Grazing in the BLACK

Management-intensive grazing focuses on the economic and environmental sustainability of beef production systems.

by ***Corinne Blender***

For many cattlemen, keeping the cows on the range for another year or retaining ownership with stocker cattle through the summer comes down to one determinant: Does it add up?

To get to the answer, producers need to apply a little grazier's arithmetic.

Before a producer can justify adding more animals to the herd, or even maintaining numbers, he or she needs to calculate the land's carrying capacity (see Fig. 1).

Carrying capacity is defined as "the stocking rate that provides a target level of performance while maintaining the integrity of the resource base," says Jim Gerrish, research assistant professor at the University of Missouri (MU) Forage Systems Research Center (FSRC) at Linneus, Mo. Calculating a carrying capacity is "only a ballpark estimate, not your farm plan," he adds. The farm plan involves careful evaluation of many aspects.

Fig. 1: Carrying capacity =

$$\frac{\text{forage production x seasonal utilization rate}}{\text{daily intake x length of grazing season}}$$

Fig. 2: Stock density =

$$\frac{\text{forage availability x grazing period utilization rate}}{\text{daily intake x length of grazing period}}$$

Stock density (see Fig. 2) is "the number of animals or animal liveweight assigned to a specific pasture area for a specific time period."

These two formulas can help producers start evaluating their land resources and serve as a first step toward developing a management-intensive grazing (MiG) system focused on profit and health of the forage base. And while the stock density "is the most powerful tool in the grazier's toolbox," Gerrish says, there is more to be learned to fully understand a grazing scheme.

Let's go to school

The FSRC was started in 1965 on land that was later donated by the Cornett family for the express purpose of grassland research. Today, the center has produced one of the world's leading pasture research teams that, Gerrish says, focuses on "plant-animal-soil relationships. The center is geared to a low-cost, forage-based production system."

With the input from MU researchers and Extension specialists representing plant, soil and animal sciences; ag economics; and entomology, the center's main research goal, Gerrish says, is the "economic and environmental sustainability of beef production systems."

Since its inception, the center has developed one of the most widely adaptable grazing systems in the world — the MiG system. This system was developed through "years of observation and re-evaluating what we are doing," Gerrish says.

"MiG is a flexible approach to rotational grazing management whereby animal nutrient demand through the grazing season is balanced with forage supply, and available forage is allocated based on animal requirements," he says. "Cows 'intensively graze' by nature; only *you* can 'intensively manage.' "

This flexible approach has allowed the MiG system to be used in every state across the nation. The demand to learn more about managing grassland to keep beef producers "in the black" and to maintain a healthy environment is part of the reason why Gerrish works with many specialists to conduct grazing schools that offer hands-on experience in the operation of an MiG system.

Gerrish will point out that rotational grazing practices have existed since biblical times. He says the Romans used them extensively. While there are many types of rotational grazing systems, most will fall into one of two categories — calendar-based or flexible rotation. "Calendar-based rotations are rigid and follow fixed numbers of days," he adds. "Flexible rotations are flexible in both grazing periods and rest periods."

Gerrish believes that nothing in nature works with the calendar, and to manage grazing by set-day intervals will probably not meet ranch goals to reduce production costs, to maintain resources and to extend the grazing season. Flexibility is the key to making the system work.

