GRAZING MANAGEMENT: PRINCIPLES AND TECHNIQUES

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One of the critical decisions facing livestock producers in Illinois is how to best utilize the forage resources on their farm. In a typical cow-calf operation, forages supply over 80 percent of the annual feed requirement. Over 90 percent of the diet of breeding ewes are forage. The manner in which this valuable resource is utilized often determines the profitability of a livestock operation. Unfortunately, on many farms pasture and haylands have received the least amount of management attention. In recent years producer awareness of pasture management has been increasing. A number of factors have brought this about. Mainly, economic conditions have forth producers to look at their bottom line and this has reflected the low returns from mismanagement of forages and pastures. Also, worldwide lowering of feed grain prices and new emphasis on soil erosion and water quality have led many farmers to a renewed interest in forage and grassland agriculture. Lastly, advancements in the technology of pasture management and improvement have made more intensive utilization of the forage resource more economically viable. Advances in equipment, especially fencing and water equipment have also helped bring about the increased interest in better grassland management.

Commonly heard terms today are “controlled grazing”, “rotational grazing”, “short duration grazing”, and “management intensive grazing”, among others. A number of different management techniques are included but the best overall is probably “management intensive grazing”. The main point of these systems is the imposition of management practices, which put the producer in control of what his livestock are consuming. In many producer-stock relationships, the animal is making an awful lot of the decisions about the grazing management, which the producer could be making to his advantage.

Forage supply and stock output are not being controlled by the producer in most traditional grazing operations but are largely left to chance. From certain economic standpoints, this may be acceptable situation based upon theories of low input, extensive agriculture. All of the currently discussed management intensive grazing systems requires both capital input, initially, and management expertise. I say “initially” for capital inputs because many producers find that as they move to improved grazing management other inputs they previously considered to be necessary were really no more than a cover-up for deficient pasture management. Excessive fertilization being typical example.

MANAGEMENT INTENSIVE GRAZING FUNDAMENTALS

A sound management intensive grazing (MIG) system is build around three key factors: 1) meeting the nutrient needs on whatever class of livestock is involved; 2) optimization of forage yield, quality and persistence; and 3) utilization of appropriate technology to develop a practical, economically and environmentally viable management system.

All of these factors are closely interrelated and should be considered from a total systems approach. For example, if a producer chooses to be a stocker feeder cattle backgrounder he will want to utilize forages of high quality to maximize individual calves gain. He decides that alfalfa is the pasture crop required to meet his performance expectations. The alfalfa will have particular fertility and seasonal grazing management requirements, which he must meet in order to maintain a high yielding, good quality, persistent pasture. If he makes an inappropriate management choice at any stage in the process, the impact is felt along the system. If he fails to choose high quality forage, calves performance does not meet his expectations and he is required to feed a costly supplement. He may have chosen the proper forage but failed to take into account its fertility requirements. The species disappears from the pasture and he is left with no feed or a lower quality feed. So it is much easier to plan the total system out on paper first and then if you need to make changes they are less time consuming and definitely less expensive.

MEETING THE NUTRITIONAL NEEDS OF LIVESTOCK

The first consideration in designing a forage system is that it must meet the nutritional requirements of the class or classes of livestock involved. There is no class of ruminant livestock that cannot be raised or maintained on a 100 percent forage diet, with the exception of "corn-fed-beef". We often use grain supplementation as a substitute for good forage management or even to remedy poor forage management.

There are very real differences in the nutritional requirements of different classes of livestock and these must be taken into consideration when setting up a grazing program. Most producers realize the difference in nutritional demand of stockers vs dry cows or first calf heifers with suckling calves vs mature cows with calves but we sometimes overlook the more subtle differences of a high milk producing cow vs an average cow or straightbred calves vs crossbred calves. Likewise, producers can easily recognize what is "good" pasture and what is "poor" pasture. But what is "good" or "poor" is a matter of perspective. What may have been good enough for a 950 lb cow weaning a 400 lb calf may be good enough for a 1200 lb cow weaning a 600 lb calf.

