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CONTROLLED GRAZING:
Balancing Forages, Livestock & Management

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Introduction

Pasturing, or grazing, is the original animal feeding system. With the advent of cheap energy and automated feed harvesting systems, grazing declined dramatically in the Midwest. Two events have renewed interest in grazing: the lack of a reasonable profit margin when using the current mechanized "heavy metal" systems, and technological advances in grazing and fencing. Use of a grazing system will not ensure a profitable operation, but it does offer an alternative system for marketing forages with less capital investment. As you read this bulletin, keep in mind the concept of putting pieces together to achieve a definable goal. Since we are balancing three biological entities — plants, animals and humans, each of which has different goals for existence in an ever-changing environment — we can only manage this interaction, not control it.

If grazing is the point where livestock and forages meet, then controlled grazing is the managed meeting of livestock and forages to meet a producer's goals. Use of controlled grazing can increase the harvestable yield of forages by more efficient and effective harvesting. It will decrease the fossil fuel energy, capital investment, and depreciation currently used to market forages via livestock. Controlled grazing also gives the manager the opportunity to manage plant and animal performance.

Controlled grazing will not be appropriate for every farm or livestock producer. While grazing can be very flexible, some farms may not have enough land base with livestock accessibility to make grazing practical. Some producers may not be willing to accept the burden of day-to-day management decisions that grazing requires. There is no magic grazing formula, but there are guidelines that a farmer can follow.

The Footstool Concept

As we study grazing, it is impossible to separate the interactions between forage production, animal performance and management. There is a bigger purpose to all our activities — to reach our farm goals, which include profitability, an acceptable lifestyle and a clean environment to pass on to future generations. We call this the "footstool concept" because it reminds us that balance of the three legs is necessary to support our goals. With a specific goal in mind, or preferably on paper, we can develop the three legs or components of a grazing system (Fig. 1).

The Footstool Concept

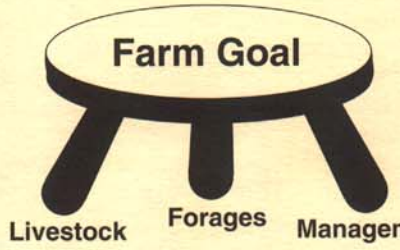
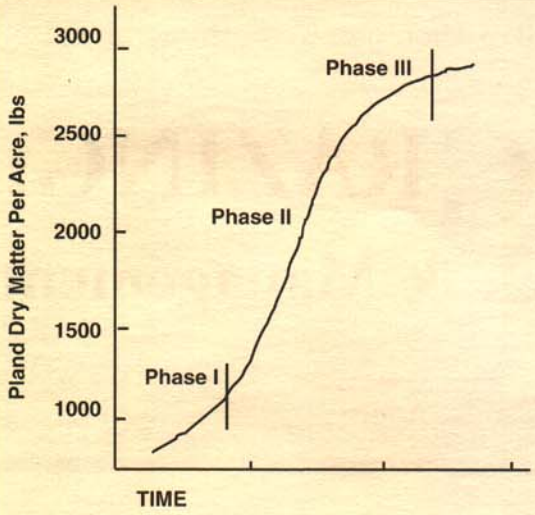


FIGURE 1

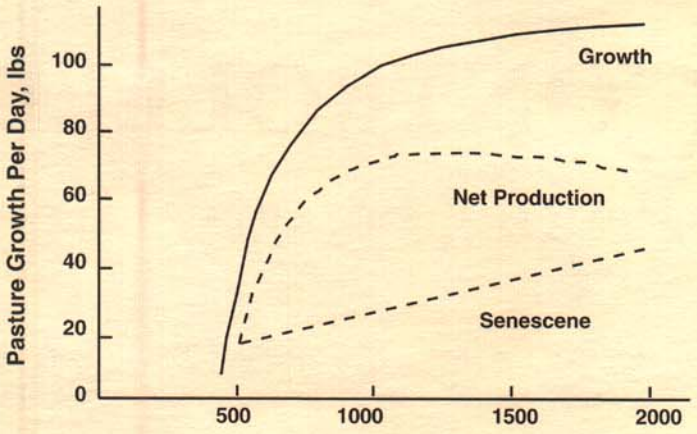
Forages: The First Leg

Plants are the first step in converting solar energy to a salable product. By understanding the general principles of forage growth, you can more effectively and efficiently harvest this solar energy. The first growth in spring or regrowth after harvesting (phase I) comes from the nutrients stored in the roots. The root reserves are depleted and the growth rate is slow until enough leaf area is produced for photosynthetic activity to begin. In this photosynthesis phase (phase II), plant growth is very rapid and root reserves are beginning to be replenished. Phase III begins with seed head formation. At this point, the plant decay rate (senescenes) is faster than new growth, so net production is actually declining even if the plant looks bigger. Fig. 2 illustrates this growth curve that all forage plants follow. (There are, of course, differences in curve shape between plant species and time of year.)