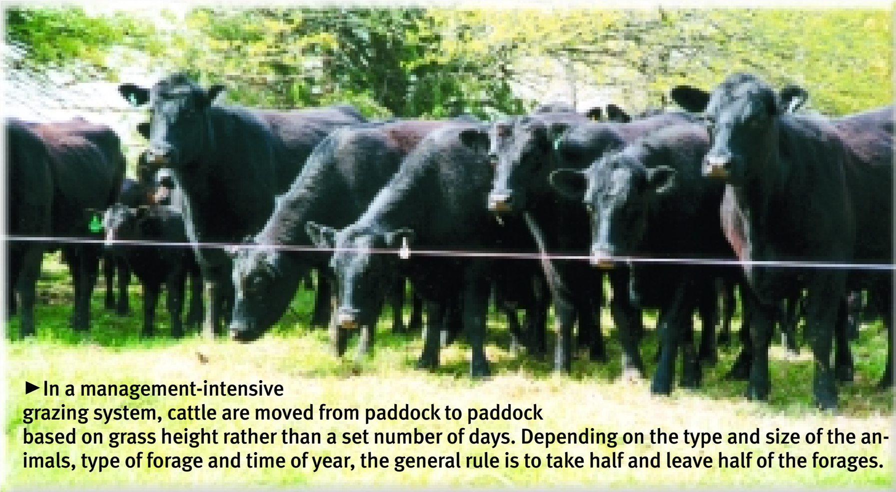
To begin developing an effective MiG system, Gerrish says, producers need to have a "willingness to change and to try something different. Understanding how the components fit together is critical for their success. Rather than managing individual components, MiG requires managing the whole system."

The whole system includes setting goals for the ranch and making certain decisions — whether for a choice of lifestyle, for financial reasons, resource conditions or any other reason. "You will always get what you manage for," Gerrish says.

Monitor grass height

Grass is one of the most important indicators in an MiG system. It tells a producer many things about the acreage's ability to put gain on livestock.

"The two main things to know are what height of grass is needed to maintain the target intake level and what is the minimum height that a particular plant species can be grazed to without damaging the stand," Gerrish says. "This varies somewhat from species to species, but a general rule for cool-season grasses is to maintain the pasture



►In a management-intensive grazing system, cattle are moved from paddock to paddock based on grass height rather than a set number of days. Depending on the type and size of the animals, type of forage and time of year, the general rule is to take half and leave half of the forages.

PHOTOS BY SHAUNA ROSE HERMEL, SOME COURTESY OF *BEEF* MAGAZINE

►Grass is one of the most important indicators in an MiG system. It tells a producer many things about the acreage's ability to put gain on livestock. Measuring grass height will allow producers to calculate how many acres to allow for a day of grazing and when the cattle need to be moved to a new paddock.

The MiG system's key point of economic impact is increased gains per acre expressed through increased forage utilization, increased stocking rates, potentially greater average daily gains (ADGs) and an extended grazing season, says Kevin Moore, University of Missouri ag economist.

height between a high of 8 to 10 inches and a low of 3 to 4 inches."

KC Olson, commercial agriculture beef specialist at MU, says that it is important to know the type of forages in the pasture mix as well.

"Grazing animals have the ability to select a diet of higher nutritional quality than the average nutritional quality of the pasture forage," Olson says. He adds that it is the result of the animal's selecting specific species and plant parts according to palatability, access, habit and experience. It also means forage calculations are just an estimate — a base for planning.

"Grasses vary in when they grow and need to be grazed accordingly," Gerrish says. "They also vary in density, so some species can be grazed at shorter heights while others are less dense and need to be left with greater height."

Olson says, "Managing season of use involves manipulating the production cycle to synchronize periods of peak nutrient demand by livestock with peak forage quality." He adds that by doing this a producer can maximize the length of time that the pasture can meet animal requirements, which can minimize the use of expensive feed supplements. He also points out that animal nutritional requirements fluctuate with body size and physiological state.

While graziers can manipulate the grazing season to some extent, Gerrish says that it will depend on the area of the country in which the MiG system is in use as to what height and how much of the forage can be utilized at any one time. The MiG system should be adapted to each environment.

"The greatest variances are in length of rest period and grazing period and appropriate residual heights," he says. "For example, while 20- to 40-day rest periods work well in Missouri, the Nebraska Sandhills require 30 to 90 days rest, and in the high-desert range in the Intermountain West it may be 14 months, plus or minus."

Water supply drives paddock development

Producers who are considering moving to an MiG system generally have a concern for water and how the supply will be given to the cattle grazing the paddocks. In fact, Gerrish says the biggest start-up cost could very well be water development.

