Achieving Maxi-Calf: *some suggestions*

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Most of the research in this paper resulted form the Haller Beef/ Forage Farm, Penn State University; Peter J. Levan, research assistant, Richard F. Todd, research aide, and Crystal Egan, student assistant, should receive much of the credit for the Penn State research cited and discussed. Keith Bryan was instrumental in conduct of the data analysis. Also of assistance in preparing this paper was the "Forage-Animal Management Systems" report by Dr. Roy E. Blaser and Colleagues, Virginia Agriculture Experiment Station, Blacksburg, Virginia.

The profit potential for the beef cow/calf operation is much better than in most recent times. Although there are beginning signs of a rebuilding of the nation's beef herd, the consensus of most outlook experts is that good times will persists. There are other positive factors, including the rebuilding of the desirable image of beef as a consumer food-one that is lean, healthful and which can be used in new or improved ways by the consumer.

With increased potential for profit, this seems to be the time to improve all aspects of managing the beef cattle enterprise. There are many components of management, but one of the most important is increasing the efficiency of utilizing land that is under cattle. Land cost is the major capital and production cost, but also the source of the highest single input of maintaining a cow herd or a stocker/feeder operation-feed costs. This is particularly true in the northeast where land costs are increasing, but where we have a real forage potential.

This report specifically discusses the cow-calf unit, and the source of over 90 percent of the feed for the enterprise–forages. Not all aspects of forage production and utilization can be discussed in this report-and there are many grazing management systems that cannot be included. Primary emphasis will be on maximizing efficiency of using forages of different qualities by different types of cattle in a herd.

SOME PERCEPTIONS (AND MISCONCEPTIONS) ABOUT THE COW-CALF HERD

1. **Beef cows don't need high-quality pasture or hay.** It is true that "dry" or non-lactating cows can survive on fairly low-quality hay. But that is not the case for rather high-producing cows nursing calves. The percent total protein and percent total digestible nutrients (TDN; a rough estimate of energy content of feeds) for sucking steer calves, yearling steers, dry cows and cows nursing calves are given in Table 1. The dry cow needs hay, pasture or silage containing only 7 percent protein and 43.8 percent TDN. So we are right in assuming that forages of such poor quality that they cannot be used for any other purpose can be used to maintain dry cows.

But a high-producing cow nursing a calf needs a diet containing 11.9 percent total protein and 65.2 percent TDN. Notice that the percent protein in this diet for the "wet" cows is higher than the 10.5 percent required by the 700-lb. yearling steers gaining 2.5 lbs./head/day. The energy requirement is only slightly higher for yearling steers than for "wet" cows.

Table 1. Protein and Energy(TDN) Requirements

Item	D.M. (lbs.) per day	%Protein a	%TDN a
Steer Calves (300-lb., 3.0 lb. gain)	9.6	18.0	72.0
Yearling Steers 700-lb., 2.5 lb. gain)	18.0	10.5	67.5
Dry Pregnant Cows, Middle 3rd Lactation (1,100 lbs.)	19.5	7.0	48.8
Cows Nursing Calves (1,100 lbs.)	22.3	11.9	65.2

a Percent of Dry Matter.

center in the United States which has helped thousands of farmers and ranchers struggling with land problems in the American West and throughout the world.

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Bush confirms grazing fees

After several months of review, the Bush administration recently reaffirmed its support for the current grazing fee formula used to calculate fees for livestock grazing on public lands, according to Public Lands Council President Bud Eppers of Roswell, N.M.

Eppers, also chairman of the National Cattlemen's Assn. Public Lands Committee, said that Secretary of the Interior Lujan, Agriculture Secretary Yeutter,and Office of Management and Budget Director Bob Grady recently sent letters to key members of Congress clarifying the administration's position after recent confusion over where the Bush administration stood on the issue.