Plant Growth

FIGURE 2



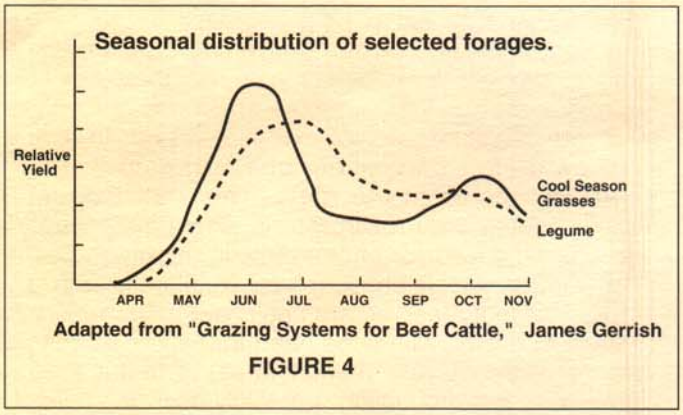
Total Pounds DM/Acre

FIGURE 3

Adapted from Ag Link Publication FPP 846, Ministry of Agriculture and Fisheries, New Zealand.

Fig. 3 shows that as a plant nears maturity, the rate is slowing even if the plant looks like it is getting taller.

Since forages can be harvested many times (three to six) during the growing season in our Midwest climate, understanding factors affecting regrowth is critical. Solar energy again plays a major role with maximum rate of regrowth during the longest daylight periods. Moisture or lack of it can also play a major role, but even with irrigation, growth will slow after June 21. This decrease in growth rate is very similar to lawn growth, where weekly mowing is required in June, but only one or two mowings are required in August. This is also the weakness of a rotational grazing system where a fixed area is supposed to supply feed for a fixed number of animals for the entire summer. Fig. 4 shows typical growth rates for cold-season grasses and legumes over



Adapted from "Grazing Systems for Beef Cattle," James Gerrish

FIGURE 4

the entire grazing season; however, moisture and temperature can often alter this "typical" curve.
Both undergrazing and overgrazing will decrease pasture growth potential. Plants that become mature are producing no net growth, but take up moisture, sunlight and soil nutrients while declining in feed value. This mature forage also becomes a mat of litter that ties up nutrients, only slowly working their way back into the the soil and the nutrient cycle. Conversely, when plants are grazed short (1 or 2 inches) or a majority of their leaf area is removed, the plants have to pull from their root reserves for regrowth. Table 1 shows that when more than 50 percent of the leaf is removed, root growth is severely slowed, resulting in a weakened plant and slower regrowth.

Table 1. Leaf Removal Effect on Root Growth

% Leaf Volume Removed	% Root Growth Stoppage
10% to 40%	0%
50%	2% to 4%
60%	50%
70%	78%
80 to 100%	100%

Adapted from "Grassroots," Bob Kingsbery.

Management of the grazing pressure can also change pasture species, affect plant density and influence the nutrient recycling. While these are just the basics of understanding forage growth, this information can help you build a strong forage production leg under your farm goal.

Which is the best forage species to plant? Many farmers are currently underharvesting their farm's forage

production potential. Unless you start with a tilled field, consider fencing and managing your grazing first. Then, if you still want increased forage production, fertilize and overseed. Tillage and complete reseeding is a necessary measure for tilled fields, especially if you don't have the patience to let grazing improve the pasture for you. The species combination that seems to be working in the Upper Peninsula and northern Michigan is orchardgrass, white clover, birdsfoot trefoil and timothy. Some quackgrass and bluegrass will automatically creep into the mix. If the pasture will also be mechanically harvested, consider using alfalfa in the mix. These recommendations are based on appropriate pH and drainage, and are subject to change with future research and experience. Contact your county Extension agricultural agent for more information.

not be grazed for more than three days before resting, especially in the spring. Due to slower regrowth, the grazing period can be longer in the fall. But the longer the animals are in a paddock, the more feed is wasted, because the animals do more walking and selective grazing–thus, the harvest is less efficient.

Grazing livestock requires the same feeding management skills as bunk-feeding animals, because instead of taking feed to the animals, you take the animals to the feed. Use the time you used to bunk-feed for walking pastures to evaluate pasture density, quality, height and feed residue as animals are moved to a fresh paddock. "Windshield observations" can be very misleading, since a lot of grass pastures are often a combination of rank tall mature forage with spots of overgrazing.