A grazing system design begins with mapping out ponds, streams and other sources of water that will supply the paddocks. Once the water sources are identified, it is important to know the landscape, as it contributes to the ability of water to flow to paddocks farthest from the source.

Gerrish says a rule of thumb is to keep livestock within 800 feet (ft.) of water. He

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►Producers who are considering moving to an MiG system generally have a concern for water and how the supply will be given to the cattle grazing the paddocks. Water development is one of the biggest start-up costs, especially if ponds aren't already in existence.

PHOTO BY CORINNE BLENDER

►**Left:** Producers may have to develop ponds to retain water for piping to tanks away from the surface water. There are many options, like using a traditional watering tank such as this or making tanks from heavy equipment tires with concrete plugs.

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says the operation will benefit from improved grazing distribution, more uniform manure distribution and increased water consumption.

Even though paddocks do not have to be exactly square, focusing on that general shape will keep livestock closer to water and require fewer feet of fencing. Many times it is best to make the primary subdivisions by following the landscape lines, such as dividing along bottomland or at slope lines, Gerrish says.

It is also important to make paddocks of similar grazing capacity to keep the diet more consistent and rotation management easier. Gerrish says, however, the first step is "setting specific objectives for the operation and deciding how you are going to accomplish them. There is no need to build fence and develop a water system if you don't know what you want to do with them."

In the black

Once a better understanding of the whole system is achieved, there is still the profit question. How could an MiG system affect an enterprise's profits and/or productivity?

Kevin Moore, an MU ag economist, says profit must first be defined. Typically, he says, it is defined as the return on unpaid labor, management and equity capital, but it can mean other things, such as return on assets (ROA) or return on labor and management.

Animal scientists and economists alike will tell you that the most expensive input into a cattle operation, after purchasing the animals, is feed cost. The MiG system allows producers to better manage that input, as well as to help control reproductive efficiency, weaning weights, sale prices, and other variable and fixed costs, all of which, Moore points out, are costs that determine whether the bottom line sits somewhere in the black.

When Moore boils down the profit equation for a growing enterprise such as backgrounding steers it reads:

(value of gain – cost of gain) × weight gain = profits

The MiG system's key point of economic impact is increased gains per acre expressed through increased forage utilization, increased stocking rates, potentially greater average daily gains (ADGs) and an extended grazing season, Moore says.

Utilizing an MiG system could also decrease inputs such as fertilizer and weed control costs. The cattle more evenly and more uniformly graze the pasture, providing more even distribution of manure for fertilization. The practice of resting grazing land also allows desirable plants to thrive and compete with invasive weeds that try to enter the grass system.

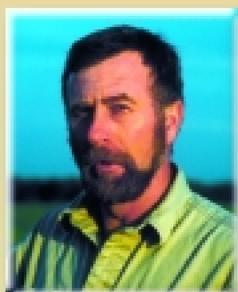
Many factors contribute to the profitability of using an MiG system. Scale economies, enterprise, pasture productivity, length of grazing season, forage species and feed budgeting, Moore says, can all determine profits to be made.

He points out that it would be cheaper on a per acre basis to fence ten 25-acre paddocks than it would be to develop ten 5-acre paddocks. This is true based on the expense of fence corners and gates, which are more expensive, while line is cheap, comparatively. Moore says that costs per acre for fencing materials escalate rapidly as the amount of land in the system falls below 80 acres.

He also says the enterprise, or what class of grazing livestock, is used will also determine whether an MiG system will add to the profit side of the equation. He says it is the ability of the animals to respond to improved grazing and/or forage management that is important. Will cow-calf sales (calf gains) be buffered by the cows' performance? Stockers provide a more direct relationship between grazing and gains, but

Winter Advantage

In all of the data that has been gathered on the advantages of implementing a management-intensive grazing (MiG) system, Jim Gerrish, research assistant professor at University of Missouri (MU) Forage Systems Research Center (FSRC), Linneus, Mo., says that the proof is in winter grazing. "Winter feeding is the most expensive part of being in the cattle business," he adds. "More money can be made with MiG in the winter than in the summer."