Last fall, then Vice F'resident Bush assured the livestock industry of his support for the grazing fee formula during the presidential election. However, during an April hearing before the House national parks and public lands subcommittee, Bureau of Land Management and Forest Service witnesses refused to state any administration position on grazing fee formula bills.

One of the bills, H.R. 775 (introduced by Rep. Buddy Darden, D-GA), strongly opposed by western permittees, would change the current formula and could raise fees to as much as $9.79 per Animal Unit Month in some areas by four times higher than the current fee. The other bill, H.R. 1670, introduced by Ron Marlenee (R-MT), would make the current formula permanent. It is strongly supported by the livestock industry. The current formula, established by law in 1978 and extended by former F'resident Reagan via executive order in 1986, measures several variables, including production costs, the price of beef and private lease rates. Grazing fees for 1989 are $186/AUM, representing a 20-percent increase over 1988.

"The livestock industry supports the current formula," said Eppers. "It is fair and is based on fair market value. It adjusts annually according to economic conditions. Cattlemen are pleased that the administration has gone on record again in support of the current formula."

Large bales study looks at methods

Iowa State University researchers have found that high-density bales have lower nutrient losses than low-density bales. Also, storing the bales on crushed rock reduces nutrient loss regardless of bale density.

ISU researchers in the departments of animal science and agricultural engineering recently studied the effects of bale density, type of binding and storage surface on the chemical composition, nutrient recovery, and digestibility of large, round hay bales.

Jim Russell, ISU associate professor of animal science, said alfalfa-bromegrass forage was cut at mid-bloom, sun cured, and baled as either high- or low-density large round bales bound with either plastic mesh or sisal twine spaced at six to eight inches. Bales were stored outsideeither on a six-inch layer of crushed rock or on the ground.

"Results from the study show that high-density bales have lower nutrient losses than low-density bales. The nutrient losses from low-density bales may be reduced by use of a plastic mesh binding," Russell said.

Storage of bales on crushed rock will reduce nutrient losses regardless of bale density or binding, he said.

"Sheep consumed 21 percent more hay from bales with plastic mesh binding compared to bales bound with twine, and 16 percent more hay from bales stored on crushed rock compared to bales stored on the ground," Russell said.

However, neither bale binding nor storage surface had any effects on hay dry matter digestibility, he said. AJ

2. **Beef Cows are Scavengers.** To a certain extent this is true+and accounts for the rapid expansion of cow numbers in the Midwest in the 1970s. Cows utilize corn stalk residues and hill pasture that exists in the Midwest and in every other state. But when the cows are nursing calves, they have to be fed a higherquality pasture or stored feed. A diet of thorn ap ples, swamp grass, salt grass, June grass, etc. is just not enough to allow a cow to rebuild herself after weaning a calf in the fall and to prepare for calving the next spring. These herds are the ones that have a rapid turnover rate40 per- cent of the cowsmay not be bredafter the breeding season. **(Note that the cow selecting from this diet doesn't have a calf to worry about.) The** fleshy cow and her prof- itable calf has a varied nutritious, ample diet menu-consist- ing of forages.

3. Cow's Milk **is All a Calf Needs. Calves can** least survive on only their mother's milk-without additional grain or for- age-but calf growth rate might be only 20 percent of the growth obtained where the calves also graze or are creep-fed grain. This is best shown by a classic experiment by Blaser et al. (1986; Figure 1).