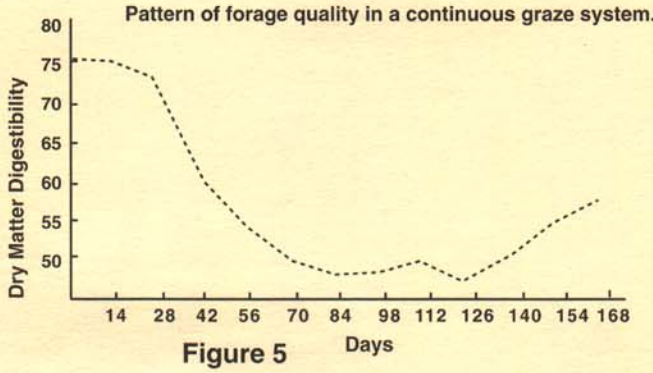


Figure 5

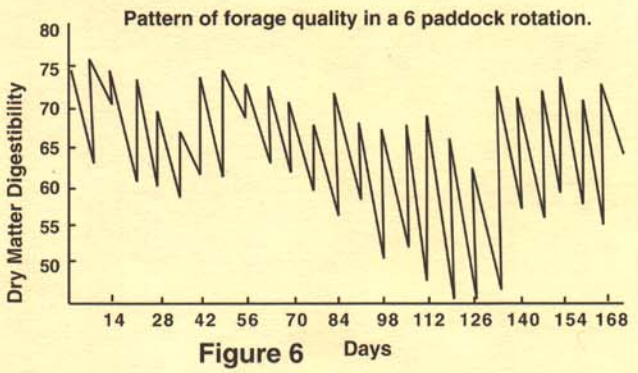


Figure 6

Adapted from "Grazing Systems for Beef Cattle," James Gerrish

Livestock: The Second Leg

Livestock harvest the solar energy captured in forages and produce value-added marketable commodities in the form of meat, milk and wool. The general guideline for ration management of pastured livestock is to start grazing when forages are 6 to 10 inches high (approximately 2,000 to 2,500 pounds of dry matter/acre), and quickly graze down to 2 to 3 inches. The one exception to this is in the spring when you start grazing at 3 to 4 inches so paddock growth is staggered and the remaining paddocks do not overmature. Forages should be about 8 to 10 inches or shorter, because livestock graze top-down on this type of forage. This provides adequate bite size and helps control ration quality by how far down on the plant you allow the animals to graze. Taller plants (those taller than 10 inches), which require considerable chewing, are bitten off at the bottom–particularly by cattle. Since livestorck graze only about eight hours per day, it is critical for optimal animal performance to have the forage at the proper height to achieve maximum bite size or intake. When pastures are short (2 to 4 inches), quality may be high, but intake declines because of the smaller bite size. To prevent regrazing new growth, paddocks should

Even with a high percentage of grass, pastures have tested over 20 percent crude protein and have had energy values equal to corn silage. Properly managed grazing systems can support over 2 pounds a day of gain on growing cattle, or provide the forage for dairy herds producing 20,000 pounds of milk per cow. Control-grazing the animals can provide a high quality ration by keeping the forage in a high-quality stage of growth. Fig. 5 shows the decline in pasture quality or digestibility if harvested with a one-pasture continuously grazed system. Fig. 6 shows that even a six-paddock system allows the forage to regrow and therefore maintain a higher overall level of digestibility. The sawtooth pattern in feed quality in Fig. 6 is the difference between feed quality when the animals go into a new paddock and the feed quality when the animals leave that paddock for the next fresh paddock.This illustrates why one-day- or even 12-hour-sized paddocks are better for lactating dairy animals where feed quality is quickly translated into milk production.

Management: The Third Leg

Management is treated as a separate component because controlled grazing requires a new perspective

and set of skills. Many people know how to grow forage and/or feed livestock, but feeding livestock, growing forage and keeping the system in tune while still meeting farm goals is a new challenge. The task is not really that difficult. It is a lot like riding a bike — more difficult to explain than it is to do.The two questions always asked with controlled grazing are, "How big should my paddock be?", and "How many paddocks do I need?" There is no standard answer for every situation, but here are some guidelines to get you started.

"How big should my paddocks be?"

"Most pastures of average density or thickness will have 2,000 to 2,500 pounds of total dry matter per acre (DM/acre) in the first 8 inches of growth. You need to leave about 1,000 to 1,200 pounds of DM/Acre for regrowth, or 2 to 3 inches. This leaves about 1,200 pounds of harvestable DM or feed per acre. If you allow the daily allotment of DM shown in Table 2, you can readily calculate the paddock size with the equation listed below. For those of you who hate math, note that this equation is really very simple, and it will give you a good handle on how to size your paddock.