The energy requirements of female ruminants are primarily affected by their mature size and milk production potential. For example, at peak lactation, the energy requirement of a large beef cow with a high milk production potential, such as a Simmental, will be 43% greater than that of the moderate-sized Angus-Hereford crossbred cow with moderate milk potential. Similarly, at peak lactation the energy requirement of the large Holstein cow is more than 40% higher than that of the smaller Jersey.

Energy requirements change during lactation a pregnancy. The maximum energy requirement of cows and ewes occur at peak lactation, which is about 6 to 10 weeks after calving and 3 to 6 weeks after lambing. The increase in the energy requirement from the dry, maintenance period to peak lactation can range from an increase of 805 for a ewe nursing a single lamb to about 150% for a high milk producing Holstein cow. In general, a diet of high-quality forages will meet the energy needs of lactating ewes and beef cows even at peak lactation. However, it is hard for dairy cow at peak lactation to consume enough energy from a forage diet alone, and they often require supplementation with higher energy feeds.

Cattle and sheep, during their period of rapid weight gain, should be given priority to the higher quality forage to reach their production potential. For example, when grazing a pasture unit for 2 days, the weaned heifers and steers would graze the pasture unit on the first day and get the higher quality forage, and the dry cows would graze the pasture unit the second day consuming the lower quality forage.

OPTIMIZATION OF THE FORAGE BASE

When selecting the plant species to use in a forage system, we try to arrive at an optimal compromise of the factors of yield, quality, and persistence. We commonly think of different forages as having particular attributes. We can easily visualize endophyte infected tall fescue as being very productive and persistent but of limited quality or bluegrass as being persistent and of high quality but a low yielding grass. Orchardgrass-alfalfa mix is very productive and high quality but may not be persistent under lax management or harsh environmental conditions. Thus, we must recognize he strengths and weaknesses of our players in order to combine them into a balanced team. A good livestock producer should have as sound an understanding of the production characteristics of the forage he has available just as he understands the usefulness of different breeds and bloodlines of cattle or sheep.

Depending upon the rate of growth of the calf, the nutritional demand of a cow-calf pair may increase, decrease, or remain nearly constant through the grazing season. Not only may the dry matter requirement increase, but we should also be concerned with increasing the quality of the sward through the season, as it is important to consider the needs of the calf as well as the cow. The nutrient demand of the cow will begin to diminish after peak lactation occurs about 0-75 days after calving and will remain fairly steady from that time until weaning. After lactation begins to decline, the calf will begin to consume more forage and will increase until weaning. The calf's increased demand will more than offset the decrease in the dam's consumption if growing at an acceptable rate. As already shown, the quality of forage available to the calf at this time should exceed that which we would typically consider adequate for the beef cow. After weaning the requirements of the cow are fairly low until the final months of pregnancy.

To meet this particular animal needs, we must have forages of the appropriate quality growing or stockpiled throughout the grazing season. The very good livestock grazier should consider the grazing season to be any time other than deep snow cover. Forage species should be selected on the basis of regional and site adaptation, seasonal distribution as well as total yield potential, and ability to meet the nutritional needs of the livestock involved. Usually a combination of several species will give the best overall availability and quality profile for the season; however, simplicity has a lot going for it, too! Some tailor made grazing systems designed to meet every imaginable circumstance are too cumbersome in their complexity to be of practical value to the producer. A combination of two or three base pasture types can generally be managed to provide adequate forage availability and quality throughout the grazing season. Neither fescue nor alfalfa is the universal solution.