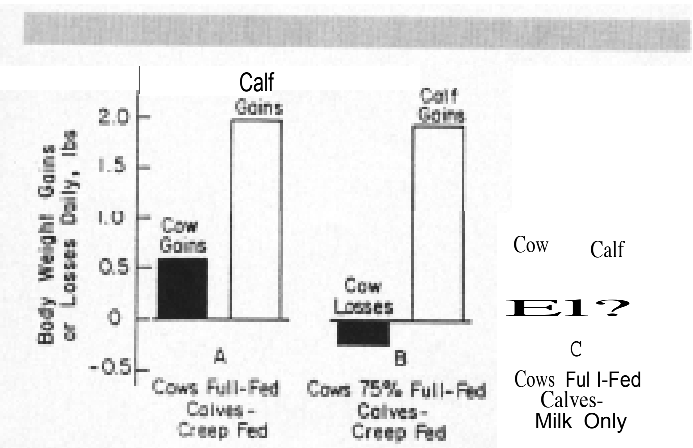


Figure 1. Body weight gains (lbs.)of cows and calves emphasiz- ing importance of feed (either pasture or grain) for calves in ad- dition to dam's milk.

The above trial was conducted in dry lot, with the calves not having any other source of nutrition but the dam's milk; calf growth rate was 0.33 lbs./head/day. Identical cows, although es- sentially full-fed, but whose calves were allowed grain-creep- feed gained 2.0 **lbs./head/day. In** other words-no matter how liberally the cows are fed-the calves needed more than the milk produced by their dams to have an adequate growth rate. In the same trial, feed for the cow was reduced by 25 percent and still did not affect calf gain. But it is especially important **during re- breeding to make sure that these cows are gaining in weight so as to have a high conception rate.** There is also the thought that putting fat on the cow's back in excess of her needs to produce milk during grazing may allow the cow to get by on lesser amounts and qualities of feeds during the winter. **But it is usually inefficient to put on body fat for later use.**

4. **Calf gains before weaning are so efficient that grain creep-feeding always pays.** We will present some figures with varying costs to show that just like everything else, gains from creep-feeding depend first and foremost on cost of **the feed; in** this case grain cost. When grain cost is high, it is difficult to justify a calf eating, free-choice, the dollars in a creep feeder.

5. **Rotational grazing takes too much time and money.** Just like any other management practice-no one grazing sys- tem will work for everyone. In some cases it may pay the beef producer to use highly intensive systems with daily rotations; in other situations weekly rotations may be most desirable. And depending on land type and other resources-perhaps con- tinuous grazing and/or monthly rotations may be best. But this is the time, with a bit more profit in the cow-calf business, to consider some options; **improved fencing system-no-till and- legume techniques-changing of pas- ture plant species-storage for stockpiled hay** (for addi- tional hay made because of a change in grazing manage- ment all of these things take time and investment. But mak- ing these changes now, when they can be better affordedthan five years ago-might increase the probability of a profit later when cattle prices decline and/or costs increase further.

FACTORS AFFECTING FORAGE QUALITY

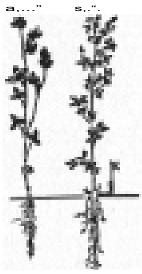
We are all familiar with effects of maturity and plant species (eg., different grasses and legumes) on percent total pro tein, and energy content and acceptability of the forage to the animal. But one factor that we would like to consider is the effect of the plant part-leaf versus stem-on **nutritive value. The** ranges in percent protein and percent TDN of alfalfa, orchardgrass and peretial ryegrass leaves and stems are presented in Table 2. These samples were obtained from weekly rotational grazing systems over all seasons-spring, summer, fall.

There is tremendous variation in protein between stems and leaves. In the case of alfalfa this range is from 9 percent to 41 percent; for orchardgrass from 6 percent to 29 percent; and for perennial ryegrass 7 percent to 31 percent. Since these samples were taken from weekly rotational grazing systems, the differences may be even greater in an extensive grazing system where there would be more variation in stages of maturity. Theoretically, the results in Tables 1 and 2 indicate that we could obtain a 3-lb./head/day gain on yearling steers if their diet consisted primarily of leaves from any of the three plant species. But-a stemy pasture might be all that is required for "dry" brood cows. Actually both the protein and energy content of the leaves of any plant in Table 2 easily exceeds the nutritional requirement for the higher-producing tattle-300-lb. suckling steer calves, yearling steers, and even the highest-producing lactating beef cows.

