feeders when possible.
- Paddocks should be configured on similar production not size.
- Animal trails and walkways should be used only to facilitate the movement of animals to and from paddocks, working pens, cooling ponds, and milking parlors.
- Permanent paddocks should be sized to provide similar forage production and be subdivided as needed later.