Jim Gerrish

Gerrish offers a comparison of feed costs for feeding fall-calving cows through a winter feeding period from Dec. 1 to April 10.

	Forage source			
	Hay	Cornstalks	Stockpiled tall fescue	Ryegrass + Cereal rye
$ per cow per day	$1.32	$0.05	$0.31	$0.61
Days of use	130 hay	60 stalks, 70 hay	90 graze, 40 hay	90 graze, 40 hay
Wintering cost	$172	$122	$70	$108

Gerrish says that the utilization rate will have an effect on a daily forage cost for stockpiled pasture, winter annual forage and hay feeding.

Utilization rate	Stockpiled pasture	Winter annual	Hay feeding
80%	$0.27	$0.54	$1.32
70%	$0.31	$0.62	$1.51
60%	$0.36	$0.72	$1.76
50%	$0.43	$0.87	$2.12
40%	$0.54	$1.08	$2.65

PHOTO BY CORINNE BLENDER

Stockpiled pasture is the least expensive winter feed. Gerrish says that if it is properly managed, this feed source can be adequate for lactating cows throughout winter.

"By being in better control of pastures during the growing season it is much easier to accommodate stockpiling," Gerrish says. "By controlling grazing during the winter period, forage can be rationed out on an as-needed basis, and the grazing season is greatly extended."

►**Left:** Jim Gerrish, research assistant professor at University of Missouri Forage Systems Research Center, says, "Winter feeding is the most expensive part of being in the cattle business. More money can be made with MiG in the winter than in the summer."

stocker operations aren't for everyone.

It's also true that a producer can spend more per acre in developing costs if the forage value of that acre is more. Higher yielding pastures can justify higher costs because it costs the same to develop the same amount of acres. If you can yield 4,000 pounds (lb.) from one acre of one pasture vs. 7,000 lb. from another acre, it's clear which track would be a more profitable investment. "The level of 'intensification' will be related to the level of productivity," Moore adds.

"As with productivity," Moore continues, "a longer grazing season provides more days to recover development costs." He says producers should look at extending the grazing season. "Replacing a day on stored feeds with a day on grazing is very cost-effective," he adds.

Controlling forage species through the ability to establish and maintain improved forages due to improved grazing management will also affect profits. Producers have options when they consider native range vs. introduced tame-grass pastures, but the environment may limit cattlemen's abilities to use improved forage species.

And when grazing those forages, the feed budget can be affected by how much forage is left after grazing and at what time of year it is left, Moore says. Additional forage in the spring may mean less profit because the grass is not utilized when it is at its highest nutrition, but extra forage in the late summer can be very valuable for fall and winter grazing.

Above all, Moore says, management is the single most important factor that ultimately affects MiG profitability. He points out, "How you manage your grazing system under changing environmental and economic conditions ultimately determines the level of net profit."

AJ

Editor's Note: *The University of Missouri (MU) Forage Systems Research Center (FSRC) offers beginning and advanced grazing schools throughout the year. Techniques and advantages of the management-intensive grazing (MiG) system are discussed. Information can be obtained by e-mailing mfgc@mchsi.com or by calling (573) 499-0886.*

GRAZING Systems vs. ROW-CROP Enterprises

by ***Kevin Moore*** *and* ***Jim Gerrish***

Editor's Note: *Kevin Moore, ag economist at the University of Missouri (MU), and Jim Gerrish, research assistant professor at the MU Forage Systems Research Center (FSRC), say if landowners are looking for alternatives to cropping marginal agricultural land, it would pay to develop a management-intensive grazing (MiG) system.*

In their report, "Economics of Grazing Systems Versus Row-Crop Enterprises," Gerrish and Moore examine the costs and potential returns of intensive/rotational grazing systems and compare them to the profits from row cropping similar land. A condensed version of the abstract edited for Angus Journal *style follows.*

Introduction:

Research in Missouri and Iowa has shown that livestock gains can be substantially improved under rotational grazing, and income will more than cover the costs of developing the necessary infrastructure. Net returns from these systems have also been shown to be greater than returns from cropping, especially erosive land with relatively poor crop yields.