SELECTION OF FORAGE SPECIES

In Illinois we are very fortunate that we have a great diversity in adapted forage crops. We can broadly break these out into three classes based on plant biology: 1) cool season grasses, 2) cool season legumes, and 3) warm season grasses. Most sown pastures in Illinois are dominated by cool season grasses, including smooth bromegrass, orchardgrass, tall fescue, Kentucky bluegrass, timothy, perennial ryegrass, and Reed canarygrass, among others. The advantages of interseeding legumes in a cool season grass pasture are well known and have been practiced by many stockmen for years. Legumes commonly user are alfalfa, red clover, white clover, birdsfoot trefoil, and lespedeza. The third category includes the commonly used annual summer grasses such as sudangrass, sorghumXsudan hybrids and pearl millet. In addition the perennial species that were native to the American prairies have seen some renewed interest as forage crops. These would include switchgrass, big bluestem, Eastern gamagrass and indiangrass. In reality the individual species within each class may have quite different production trends depending upon relative maturity, specific site adaptation, and the production grazing management fertility can also alter curves.

We can further divide each of these classes into whether they are perennial or annual species. On rolling erosive ground where long term pasture is desirable, the most persistent of the perennial species may be the desirable crop. In a mixed crop/livestock system where crop rotations are used, the inclusion of an annual forage crop may be useful from the standpoint of erosion management. No-till interseeding of cool season annuals such as rye or oats into dormant warm season sods is an acceptable practice in many parts of the state and no-tilling summer annual grasses into cool season sods for mid-summer production has been used successfully by some producers.

It is clear that we have many options available to us in developing a forage program. Which particular species or combination of species depends on several factors.

First consideration to make is what species are best adapted to the soil resource of your farm. There is no point in planting alfalfa when the land will only support lespedeza. The reverse is also true, the most productive species that will persist and perform on your farm should be chosen. Do not grow a low producing grass if the land will support a higher producing species, if all other factors are equal.

Secondly, is the level of management you are willing to provide adequate for the survival and persistence of the species. Grazing, fertility, and pest management come under this heading. Are you really willing to take care of this pasture to keep it producing?

Thirdly, acceptability and appropriateness to the type of livestock you wish to produce. If a plant is unpalatable to a particular type of livestock, it isn't going to contribute very much to their output.   The argument can also be made that the animal type should be adapted to the grass resource already in place. In harsh environment this is definitely true. In a soft environment such as central Illinois, alterations in the forage base to meet animal needs is perfectly reasonable.

UNDERSTANDING GRAZING ANIMALS AND THEIR MANAGEMENT

Animal care and their behavior influence daily decisions about movement and animal handling activities in grazing systems. Animal behave first as individuals in their particular grazing selectivity, reproductive cycle, and health, but practicality requires that we manage animals as a herd or flock, which generally improves the efficiency of animal handling. There are inherent group behaviors that should be considered in the design and management of the grazing system.

Cattle graze from 8 to 12 hours per day and sheep from 6 to 8 hours. Horses will graze up to 14 to 16 hours per day. Cattle and sheep break this active grazing time into about 5 or 6 separate grazing periods, with time required for ruminating and resting between grazing periods. A horse’s normal pattern is to graze continuously for several hours, rest, and then continue grazing. For cattle and sheep during summer, grazing the first few hours after daybreak is normally the largest single meal of the day. In this early morning grazing, animals tend to eat a lot and are less selective in their diet. A second large grazing period occurs in late afternoon until about sunset, with minor grazing periods during other parts of the day and even a night. During hot weather, animals tend to graze more at night. In winter, most grazing occurs from midmorning to midafternoon when temperatures are warmest.

Animal behavior can be useful when deciding when to move animals. Because the average nutritive quality of the forage declines the longer a group of animals is in a pasture, the early morning “quantity” grazing is a good time to get the animals to eat more of the lower-quality forage in the paddock… Under ideal conditions, when the nutritional requirements of the herd or flock are relatively low (dry, open, or gestating) moving the group after the morning grazing is a good use of the lower-quality forage on the last day of the graze period. But if the animal group is one that requires a high-quality diet for lactation or gain (dairy cows, stocker calves, or lambs), then turning the group onto the next high-quality paddock before a big grazing (daybreak or midafternoon) will permit a better level on nutrition in the diet. However, convenience and bloat management often dictates when groups are moved. Herds and flocks often behave according to a leadership hierarchy. This is important when moving animals. Each animal group has leaders, followers, and subordinates. Disruption and conflict can arise if subordinates are forced into the leader or follower group as animals are being moved.