Table 2. Ranges in Total Protein and TDN Percents of Leaves and Stemsa

Item	Protein, %	TDN, %
Alfalfa leaves	22-41	64-75
Alfalfa stems	9-23	47-57
Orchardgrass leaves	11-29	56-72
Orchardgrass stems	6-12	46-55
Perennial ryegrass leaves	12-31	58-72
Perennial ryegrass stems	7-17	47-60

aSamples obtained from weekly rotational grazing system over all seasons; on dry matter basis.



Our challenge as livestock producers is try to **partition the different parts of these plants** to meet the needs of the animals which can utilize these different qualities of materials most efficiently-without overfeeding or underfeeding.

METHODS TO PARTITION A FORAGE 'STAND" OF DIFFERENT QUALITIES

Calves can convert high-quality feed to weight gain more efficiently, and the gains are of high dollar value, than if that same high-quality forage was fed to mature brood cows, Therefore, one way of partitioning the high-quality and most nutritious parts of the plant (the leaves) to the calves would be to allow **the calves to graze ahead of the cows. This can be** accomplished in two general wavs:

a. In a rotational grazing program, calves can graze the next paddock ahead of the cows through a creep gate made of wood or pipe (see Figure 2).
b. If the herd is continuously grazed, or perhaps rotated each month from pasture-to-pasture, a special area of high-quality forage (eg., perennial ryegrass-alfalfa) can be set aside and grazed only by the calves. Brassicas (forage turnips, rape, tyfon)or cereals (wheat, rye) could also be used for the calves.

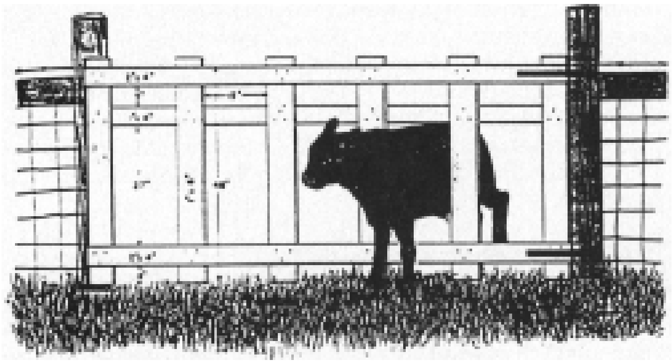


Figure 2. Calf creep gate to allow calf to graze rotational pastures ahead of the cow or special creep pastures (Blaser and Colleagues, 1986).

In most years there is increased quantity and quality of forages produced in late August through the remainder of the fall because of increased rainfall and cooler temperatures. Different pasture species react differently, but a general trend for most cool-season grasses and legumes is given in Figure 3.

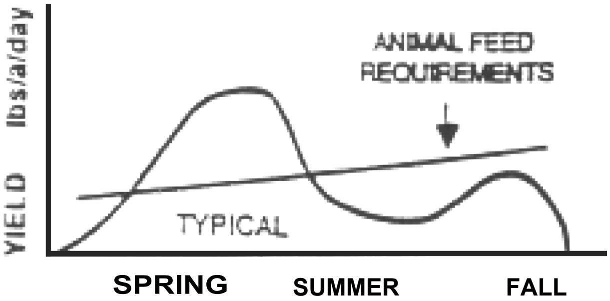


Figure 3. Generalized forage production curve, over seasons, for cool-season grasses and legumes; note increased production in autumn.

The additional fall forage may stimulate a bit more milk production in the cow, but probably not enough to make a big difference in calf growth rate. In a spring-calving program, this would be the time when calves **would be big enough to maximize utilization of pasture. The calves** would need more and better forage because of their size and growth potential. This is also the time when most producers would grain-creep calves if they were going to do so. It should be remembered that even though this high-quality additional forage is consumed by the cow, and does not stimulate much additional milk flow, it can still serve as body fat stores to be used for maintenance during the winter.