Traditional continuous grazing systems are viewed as low-input, low-return extensive enterprises best adapted to rough land not suited to crop production. Management-intensive grazing offers the potential for better utilization of grazed forage crops via rotational grazing of livestock through a series of pasture subdivisions. While the costs of fencing and watering systems can be substantial, they open up the potential for much greater returns to grazing enterprises. This paper examines the costs and potential returns of intensive/rotational grazing systems and compares them to the profits from row cropping similar land.

Materials and methods:

Enterprise budgets are used to compare the costs and returns from various

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►The MiG system can be used for any type of livestock grazing management. A group of 300 stocker calves can be easily moved from one paddock to another by just one individual. Stocker cattle are generally moved to fresh paddocks before cows are moved because the fresh grass keeps the calves eating, thus gaining.

PHOTO BY CORINNE BLENDER

Grazing Systems vs. Row Crop Enterprises CONTINUED FROM PAGE 93

production activities. Enterprise budgets are tools often used in farm management and farm planning. They represent the income and expenses of a farm, allocated to the various production activities. Both variable costs and fixed costs are included. Variable costs are expenses that vary with the level of production, i.e., seed, fertilizer, feed, veterinary expenses, etc. Fixed costs are incurred regardless of the amount of output, i.e., ownership costs for machinery, land, improvements, etc. Enterprise budgets show the contribution to profits of each production activity. They allow us to compare the profitability of various ag enterprises. We will construct budgets representing intensively grazed cattle and compare them to crop costs and returns.

Results and discussion:

To compare the economics of grazing vs. cropping, we must first look at the costs to develop a grazing system. Pasture establishment is the first cost that comes to mind. This expense can vary widely, depending on the species being seeded and the method of establishment. For example, alfalfa-orchard grass drilled into a prepared seedbed may cost as much as $150 per acre to establish, whereas switchgrass no-tilled into last year's cornstalks may cost as little as $50 per acre.

Water and fencing costs are the two expenses that many producers see as the biggest hurdles. Water costs will vary tremendously with each application. If no ponds or wells are available, and if a water district is not accessible, costs can be quite high. But if possible, providing water to every paddock is ideal. Fencing costs will also vary depending on the existence and/or condition of existing fence, topography and acreage to be fenced. Fencing costs per acre can be very high if fewer than 40 acres are enclosed, but fall rapidly as the area increases (see Gerrish, et. al., 1992).

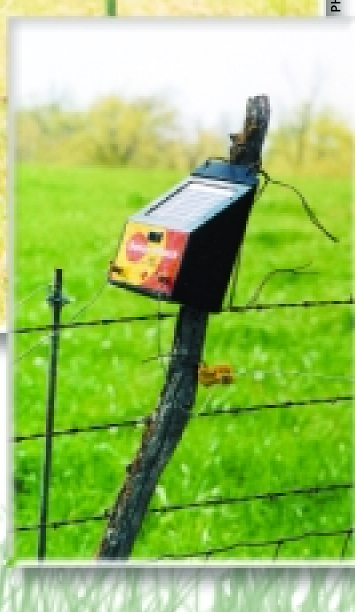
Take an 80-acre pasture divided into 24 paddocks as an example. If 1-inch (in.) high-density polyethylene (HDPE) pipe is buried and a tank is placed in every cell, water system costs are $42.95 per acre. If over-the-surface 1-in. HDPE pipe with quick couplers is used along with one portable 100-gallon (gal.) tank, water system costs are only $8.42 per acre. Using 12.5-gauge high-tensile electric wire can keep perimeter costs down. To enclose our 80-acre pasture, costs for materials and labor are $38.00 per acre. If we use permanent, single-strand, high-tensile wire for subdivision fence, with a lane in the middle to provide access to any paddock, subdivision fencing costs $38.47 per acre. We can cut these costs substantially by using three sets of portable fence, polytape on reels and step-in posts. This system will take more labor, but costs only $7.00 an acre. Annual maintenance for this system — for things like fertilizer and fence and water system repair — are estimated at $18.32 per acre for the permanent fence system, and $14.32 for the portable fencing system.