Groups of animals appear to prefer to be able to see each other at all times. So when the lead animal begins to move to water or to a remote part of the pasture, all the members of the herd move too. This is a great advantage when rotating to a different paddock in rotational systems, but can be a disadvantage when the group move to a distant water source interferes with grazing and uses energy unproductively for movement, particularly for high-producing animals (lactating dairy cows, stocker calves). Recent research in Missouri shows that if animals are within 700 to 800 feet of the water source, they can generally see each other and are more comfortable going to water individually in coordination with their own grazing and ruminating preferences. Providing water in each paddock or at several locations in large pastures will improve the efficiency of grazing, animal production, and manure nutrient distribution.

In large pastures, grazing animals often prefer to graze near the water source and avoid grazing in distant corners. Some producers place salt and mineral supplements in locations away from the water source to encourage better forage use over the entire pasture.

SPECIES RESPONSE TO GRAZING MANAGEMENT

There are few desirable forage species that will persist under continuous, uncontrolled grazing. A few examples are tall fescue, Kentucky bluegrass, and common white clover. These are the sorts of plants, which would not be expected to show a great response to implementation of a controlled grazing program, although some improvementin utilization rate and animal output/acre could be expected. Upright growing legumes, such as alfalfa and red clover, and grasses which elevate growing points early in development, such as bromegrass and indiangrass, are more likely to respond dramatically to controlled grazing. This difference is due to two factors: 1) carbohydrate (CHO) balance in the plant, and 2) location of the developing seedhead (meristem) relative to grazing height. Low growing or prostrate species maintain a fairly substantial leaf area below grazing height and subsequently maintain a positive CHO balance even under heavy grazing. The upright growing species maintain very little leaf area below grazing height, unless lightly grazed, and must rely upon stored CHO for regrowth following defoliation. In legumes most of the CHO storage is in the root while in grasses it is mostly in the lower part of the stems. With repeated defoliation by grazing and no rest period to replenish CHO reserves, the plants will not survive. Controlled grazing allows the needed rest period for replenishment and plant persistence improves.

Anytime a terminal meristem is removed by grazing; regrowth must come from basal or other axillary buds. At some stage of development in certain species, these buds are inhibited from developing new shoots due to the hormonal control exhibited by the dominant growing point (apical dominance). Grazing closely in this situation can result in very slow regrowth, as is the case with smooth bromegrass and timothy. With controlled grazing, livestock can be managed to leave the meristems intact or remove all growth, depending upon what plant response is desired.

Selective grazing is much reduced by controlled grazing allowing different species in a mixture a more even opportunity for survival and persistence. Undesirable and less desirable species are grazed and are not given the competitive edge they frequently enjoy in continuously grazed pastures. Species combinations such as tall fescue-alfalfa can be practically managed and maintained on a balanced basis when timing and extent of grazing is controlled. By altering the paddock size or increasing stock density, grazing pressure can be adjusted to favor one species over another depending upon season or particular type of sward, which is desired.

ANIMAL GRAZING EFFIENCY

If forage is too tall or too short, animals will be unable to consume enough during the time they will graze each day to meet their nutritional needs. Grazing animals cannot greatly compensate for inefficient bite size by grazing more hours during the day. Cattle graze by bringing in forage with their tongue and tearing or shearing it off with the teeth on their lower jaw. The most efficient forage height for a cow to graze is from 4 to 10 inches. It is difficult for them to get sufficient bites if forage is shorter, and it requires much more time for them to get longer forage into a form that they can swallow. Horses have both upper and lower teeth and graze by nipping forage. Sheep use upper lips and lower teeth to graze nearly as close to the ground as do horses. Horses and sheep can both eat shorter forage more efficiently than can cattle and their most efficient forage height for grazing is from 2 to 6 inches. It is difficult for them to get sufficient bites if forage is very short. Sheep and horses also have more difficulty grazing forage that is much taller than their optimum.