NO-CREEP, PASTURe-CREEP, GRAIN-CREEP COMPARISONS

These comparisons were conducted in 1987 **(a normal year-if there is one)** and in 1988 **(a drought year). The** results are summarized separately fi-om each year. The results fi-om 1987 are in Table 3.

There was essentially no difference in cow weight gain, averaging 119 lbs. over all three treatments. The pasture-creep-feed calves weighed 33.8 lbs. more than the no-creep calves; grain-creep-fed calves weighed 77.9 lbs. more than no-creep calves. The amount of grain-creep-feed required per pound of added weight gain, compared with non-creep-fed calves was 6.9 lbs. per calf per day. Assuming grain costs at $100 per ton, the added weight gain from creep feeding, compared to no-creep-feeding, **cost $.34 per pound of calf gain.** But if grain cost $250 per ton, the added calf weight gain from grain-creep-feeding cost $.86 per lb. This comparison is valid for the producer who **absolutely cannot pasture-creep the herd,**

The alternatives of pasture-creeping and grain-creeping were also compared in Table 3. There was a difference in calf weight between pasture- and grain-creep weights of 44.1 lbs., which resulted in 12.2 lbs. of grain per pound of added calf weight. At $100 per ton of creep feed, **the cost was $.6l/lb. weight gain; with a $250 per ton, cost was $1.53/lb. of additional weight gain.** There is no one alternative that is best for all operations under all conditions, but when grain costs approach $250 per ton, creep feeding is clearly expensive, and pasture-creep-feeding has cost advantages even considering the increased weight from grain creep.

At weaning, the cows and calves were measured (ratio of weight divided by height) in order to **determine the differences in condition or fatness.** A higher weight to height ratio indicates a fatter animal. The grain-creep-fed calves were significantly fatter, with the pasture-creep calves about half-way between grain-creep and non-creep calves. These calves were a result of a 3-way crossbreeding system (Charolais/Simmental/Angus) and were of typical large frame size. Gain-creep-feeding of smaller frame calves would have increased fatness or condition.

Table 3. Comparison of Creed-Feeding Methods (Normal Year-1987)a

Item	No-creep	Pasture-creep	Grain creep
Cow wt. gain, lbs.	+118	+116	+123
Calfavg. daily gain, lbs.	2.50	2.73	3.03
Calf wt. gain, lbs. (147 days)	367.5	401.3	445.4
Wt. advantage compared to no-creep	0	+33.8	+77.9
Wt. advantage compared to pasture-creep	-	0	+44.1
Cow wt./height ratio b	9.70	9.60	9.72
Calf wt./height ratio b	4.70	5.01	5.34
Grain-creep per calf	-	-	536.0

COMPARED TO NON-CREEP-FED CALVES

Cost of grain/lb. added gain (6.9 lbs./lb.gain) (creep grain cost of $lOO/ton) $0.34

Cost of grain/lb.added gain (6.9 lbs./lbgain) (creep grain cost of $25O/ton) $0.86

COMPARED TO PASTURE-CREEP-FED CALVES
Cost of grain/lb. added gain (12.2 lbs./lb.gain)
(creep grain cost of $lOO/ton) $0.61
Cost of grain/lb.added gain (12.2 lbs./lb.gain)
(creep grain cost of $25O/ton) $1.53

a Weekly rotation ryegrass-alfalfa pastures; creep gates used. Grain creep mix was 41 percent each of rolled oats and cracked corn, 14.3 percent of 32 percent protein pellets and 4.3 percent molasses; minerals free-choice. Cattle on trial 147 days; creep-feeding was started 62 days before the end of the trial.

b Weight divided by height at hooks is a measure of body condition or fatness; higher ratio indicates higher degree of condition or fatness.

