Grazing Management Systems for Optimum Pasture Utilization

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INTRODUCTION

In an attempt to improve harvest efficiency and attain optimum utilization of forages, many pastures have been intensively grazed either by design or default. And, in an effort to "optimize or maximize" economic returns, many annual and perennial pastures have been intentionally or unintentionally overgrazed. The primary objective of most grazing operations is to make a profit. And, there are numerous management schemes and pasture systems used today to meet this objective. Too often, grazing ventures return little, if any, net returns on the initial investment in land, cattle, and management. As a result, the grazing operation has been done "just for fun", but no one can find humor in the negative cash flow situation. To eliminate the "experience only" trauma of the grazing operation, and initiate potential profits from grazing pastures, several factors should be considered. Perhaps the first factors to consider are those of formulating objectives for the operation and providing sufficient flexibility to: (a) take advantage of profitable situations as they may occur, and (b) reduce risks which are influenced by climatic conditions. Some of the more significant factors which are likely to influence management decisions and practices and the effective marketing of forage through grazing systems are discussed in the following categories.

CLIMATE

Although one cannot alter the climate of a specific area, managers need to be familiar with the average as well as the erratic climatic conditions, primarily rainfall and temperature, which are likely to occur. Warm-season perennial grasses such as bermudagrass for example, have distinct seasonal characteristics of dry matter production under normal environmental conditions of the humid southeastern U.S. Thus, the forage growth traits of these forages cause many pastures to be either understocked or overstocked during much of the active grazing period. Usually, there is only a limited time when stocking rates are ideally balanced with forage production. Therefore, a good knowledge of the erratic nature of the rainfall distribution of a given area will allow operators to make sound management decisions and to plan in advance of these climatological irregularities.

SOIL

Pasture productivity and livestock performance levels are also dependent upon nutrient status of the soil. Soil tests, therefore, are essential to the most cost-effective methods of forage production. Bermudagrass, for example, is very tolerant of acid soil conditions. Unless the bermudagrass pasture is to be oversown with winter annuals, particularly legumes, then there may be little immediate economic justification for adding sufficient quantities of lime to "neutralize" the soil. Numerous research and demonstration plots have documented that there is little detrimental effect on forage production of bermudagrass when using soils with a pH as low as 5.5. However, on these low pH soils, one must pay close attention to potassium levels. Low potassium in the soil, combined with harsh management and/or winter conditions may lead to a thinning of the bermudagrass stand. Bermudagrass is very responsive to nitrogen fertilizer and seasonal rates should be in accordance with desired levels of stocking rates.

FORAGE PRODUCTION AND VIGOR

Warm-season perennial grasses are the basic forage unit for pastures in the southern U.S. In the southeastern U.S., most of the intensively managed pastures consist of *Cynodon* or *Paspalum* spp. Much of the previous grazing research with these sod-forming grasses has been directed at evaluating cultivars, grazing systems, or research techniques and methodology. In the arid rangelands of the U.S., there is a continuing struggle to have some balance and control over plant defoliation by livestock. Excessive defoliation or overgrazing followed by prolonged drought conditions may ultimately destroy the grass resource for several years or even decades. One of the primary objectives under rangeland management is to conserve the forage resource and maintain or adjust various plant populations. Thus, with this and other range conservation-production objectives in mind, various grazing systems (continuous seasonal; continuous year-long; deferred-rest rotation with multi-paddocks and multi-herds; and high intensity rotational grazing with multi-paddocks and a single herd) have been postulated, researched, and demonstrated to be viable alternatives for accumulating biomass, distributing grazing, and enhancing range and livestock production. Generally, under rangeland conditions, cattle remain on a given area for a 12-month period and thus depend upon summer biomass production for winter forage supply. But, as the climate becomes more humid and the forage changes from a multi-species, bunchgrass community to a near mono-specie, rhizomatous sodgrass such as bermudagrass or bahiagrass, the grazing strategy and management change. Bermudagrass and bahiagrass pastures are basically utilized during the active growing season(s) with hay or winter pasture providing winter forage requirements.

Bermudagrass pastures do not require periods of rest during the active growing season, or other manipulations for stand maintenance and vigor. In the southeastern U.S., rainfall is usually adequate so that only fertilizer may be actually needed to maintain this valuable forage resource. Pasture size in humid areas is usually very small compared to the multi-section, semi-arid rangelands, and biomass produced in the humid areas needs to be consumed rather than accumulated. Thus, the regimented cattle rotation schedules have not, to date, been a viable, economic alternative to those continuously grazed warm-season perennial grass pastures in which some variable stocking rate method has been utilized.

Forage-animal management systems for warm-season and cool-season forages vary from the very simple to the most complicated, but all systems attempt to optimize animal performance by the economic utilization of soil and plant resources. Seasonal and total forage dry matter production and nutritive value should be matched with livestock requirements. The most efficient means of matching warm-season perennial forage with livestock is by the use of a variable stocking rate. Variable stocking rates may be achieved by altering the number of animals per land area, altering the size of the land area to the number of animals, harvesting excess forage as hay, and/or by mowing excess forage within a pasture. The intensive use of warm-season perennial grasses may involve only a single pasture, but the economic, intensive utilization of these forages at the commercial operation level often involves several pastures. The pastures are not necessarily intended for rotational purposes, but rather for flexibility of matching animal demand with forage supply.