STOCKING RATE AND CARRYING CAPACITY

Potential stocking rate or carrying capacity is closely correlated with total yield potential of a species but will vary with site adaptation, fertility, grazing system, and resistance to grazing damage. When constructing a forage program, remember that it is only as good as its weakest component. Species which give high carrying capacity in the spring and very little in the summer are commonly used in Illinois and must be worked around. Legumes or perennial and/or annual warm season grasses are essential for a well-balanced forage system to meet the summer forage shortage.

A good controlled grazing system will greatly extend the summer and fall productivity of cool season grasses when compared to continuous grazed systems, especially with the species with lower grazing resistance (e.g. Orchardgrass, bromegrass). Persistence and productivity of legumes will be increased through controlled grazing, providing fertility requirements are met, and this will translate to increased carrying capacity.

Tall fescue has been reported as a species having very good carrying capacity. One reason for this apparent effect is the low animal intake on endophyte infected fescue. It may be possible to maintain a high number of animals per acre on infected fescue but performance may be nil. When discussing carrying capacity it should be related to some measure of performance. The measured carrying capacity of endophyte free fescue under continuous grazing is somewhat lower than the infected strains. Overall the endophyte free fescues are probably still somewhat higher than orchardgrass or bromegrass but no real data is available to make that judgement. Under intensive controlled grazing, orchardgrass may have higher yield potential and carrying capacity than low endophyte fescue.

It is very difficult to rank species in terms of carrying capacity due to site, varietal, and management differences. Species in mixtures are even harder to predict. More variation in yield potential of a species due to site variation occurs than we frequently like to believe. A basic principle of grazing mixed species, especially when utilizing controlled grazing, is that when each component specie is used at its optimum stage for yield and quality, the carrying capacity of the system will be higher than if any one of the components was used in a single species system.

NUMBER OF PADDOCKS

There is no magic number of paddocks that one must have for a successful controlled grazing systems. The optimum number of paddocks will vary with species due to resistance to grazing, regrowth habit, and economic potential. The ideal system would have grazing animals move daily to fresh paddock. However, this ideal is often difficult to sell to many producers. The advantage of such a system include minimal feed wastage, very high quality feed each day, reduction of parasite infestations, rapid uniform grazing, and many more. For starting out, the serious grazer should have a minimum of 8-12 paddocks. Most producers quickly see the advantage of more paddocks and move in that direction. The objective of increased paddock number is basically to raise stock density to produce uniform grazing. To decide on how many paddocks should be laid out, add up the total liveweight of your herd that will run as a single grazing unit, divide that total weight by the desired stock density and the answer will be the approximate number of acres that each paddock should be for a single grazing day. IF you want approximately a four-day grazing period in each paddock, then multiply your answer by 4.

All of this is obviously tied to forage availability per acre. A more productive crop will support a higher stock density than will a less productive crop. The next question is how to determine what the desired stock density is. We must know three factors to determine this: 1) what is the daily feed requirement, 2) what is the forage availability, and 3) what is the desired utilization rate.

Daily feed requirement can be determined approximately from National Research Council (NRC) tables. These tables are available through local Extension Offices and give the daily fed requirements for most classes of livestock. These are average figures under controlled conditions, so always err on the side of being conservative. If the table says an 1100 lb lactating cow will eat 21.6 lbs of dry matter per day, figure that she will eat 27 lb. As a rule of thumb, figure 2.5% of body weight for breeding animals and 3% for growing stock. You might find you're wasting some feed, but that beats running out!