Table 2. Forage dry matter intake from pasture

Animal	Pounds/day
Dairy cow	30
Beef cow/calf	30
750-pound yearling	20
Ewe/lambs	8
Dry ewe	5
100-pound horse	24

Paddock size formula:
[(No of animals) x (DM intake) x (days in paddock)] divided by 1,200 lb/acre = paddock size (in acres).

Example 1: 40 dairy cows in a paddock for 2 days
(40 dairy cows x 30 lb DM x 2 days) divided by 1,200 lb/acre= 2-acre paddocks

Example 2: 50 ewes/lambs in a paddock for 3 days
(50 ewes/lambs x 8 lb DM x 3 days) divided by 1,200 lb/acre = 1-acre paddocks

The 1,200-pound yield or range of 900 to 1,500 pounds depends most on density of growth rather than height. Due to wastage, it is very difficult to get more harvestable feed unless you sacrifice animal performance and make them eat everything. Table 3 is an example of two paddocks where the pre-grazing and post-grazing levels of dry matter were measured. Paddock A had 3,475 pounds of forage that was 12 to 16 inches tall, but only 725 pounds were utilized or eaten; 2,750 pounds were trampled or too coarse. Paddock B had shorter forage (6 to 8 inches), but provided 1,175 pounds of animal feed because only 750 pounds were left after grazing.

Table 3. Pre- and Post- Grazing Forage Utilization.

	Paddock A lb dry matter	Paddock B lb dry matter
Pre-grazing	3,475	1,925
Post-grazing	2,750	750
Animal intake	725	1,175

Source: Ben Bartlett, unpublished data.

"How many paddocks do I need?"

"The number of paddocks you need is determined by the pasture regrowth rate and the number of days per paddock. In the spring, with rapid regrowth, the rest period only needs to be 18 to 21 days. This means you need eight paddocks, each grazed for three days, or 21 paddocks, each grazed for one day. As the regrowth slows, you will need more paddocks to allow for regrowth to the desired 8- to 10-inch height. During periods of extremely slow growth, such as drought or late fall, as many as 20 three-day paddocks or 60 one-day paddocks may be required. Sixty paddocks may sound impossible, but with the new forms of temporary fence available, you can easily accomplish this with minimum cost.

Other Paddock Considerations

Layout: After you have calculated the necessary acreage for the fast regrowth period, draw out those first paddocks on a farm map. Utilize acreage that is closest to animal handling facilities and least desirable for mechanical harvesting. Extra acres or paddocks needed later in the summer will have to be mechanically harvested in the spring to provide high quality feed later in the year.

To prevent excess travel from end-to-end, paddocks should be ideally no more than twice as long as they are wide. Lanes should be high and dry, especially with dairy cattle. Study the pasture before fencing and try to fence similar areas and plant species together to prevent selective grazing. Gates should be located in the most-traveled direction to prevent stock from getting caught behind the fence.

Water: While lush pasture will provide considerable moisture, water still needs to be readily available in proportion to the expected level of production. High-producing dairy cattle should have water in every paddock, or at least not have to walk very far, while dry beef cows can walk up to a mile for water during the fall. Use black plastic pipe or a portable tanker to move water inexpensively. The water tank size should match the number of head and the recharge capacity of the water supply system.

Shade: Shade is rarely economically justified in our Midwest climate, even with dairy cattle. The infrequent, small benefits of shade are easily outweighed by the problems with mud and the concentration of manure and urine in shaded areas.

Fencing: Effective fencing is critical to the success of controlled grazing. If you can't keep the animals where you put them, it is no longer "controlled" grazing. You can use temporary fencing for paddock divisions, but it is best to have a good, permanent perimeter fence to keep your livestock off of your neighbors' property. When used with high-tech temporary systems, the new electric fence energizers and high tensile smooth wire have proven to be a cost-effective animal control system.

Summary

Controlled grazing combines the principles of forages, livestock and management to meet a farm's goals. Understanding forage growth to get optimum forage quality and quantity of production is the first step in capturing solar energy. The next step in producing a merchandizable product is to have livestock harvest this forage at the stage that will best benefit both the animals and the forage plants. Management, or how to put together the number and size of paddocks plus other considerations, is the final principle of controlled grazing.

Controlled grazing — part art, part science — is the complicated interaction of three biological units: humans, animals and plants. Putting them together to meet your goals is a lot like riding a bike — harder to explain than it is to do; something everyone can learn if they so desire; and something that gets better with experience.

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