ANIMAL PRODUCTION

Animals have certain nutritive requirements based on class, age, and expected performance (gain, milk, etc.). In general, the younger the animal or the greater the expected performance level, the greater is the requirement for the forage to be of high quality. The seasonal quality traits of bermudagrass and bahiagrass are predictable from the standpoint that they decline with season to a minimum quality status in mid-summer, and then increase in quality with the advance of fall climatic conditions. Thus, a double peak in quality of forage exists with the spring peak usually being greater in protein and digestibility than the fall quality peak. However, the quality status and trends of warm-season perennial grasses are usually never identical from year to year in that the nutritive value, especially protein content, is greatly influenced by time and rate of nitrogen fertilizer as well as frequency, distribution, and total rainfall received during the growing season.

Warm-season perennial grasses usually have high carrying capacity potentials and relatively low quality when being compared to other classes of forages. Thus, one of the most cost-effective methods of obtaining acceptable animal gains, and hence of marketing these types of forages through grazing, is by paying close attention to the animals being selected for the grazing operation. Factors to consider in matching stocker cattle to warm-season perennial grass pastures are age, body condition, breed, weight, and the potential for continuous ownership through the feedlot.

Stocking Rate

Animals need adequate forage available so as not to restrict *ad libitum* intake. And, this level of forage available may vary from a moderate to very light stocking rate. As a general rule, as stocking rate decreases and forage becomes more abundant for grazing, individual animal gain increases. This assumes, however, that protein and energy content of the forage selected are not deficient in supplying and meeting the animal requirements for gain. The average daily gain (ADG) will continue to increase until a "ceiling" is reached beyond which no additional reductions in grazing pressure will provide extra animal gains.

Table 1 presents data from several trials (1, 2, 5, 7, 8, 9, 14) in which optimum gain per animal or per acre were obtained using either Coastal bermudagrass or Stargrass. All but one of the grazing trials used a variable stocking rate by either adjusting number of animals or by mechanically shredding the forage in the pastures. The earlier study by Burns et al. (2) compared method of stocking, and concluded that the two systems did not differ greatly in evaluating the productivity of Coastal bermudagrass if the average stocking rates were the same. The continuous, variably stocked pastures of Coastal bermudagrass revealed a range in ADG of .55 lbs/day under severely restricted available forage to 1.84 lbs/day when forage available did not limit *ad libitum* intake. Gains per acre ranged from approximately 400 lbs to more than 1100 lbs/ac. Average stocking rates for the summer grazing period ranged from 2.1 to 11.7 calves per acre. From these trials, it is clear that in the south-eastern U.S., Coastal bermudagrass is capable of carrying about five 500-lb calves per acre on intensively managed pastures. With 5 calves per acre gaining 1.25 lbs/day during a 150-day grazing period (May-Sept), the projected gain per acre exceeds 900 lbs.

The Stargrass data reported in Table 1 were collected under a rotationally grazed, variable stocking rate scheme (1). At optimum stocking rates (3 to 4 hd/ac), ADG was nearly 1 lb with gains per acre ranging from 530 to 580 lbs. Although the Stargrass and Coastal bermudagrass data were not presented for comparison purposes, the lower ADG from Stargrasses may be due to differences in forage quality and/or method of grazing. Guerrero et al. (6) used Conrad's (3) bermudagrass data in Table 1 to mathematically describe the relationship of animal performance to available forage and digestibility. He classified the bermudagrasses as low, medium, or high quality based on IVDMD of <53%, 53 to 60%, and >60%, respectively. It was concluded that the amount of forage dry matter required to maximize gain was 2 to 4.5 times greater than the amount of forage required for maintenance. And, further, that in order to maximize performance, animals must select individual plant parts which represent quality above that of the total forage available for consumption.

Grazing Systems

Discussions concerned with pasture management for optimum utilization of forage and maximum performance of livestock almost always terminate with arguments on the subject of rotational *vs* continuous grazing. In the mid-1950's, Riewe et al. (10) grazed Dallisgrass with two stocking rates under a continuous grazing regimen, and with one stocking rate in a 3-pasture rotation in which cattle were moved on 14-day intervals with excess forage being harvested as hay. Results of the 3-year trial showed that this specific rotational grazing-hay harvesting scheme was not satisfactory. And, further, that hay harvested from the rotationally grazed area did not provide sufficient dry matter to compensate for the decrease in gains per animal and per acre as compared to the other two continuously grazed pastures. A final conclusion was that a system of rapid rotation such as daily strip grazing may be necessary to increase gain per acre; however, this approach may be profitable only for pastures which are capable of producing an adequate quantity of highly nutritious forage.