The amount of forage standing out in the pasture can be measured by cutting and weighing and other complex methods but out on the farm this part of the operation becomes largely an eyeballing art. With a little experience it isn't too difficult to judge the amount of forage present. Most good stockmen can look at a pasture and say, "That will feed 30 cows for two weeks". Judging actual availability on a per acre basis can be learned with a little practice.

Utilization rate is another way of saying harvest efficiency. The most desirable harvest efficiency is 100% without damaging the stand. This is essentially impossible due to the excretory habits of livestock and the fact that they walk on their dinner plate. Of the forage that grows in the field, 15-25% will have to remain in residual dry matter (RDM) or stubble, as it is usually called. The amount will depend upon the species being grazed. Alfalfa requires very little residual because stored energy from the roots will support new regrowth. Indiangrass will require a higher percentage of RDM because the primary CHO storage site is the lower stem and it is also desirable to leave some active leaf area below grazing height. The longer period of time livestock are allowed to remain on a paddock the more of it they will foul by manure and trampling. Utilization rate is inversely related to length of stay. If you want to harvest 75% of the standing crop, the animal better be out there no more than a few hours. If you are content with 50% utilization, then they might stay a week to 10 days. For continuous grazing the generally accepted level of utilization is 30-35%. The longer the length of stay, the lower stock density will be so, so it is clear that utilization is very closely tied to stock density.

A fourth factor on figuring stocking rate might be whether you want maximum animal production per acre or individual animal performance. If you want individual animal performance a common stocking density is 10,000 live animal weight per acre; whereas if you want total production per acre a suggested stocking rate is between 40,000 and 50,000 pounds per acre. If you want to maximize total returns per acre the suggested stocking rate is somewhere between 30,000 and 40,000 pounds per acre.

The actual number of paddocks required for a particular grazing cycle is determined by the necessary rest interval required for that particular pasture mix under the current environmental conditions and by the maximum number of days that animals should be left on a paddock. Typically the CHO replenishment cycle in forage plants takes 20-30 days, therefore, this is the range in rest interval we should be generally considering. Under good growing conditions the shorter time frame would be required whereas in midsummer the longer time period is required to reach a state of positive CHO balance due to high respiration rates. The implication is that fewer paddocks or more livestock are needed at certain times of the year. For most producers, the paddocks not needed for grazing can be harvested as hay of haylage. The greater the number of paddocks the more fine tuned the proportion of grazed acres to hayed acres can become. One aspect to bear in mind though is that one 20-acre tract can be harvested more efficiently than five 4 acre tracts. The use of temporary fencing can facilitate both ends. Remove the first harvest of the 20 acres as hay in a single block and then erect temporary fence for controlling grazing on the regrowth.

Resistance to grazing damage affects the necessary number of paddocks. With species, which elevate their growing point quickly, a short grazing period is critical to prevent damage to regrowth potential. The grazing duration should be long enough and the stock density adjusted such that a flush of growth will be grazed off before new shoots or leaves elevate to grazing height, usually a maximum of 3-7 days depending upon species and weather. Another point to remember is that with a shorter grazing period, the fluctuation in forage quality from the first grazing day to the last grazing day in each paddock is minimized.

For species which maintain the growing point close to the ground, it is less important to graze down and move rapidly, thus fewer paddocks may be required for these species (e.g. fescue, white clover).

SHADE

Is shade advisable? There’s no definitive answer to the question.

On the one hand, several problems are related to shade. Animals congregating under shade trees obviously are not grazing. And they can trample forage underfoot and nearby, either destroying it or lessening forage quality. Furthermore, manure is not as well dispersed in the pasture. Instead, the concentrations of manure and urine damage forage and attract flies. On the other hand, animals will go to shade if shade is available. Many producers are concerned about the comfort of their animals and provide shade.