Results in a drought ye-1988

The drought was quite bad in central Pennsylvania as in other parts of the state in 1988 (Table 4). This resulted in the calves being grain-creep-fed for 53 days and an off-trial period (sparse pasture and hay feeding for 35 days during mid-summer). Calf gains were reduced by 23.5, 32.7 and 49.4 lbs. for non-creep, pasture-creep and grain-creep groups, respectively, in 1988 compared to the previous year. Also, the added weight. **gains** from pasture-creep and grain-creep were about one-half the increases obtained in the "normal" year of 1987. **Grain-creep-feeding weight gains were also more expensive in 1988 than in 1987,** compared to either non-creep or pasture-creep systems. Creep-fed calves also tended to carry more body condition than the other groups in 1988.

Table 4. Comparison of Creep-Feeding Methods (Drought Year-1988)a

Item	No creep	Pasture-creep	Grain creep
Cow wt. gain, lbs.	**+86**	**+102**	+91
Calf avg. daily gain, lbs.	**2.39**	**2.56**	2.75
Calf wt. gain, lbs.	**344.2**	**368.6**	396.0
Wt. advantage compared to no-creep	-	**+24.4**	+51.8
Wt. advantage compared to pasture-creep	-	**0**	**+27.4**
Cow wt./height ratiob	9.51	**9.55**	**9.41**
Calf wt./height ratiob	**4.77**	**4.93**	**5.24**
Grain-creep per calf	-	-	**317.3**

COMPARED TO NON-CREEP-FED CALVES c
Cost of grain/lb. added gain (6.1 lbs./lb gain)
(creep grain cost of $l00/ton) $0.31
Cost of grain/lb. added gain (6.1lbs./lb.gain)
(creep grain cost of $250/ton) $0.77

COMPARED TO PASTURE-CREEP-FED CALVES
Cost of grain/lb. added gain (11.6 lbs./lb gain)
(creep grain cost of $l00/ton) $0.58
Cost of grain/lb. added gain (11.6 lbs./lb gain)
(creep grain cost of $250/ton) $1.45

a Weekly rotation ryegrass-alfalfa pastures; creep gate used.

bWeight divided by height at hooks is a measure of body condition or fatness; higher ratio indicates higher degree of condition or fatness.

cCalveson trial average of 144 days; creep-f&ding practiced during last 54 days prior to weaning;cattle off trial 35 days before creep-feed& period due to drought.

Advantages of creep feeding: There are other advantages besides weight gain of creep-f-:

A. Calves may sell **for more per pound,** *depending on market-eg., youth club calf sales.*

B. Calves start on feed easier, which is especially important in a pre-conditioning program; but a higher energy post weaning ratio should be used for grain-creep calves.

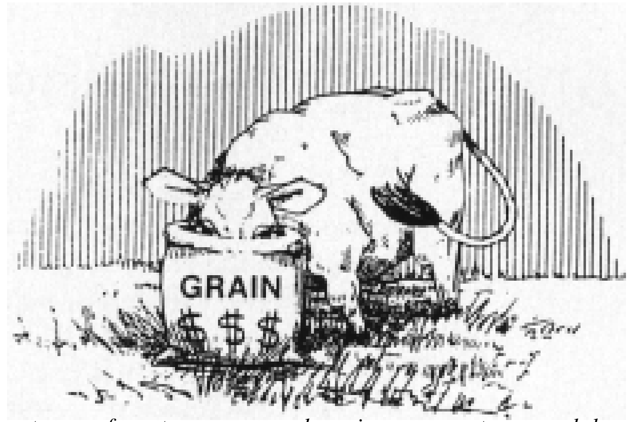
Disadvantages of creep feeding

A. Possibility of calves being **fatter,** *and selling for less per pound depending on marketing outlet.*

B. Calves may gain **less rapidly and efficiently after weaning,** *especially if put on a growing ration whichresults in less energy consumption than before weaning.*

C. Grain-creep **heifer calves** *may accumulate so much* **udder fat that futuremilk** *production may be reduced.*

The system which was not tested in the Penn State research is a combination of pasture-creep and grain-creep, with perhaps pasture-creep beginning in mid-summer when the calves are 90 days of age with grain-creep-feedingdelayed until 30 days prior to weaning. This should combine most of the advantages of pasture-creep and grain-creep systems, and lessen the effects of the disadvantages of grain-creep-feeding including the undesirable fat accumulation in heifers.