Conrad (3, 4) compared Coastal and Callie bermudagrass at four stocking rates under both a continuously and a rotationally grazed (7 days graze-21 days rest) scheme during a 3-year study. Set stocking rates of 2.73, 3.23, 3.85, and 4.92 500-lb steers/ac were used in both systems. Steer ADG for the respective stocking rates was not statistically different for both grazing systems and was .99, .91, .65, and .59 lbs/day for continuous and .85, .81, .70, and .37 lbs/day for rotational. In addition, forage quality as measured by percentage protein and IVDMD was greater in the rotationally grazed paddocks as compared to the continuously grazed paddocks. However, it was concluded that the quantity and quality advantages of the rotationally grazed paddocks on day 1 of the cycle did not compensate for the lack of available forage on day 7. Hence, in this particular rotational scheme, the "effective stocking rate" during any 7-day period was actually four times greater than the companion stocking rate under continuous grazing. An additional conclusion in view of ADG was that this particular 7 day graze-21 day rest rotation scheme had no biological nor economic advantage over a continuously grazed scheme.

Compared to stocker cattle grazing studies, relatively few cow-calf grazing trials have been conducted in which effect of level of forage available on animal performance has been evaluated using warm-season perennial grasses. The influence of restricted forage is more drastic on performance of the cow as compared to the calf (11, 12). Further, at the same level of available forage, restricted forage affects ADG of weaned calves more than that of suckling calves (13). Milk provides a "buffer mechanism" for the suckling calf which allows for acceptable gains usually at the expense of cow performance under high stocking rate conditions (11, 12, 13).

SUMMARY

If one pauses to think about the objectives of the system and the climatic conditions on the production of forage dry matter and quality, then it becomes readily apparent that systems which have only a single pasture have severe restrictions on the flexibility of operation and are liable for the risks and uncertainties of the weather conditions. The most effective and efficient means of matching forage quantity and quality with animal utilization may be accomplished by having a variable stocking rate. This method may involve rotational grazing or continuous grazing, but it does require multiple pastures on the farm or ranch. In many areas of the southeastern U.S. which receive good summer rainfall, the efficient use of bermudagrass and bahiagrass via grazing animals becomes difficult and, at times, nearly impossible. Thus, the use of methods of forage removal via hay, silage, etc. allows for optimum utilization during peak growing conditions. In these situations, cattle may be confined to smaller and smaller areas during peak forage growth rates and larger and larger areas during slow forage growth rate (drought). It is not necessary to rotationally graze in this situation. But, if a rotational grazing system is desired, then the animals should be rotated for a purpose and not merely for the sake of adopting a "system". Animals and pastures which are to be rotationally grazed should be complementary to each other. This would imply that movement between pastures occurs "as warranted" and not on a "calendar" or "clock" basis. It is also a good management practice to place two or more classes of cattle (separate groups) into a rotation scheme. In this situation, the young cattle or those with the greatest nutritive requirements would be given first access to the pasture area. After sufficient time for selective grazing (1 day to several days), then the "first grazers" are moved to a new pasture and a second set of grazers fill that pasture recently vacated by the young cattle (first grazers) (15). This "first-last grazer" concept allows for a more forced consumption of low quality, previously refused forage.

Regardless of the general or specific pasture management practices employed, the manager must make daily or regular decisions concerning matching the forage produced with the animal requirements. These daily observations, knowledge of climatic conditions, biological requirements of soil, plants, and animals, and skill in purchasing and marketing cattle will provide the expertise necessary to effectively market forages through grazing systems.

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TABLE 1. Performance per animal and per acre from *Cynodon* species

	Trial Length	Method Grazing	Method Stocking	Sex	Initial wt	Stocking rate	Gain Daily	Gain Per ac
	(days)	C or R[1]	F or V[2]		(lbs)	(hd/ac)	(lbs)	(lbs)
Coastal bermudagrass								
Burns (2) - NC	112	C	V	F	589	6.96	0.59	460
Burns (2) - NC	112	C	F	F	589	4.53	0.77	391
Oliver (8) - LA	140	C	V	M	490	2.58	1.84	637
Oliver (8) - LA	142	C	V	M	465	3.33	1.70	789
Greene (5) - LA	151	C	V	M	488	4.38	1.47	988
Morrison (7) - MS	130	C	V	M	569	5.78	1.07	804
Conrad (3) - TX	158	C	V	M	482	2.10	1.39	461
Conrad (3) - TX	158	C	V	M	482	3.16	1.34	669
Conrad (3) - TX	158	C	V	M	482	3.89	1.03	633
Conrad (3) - TX	158	C	V	M	482	4.90	0.66	511
Rouquette (13) - TX	130	C	V	M	607	4.50	1.51	883
Rouquette (13) - TX	130	C	V	M	607	5.94	1.46	1127
Rouquette (13) - TX	130	C	V	M	607	7.57	0.87	856
Rouquette (13) - TX	130	C	V	M	607	11.73	0.55	839
Stargrass								
Adjei (1) - FL	168	R	V	F	528	3.04	1.04	531
Adjei (1) - FL	168	R	V	F	528	4.02	0.86	581
Adjei (1) - FL	168	R	V	F	528	5.75	0.46	444
Pitman (9) - FL	229	R	V	M	508	1.98	1.09	494

[1]Continuous or Rotational
[2]Fixed or Variable