At first glance these costs may seem high. But if we compare them to the annual costs of putting in a corn crop they don't look so bad. Putting establishment costs aside for the moment, the $119.42-per-acre costs for permanent fence and water system development on 80 acres is less than the annual variable costs for a corn crop. Missouri Management Information Records for 1993 (see Moore, 1994) show that average variable costs (seed, fertilizer, operating interest, fuel, etc.) for corn were $150.11 per acre. Add to this a charge for machinery depreciation and an 8% return on investment ($27.63 per acre), real estate taxes and depreciation ($6.73 per acre), and a labor charge of $22.67 per acre, total costs for corn per acre were $207.14. For soybeans and wheat the figures for 1993 were $90.59 and $76.84 for variable costs, $19.25 and $17.65 for machinery ownership costs, $5.17 and $4.17 for real estate fixed costs (not including an opportunity cost for land), and labor charges of $18.67 and $13.42, respectively. Putting these figures next to grazing system development costs makes the investment in fence and water seem more reasonable, especially when you consider that the assets will likely be there for 20 years or more, while the costs for cropping occur every year.

Cropping is very expensive and requires substantial investments in machinery and equipment. For marginal

►While graziers can manipulate the grazing season to some extent, Gerrish says that it will depend on the area of the country in which the MiG system is in use as to what height and how much of the forage can be utilized at any one time. The MiG system should be adapted to each environment.

PHOTOS BY SHAUNA ROSE HERMEL



►**Right:** Producers who want to switch to an MiG system can retain their permanent, exterior fences and use electrical fencing to fence off paddocks. When developing paddocks it is important to consider the lay of the land and how water will be made available in each paddock. Cattle will graze more evenly if kept within 800 feet of water.

land, costs for meeting conservation compliance may push these figures even higher. Just to cover the costs outlined above, breakeven yields for corn are 92 bushels (bu.) per acre at $2.25 per bu., 23.35-bu. soybeans at $5.75 per bu., and 38-bu. wheat at $2.95 per bu. At this level of return, only the costs above are covered, leaving no return to land. Much of the Midwest's marginal ag land does not average these yields.

If we put this land into a grazing system, what kind of returns might we expect? An enterprise budget for a steer backgrounding operation can give us one idea. Assume we purchase a 500-pound (lb.) steer in the spring for $425 ($0.85 per lb.). Variable costs, including 8% operating interest and interest on our purchase cost, are estimated at $55. Add $6.73 for real estate taxes and depreciation (before system development costs), $5 for machinery ownership costs, and a $10 charge for operator labor. Total costs so far are $501.73.

System development costs will be depreciated over 10 years on a straight-line basis, and an 8% return on investment will be added to this. These costs, plus annual maintenance, total $39.82 for the permanent fence system and $23.93 using the portable fence and watering system. Add $18 per acre for establishing a forage base ($100 total cost over a 10-year life plus an 8% opportunity cost) and total costs for the permanent system run $559.55 per acre and $543.66 per acre for the portable system. Assuming a stocking rate of just one steer per acre, which would not be very intensive, at $0.72 per pound selling price, breakeven average daily gains for the steer are 1.32 lb. per day for the permanent system and 1.21 lb. per day for the portable system. At this level of gain, no return to land is generated (as in the breakeven yields for the crops), but development costs are recovered in a 10-year period and an 8% return on investment is also generated. These gains require only 277 lb. of gain at $0.485 value per lb. of gain in the permanent system, and 255 lb. of gain at $0.465 value per lb. of gain in the portable system. This kind of performance is certainly reachable in most instances.