But the answer is not clear-cut. It is clear that it’s inadvisable to have only 1 shade tree per pasture. And there is some evidence that dark-colored animals have more heat stress from sun than light-colored ones. But thus far there is no experimental data showing that grazing animals in Illinois needs shade. There is research, however, showing that grazing animals allowed to congregate under shade do not distribute manure and urine as uniformly throughout the pasture. Also, producers have experienced that if they have shade in one paddock they should have shade in all paddocks.

WATERING SYSTEMS AND REQUIREMENTS

Water often is the single greatest factor restricting the development of more efficient grazing systems. Movement of grazing animals to and from water in unproductive time, often increases soil erosion along animal trails and lanes, and contributes to poor manure distribution. Water must be available, and it needs to be as clean and fresh as possible. There are several undocumented observations from producers that animal production is increased when the herd is switched from pond water to well water or rural water delivery systems. You need to be creative and open minded in evaluating alternatives for providing water to the grazing herd. These are seldom easy and can be costly.

Recent grazing management research indicates that animals should be no farther than 800 feet from water for most efficient grazing. There are basically two approaches to the water dilemma. One is to let the animals move to water. The second and more desirable approach is to move the water to animals. There are many new technologies for delivering water to grazing animals. Examples include burst-proof pipe, quick couplers in water lines that allow moving small watering tanks around the pasture areas, and new pumping equipment. Various pumping systems have been tested and evaluated by graziers throughout the United States. Solar pumps, water rams, water slings, and nose pumps are all means of moving water to livestock, but some of these are only appropriate for small grazing group to 25 0r 30 cows. Producers should take advantage of the more experienced graziers in their area t observe the methods they are using to deliver water.

When you calculate the actual water requirement of grazing animals, it must be remembered that it will not be uniform throughout the year. Lactating animals have higher water requirements than other classes of animals. Environmental stress, particularly high temperature and humidity also can drastically increase the water requirements of grazing animals. A general rule for planning water resource needs is that animals consume roughly three times the amount of water per day as they do dry matter. Using this guideline for a standard animal unit (one 1,000-lb cow with or without calf consuming 26 lb of dry matter per day), you would estimate that the animal is drinking 78 lb of water, or roughly 10 gallons daily. However, animals under heat stress and during lactation may require two or three times this average daily water need.

When an improved grazing system is planned and implemented, increased stocking rates should occur over time. Therefore, planning the water system for the current water delivery needs is shortsighted and may be a costly mistake. The watering system must be designed to deliver water at a rate that exceeds the requirements of the grazing herd at peak water consumption. The water system must be designed to provide a minimum refill rate of 0.5 gal/minute/animal. (Information on water pressure, pipe sizing, and flow rates needed to match water delivery systems with animal requirements is included in Extension publication MWPS-14, Private Water Systems, available from Extension Offices). Water delivery systems with pipe buried below frost line can permit yearlong grazing opportunities. Systems with hose or pipe on the soil surface require more care in placement and restrict water delivery to the frost-free season.

FENCING MATERIALS

The changing technology in electric fencing has probably been the single most important factor responsible for the current high level of producer interest in MIG. The introduction of what has been popularly termed “New Zealand type fencing” has radically altered the affordability of subdividing pastures for purposes of MIG. Modern fence energizers are much more powerful and reliable in the face of adverse conditions. The major difference in the two types of energizers is the duration of electrical pulse and the force with which energy is entered into the wire. A conventional energizer loads energy (volts) into the wire relatively slowly (.3 seconds) with limited force (amperage). A modern low impedance energizer will load energy into the wire with much more force in a very limit time (.003 seconds). The difference is that the slow moving pulse of energy is easily bled off the line through vegetation or faulty insulators while the fast moving high energy pulse move past the vegetation and other “leaks” with only minimal energy loss. Once a producer accepts modern electric fencing as a management tool, his or her concern becomes one of paddock layout with what type of fence design.