FORWARD (OR TOP) GRAZING SYSTEMS

Forward grazing systems within any kind of rotational grazing programallows animals with higher nutritional needs (or which can use high-quality feed more efficiently) to graze first in the rotational plan. The "follow" grazers are animals which have a lower nutritional requirement, and which can more effectively utilize the remaining lower-quality forage. There are a lot of combination&high-producing dairy cows could graze ahead of dry cows; ewes with lambs could graze ahead of "dry" ewes, and in the system researched at Penn State-yearling steers can graze ahead of a brood cow herd. Two systems were compared in a recent Penn State study:

Conventional Rotational System (CRS)-This system used four pastures allocated to grazing steers, with only the steers grazing rotationally(weekly) among these four pastures.

An additional four pastures were allocated to cows with calves at side; pasture-creep or gain-creep was not used.

Forward Rotational Grazing System (FRS)-A total of eight pastures (same number and acreage as in CRS) were used but in the rotation, steers always grazed the pasture immediately ahead of the cows and calves. The steers were the "lead' or "top grazers" and the cows were "follow" or 'bottom" grazers.

The results of this comparison, over three years, are presented in Table 5. As expected, the cows and calves gained less per day during 160-day grazing season in the FRS than in the CRS. This was expected since approximately 40 percent of the higher-quality forage had previously been consumed by the forward-grazing steers, with the cows and calves having access to a lesser-quality forage. During the grazing season, the FRS steers gained 46 lbs. more, and the calves 35 lbs. less than in the CRS. Allowing the calves to creep-graze or using grain-creep should have made up the difference between the weaning weights of the two groups of calves. One advantage that is not presented here is that upon slaughter of the steers of the two grazing systems, the FRS steers graded approximately one-half grade higher than did the CRS steers. Taste panel evaluation indicated that most of the forage-finished steers yielded carcasses of only marginal acceptability. Acceptability of carcasses from steers fed corn silage and a moderate level of grain for 75 days or longer were more acceptable.

Table 5. Results of Conventional Rotational versus Forward Rotational Grazing Systems.

Item	Conventional a (CRS)	Forward b (FRS)	Difference (FRS minus CRS)
Cow avg. daily gain, lbs.	0.67	0.56	-.11
Steer avg. daily gain, lbs.	1.54	1.83	+.29
Steer total gain (160 days)	246.4	292.8	+46.4
Calfavg. daily gain, lbs.	1.84	1.62	-.22
Calftotal gain (160 days)	294.4	259.2	-35.2
Total gain (steer+calf)	540.8	552.0	+11.2

aFour pastures allocated to steers, four separate pastures allocated to cows/calves.

blbtal of eight pastures (same number and acreage as in conventional) with steers grazing pastures immediately ahead of cows and calves; calves not pasture or grain-creeped in either system.

The sequence of grazing of 7 pastures, similar to the Penn State forage grazing system, is represented in Figure 4 (Blaser et al., 1986). As indicated, the first grazers removed 40-50 percent of the available higher-quality material, and the "follow" grazers removed the remaining usable forage.

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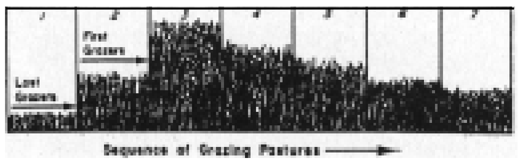

Figure 4. Forage growth and utilization by "top" (or forward) and "bottom" (or follow) grazers in a rotational grazing system.