Table 1 presents animal performance and economic return data for a 3-year average from intensive grazing research at the MU FSRC. Several items are important from this data. First, while the steers only grazed 88 days, gains during that time were in excess of 2 lb. per day. The steers forward grazed ahead of the cow-calf pairs as an alternative to cutting hay for forage management. With nearly one-half a cow-calf pair per acre plus more than one-half a steer for 88 days, total beef production per acre was greatest for the most intensively managed rotation.

Table 1: Performance levels, costs and returns for alternative grazing systems at the MU Forage Systems Research Center, 1992-94

	3-Paddock	12-Paddock	24-Paddock
Cow-calf pairs per acre	0.31	0.38	0.48
Grazing days, cows	225	212	215
Grazing days, calf	181	181	181
ADG, calf	2.27	2.30	2.03
Gain per acre, calf	126	156	176
Conception rate	95.0%	97.2%	90.0%
Steers per acre	0.35	0.44	0.54
Grazing days, steers	88	88	88
ADG, steers	2.01	2.16	2.17
Gain per acre, steers	62	83	102
Returns per acre			
Calf gain @ $0.85	$101.75	$128.89	$134.64
Steer gain @ $0.50	31.00	41.50	51.00
Total returns	$132.75	$170.39	$185.64
Pasture costs per acre			
Fence (10 yr. @ 8.5%)	$0.84	$2.91	$5.49
Water (10 yr. @ 8.5%)	2.44	3.87	5.22
Established (10 yr. @ 8.5%)	14.52	19.23	19.23
Fertilizer (estimate)	10.44	10.44	10.44
Clipping	4.44	1.59	0.27
Pasture costs	$32.69	$38.04	$40.65
Animal costs per acre			
Salt, minerals for cows	$3.39	$4.16	$5.26
Salt, minerals for steers	2.37	2.91	3.68
Veterinary, cow-calf	3.26	4.00	5.05
Veterinary, steers	2.28	2.80	3.54
Animal costs	$11.30	$13.87	$17.53
Interest costs			
$600 cow @ 8%	$9.17	$10.59	$13.57
$425 steer @ 8%	2.87	3.61	4.43
Total pasture, animal & interest costs	$56.03	$66.11	$76.18
Income above pasture, animal & interest costs	$76.72	$104.28	$109.46

Pasture costs represent total development costs spread over 10 years, plus annual fertilizer costs. Animal costs are presented on a per acre basis, as are interest costs since they are adjusted to reflect stocking rates and days grazing the system. The bottom line income over costs favors the more intensive systems. The income remaining is what is left to cover overwintering and breeding costs, plus return to land. Remember, only calf gain is measured in the table, so that calf value prior to going to grass is additional revenue available to cover costs not shown in the table.

Research published by Riley, et al., from data gathered in Iowa also shows that intensively grazed cattle can compete with cropping returns. They examined the net income per acre generated by eight different cropping alternatives and three different grazing systems on highly erodible land in southwestern Iowa. The three grazing systems were an 18-paddock and a 13-paddock intensive system and a less intensive four-paddock system. The cropping options were designed so that conservation compliance would be met. These alternatives were compared to the net return to land under the CRP (conservation reserve program) with payments of $70 per acre.

Riley, et al., collected data on the four- and 13-paddock grazing systems for the years 1991 through 1993, and on the 18-paddock system for 1992 through 1993. Net income from the grazing systems was calculated as the value of the weight gain of the calves, with a small addition or subtraction for net hay production. The 13-paddock system gave the highest return to land, followed by the four-paddock system and then the CRP option. The 18-paddock rotation was not stocked heavily enough to be competitive with the other two grazing systems. Only one cropping option generated positive returns to land, but well below that of the grazing options. AJ

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