When setting up a MIG grazing system, a producer will have three types of fencing involved: 1) perimeter, 2) permanent subdivision, and 3) temporary subdivision.

An electrified perimeter fence is the most effective means of carrying energy for subdivision fences around the farm. The most cost effective perimeter fence will be constructed using multiple strands of 12-½ gauge hi-tensil wire. The advantages of hi-tensil include Class 3 galvanization versus Class 1 on most conventional barb wire and woven wire, strength of wire and ability to keep fences tight due to this strength, and the absence of barbs for ease of working and less likelihood of damaging hides and fleece. The difference in galvanization translates to about 250% increase in the life expectancy of the fence. How many wires to use depend upon the class of livestock to be controlled and whether or not predator protection is a concern. For cattle a five-wire fence with either all wires or only 3 wires energized makes a very reliable perimeter fence. Including non-energized ground system wires alternating with the energized wires is most advantageous on dry soils where the livestock may not be sufficiently grounded just through earth contact. For sheep or goats where predator protection is a major concern, fences are usually 7 or 8 wires with alternating energized and ground system wires.

Permanent subdivision fences should also be constructed from 12-½ gauge hi-tensil wire. For most cattle situations, a single strand is usually adequate. If it is critical to keep calves in the same paddocks as their dams, then 2 or 3 wires may be used. The basic rule of thumb for height of wire on a single strand fence is 2/3rds the shoulder height of the grazing animal. For sheep a three-strand fence is very effective. Sheep that are trained to electric fence can be kept in with 1 or 2 strand fence. Typically, in a mixed cattle and sheep situation, 3 strand fences with 10”-20”=30” wire heights work out very well.

With temporary fences, there are several options available. Unless a producer has specialized equipment for taking hi-tensil wire down and rolling it up, hi-tensil is not a good choice for temporary fencing. Portable fencing may come in the form of polywire or electroplalstic twine, hot tape, electric netting or multistrand steel cable. The first three all consist of polyethylene or fiberglass strands interwoven with fine stainless steel or aluminum wires. Polywire looks like plastic baling twine in size. Hot tape is a flat, tapelike material that may be from ½ to 2” wide. Usually 6 to 9 wire filaments are included in the strand. Electric netting is more commonly used for sheep and goats and is simply a fully electrified net fence that is easily taken up and down for stock management. The multistrand cable is a 16-gauge material that has greater conductivity and useful life than the plastic based materials.

SUMMARY

Once the decision has been to develop a rotational grazing system and the preliminary calculations are made on paper, you should have some idea on the basic plan—how many paddocks or pastures will be needed and their approximate size. The challenge becomes how to best fit the basic plan to the conditions of the specific site. There are few hard rules for paddock layout, but there are some good guidelines. The most important consideration in layout and design is to **design with flexibility in mind.**

One guideline often suggested to maximize flexibility in the start-up year of a system is "don't build or install anything that cannot be easily mover or shifted." If the site has no preexisting fences or water sites, this ultraflexible approach may be feasible. But many sites already have some existing permanent fencing, water sites, and handling facilities that may be suitable to include in the layout design. There is always the risk, however, that too much of the existing fencing will be kept in an effort to economize at the sacrifice of a more flexible or efficient layout. Don't be afraid to invest in some temporary fencing and water distribution materials in the early years or a MIG rotational grazing system.

Ensuring that forage availability and quality will be adequate for the livestock involved is the most critical factor as profitable livestock production is the end goal of all forage management. Reducing the time period that harvested, stored feed is required can be accomplished through improved pasture management. Improvement of the pasture system includes establishment of productive, high quality forages, fertility to maintain a productive stand and grazing management to efficiency harvest the forage. As all of the factors are interrelated, MIG must include consideration of all aspects of the soil-plant-animal-environment complex. Remember that grasses and forages are the commodities that the stockman actually raises. The livestock are only the method by which the commodity is merchandised.

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