

INTENSIVELY MANAGED ROTATIONAL GRAZING SYSTEMS FOR IRRIGATED PASTURE

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Harvest of forage from irrigated pastures can be distinct, at a given time and a determined amount. A simplified analogy between the hay grower and rotational grazing systems may be made. The manager of a grazing system determines when and how much plant material is harvested. The manager uses livestock instead of equipment to make the harvest.

Just as the hay grower must understand plant growth principles, the manager of grazing livestock must understand pasture growth principles. These must be balanced with knowledge of and performance goals for the livestock. The objective of the grazing management plan is to quickly and uniformly harvest the desired amount of plant material. Plans, however, should be considered as guidelines and remain flexible.

A practical intensively grazed pasture system consists of a number of pastures or paddocks. Pastures are grazed for one to four days, with some period of rest between grazing. A uniform harvest with minimum selectivity and repeated defoliation is encouraged when pastures are properly stocked and short grazing periods are used. The manager determines the number of livestock per paddock, the amount of time spent grazing on each paddock and the amount of time (rest) between grazings. That is, livestock are managed to conduct a timely, uniform and prompt harvest of pasture much like a swather for making hay.

Intensive grazing systems can be one of the most cost effective management activities for pastures. However, to be successful, plant varieties, composition, fertility, and water management must be considered.

STOCKING RATES, GRAZING INTENSITY AND DURATION

Uniform removal of plant material from pasture is encouraged by using a relatively "high" density or number of livestock per unit area (acre) of pasture. Picture a mass of cattle moving through a pasture, cutting (grazing) as they move. Typically, the ideal number of livestock will remove the desired amount of pasture in at least 3-4 days of grazing. When livestock are left to graze a pasture for greater than 3-4 days, regrowth of plants previously bitten will occur. The result is areas of overgrazing, which selectively discourages desirable plants while encouraging undesirable plants.

Grazing should remove a portion of the plant while leaving some leaves to capture sunlight for the plant to use in growing new leaves. The new leaves or regrowth will be removed in subsequent grazing after an adequate period of time for regrowth. Typical recommendations are to leave about 2-4 inches of plant leaves for the plant to use in regrowing. Therefore the amount of material available for grazing is all of the plant taller than about 2-4 inches (Figure 1).

It would be much simpler to plan rotational grazing systems, if an accurate and rapid method existed for estimating the total amount of plant

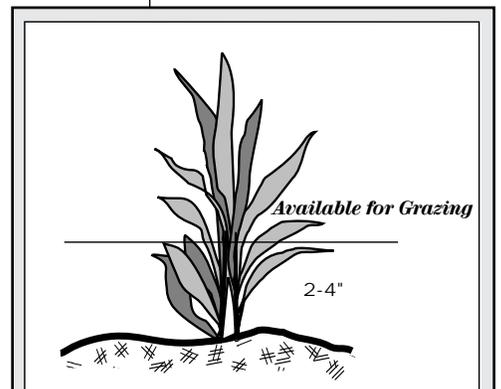


Figure 1. Grazing should harvest plant material leaving 2-4 inches. The residual serves as the basis for regrowth of new plant material for subsequent grazing.

material to be removed by grazing. A device marketed as a "Pasture Probe"¹ is adequate for making gross estimations. With experience, which the Pasture Probe can accelerate, growers can visually estimate amounts of plant material for grazing. In the Spring, improved pastures of fescue or orchard grass with some clover can typically be grazed when about 12 inches or taller.

The number of cattle per acre is best estimated as a weight relationship rather than number of head. For cows and calves the combined weight of cow and calf should be used (1). For example, about 15,000 (typical range is 15,000 to 25,000) pounds of livestock per acre are generally satisfactory when the duration of grazing is about 3 days. For cattle weighing 600 pound each, then 25 individuals (15,000 divided by 600) per acre would probably be satisfactory. If a paddock consisted of 5 acres then a total of 125 cattle (25 X 5), each weighing 600 pounds would be grazed for 3 days. Similarly if the cattle were cows with calves and their combined weight was

1350 pounds each (ex. cows 1100 plus 250 pound calves), then each acre might be grazed with 11-12 cows with their calves (15,000 divided by 1350). If the calves had been born in the Fall and weighed perhaps 400 pounds by the start of the grazing season we would use 1500 (1100 plus 400) pounds as the weight of an individual unit (pair). Thus, only about 10 pairs with larger Fall born calves might be grazed on each acre.

These examples are illustrated in Table 1 and your plans can be started in the space provided. This table provides information on management of one pasture or paddock that will be grazed for only 3 days at one time, we next need to consider additional paddocks for the entire grazing system.

There is no "correct" number of paddocks in a grazing system. For practical reasons eight paddocks is a reasonable compromise: fewer paddocks will result in overgrazing or inadequate rest between grazings, while more paddocks can increase performance of the pasture system, but requires considerably greater labor with smaller incremental returns.

Eight paddocks, when used with a rotational grazing scheme of 3 days of grazing on each paddock, results in rest periods of 21 days. This meets minimum typical rest recommendations of 21 to 30 days. Typically in the Spring the rancher is anxious to start cattle on pasture as early as possible, but pasture may be a little shorter than desired. Grazing plans can be adjusted slightly by

¹Design Electronics, Palmerston, New Zealand. Available for demonstration purposes from some Cooperative Extension offices.

Table 1. The number of livestock for a single pasture or paddock of a grazing system (collection of pastures used in a rotational grazing plan) can be based on the desired weight of beef per acre rather than the number of head. Typical weight per acre is from 15,000 to 25,000 pounds of beef per acre (column E). The "density" or number of livestock to be grazed in a single pasture is calculated in column F.

| A | B | C | D | E | F | G | H |
|-----------------------|-------------------------------|---|---|-------------------------|--|--|---|
| Total Acres Available | Number of Pastures (Paddocks) | Size in Acres of a Single Pasture or Paddock (A ÷ B) | Weight of Individual "Unit" Pair, Steer, etc. | Desired Weight Per Acre | Total Number of "Units" (D's) on 1 Acre (E ÷ D) | Total Number of "Units" (D's) for a Single Pasture or Paddock (F x C) | Total Number of "Units" (D's) for all Land Available (G) |
| 40 | 8 | 5 | 600 | 15,000 | 25 | 125 | 125 |
| 40 | 8 | 5 | 600 | 25,000 | 41-42 | 205-210 | 205-210 |
| 40 | 8 | 5 | 1100 | 15,000 | 13-14 | 65-70 | 65-70 |
| 40 | 8 | 5 | 1100 + 400 | 15,000 | 10 | 50 | 50 |
| Your Values | | | | | | | |

leaving the cattle for only 2 days in the first paddocks. This will provide enough forage for the cattle and not overgraze the pasture. Then with rapid Spring growth, pastures grazed later will have more than enough forage for 4 days of grazing. The combination of grazing for 2, 3 or 4 days, depending on forage availability will result in adequate rest to return to the first paddock with at least 21 days of rest.

Due to hotter weather after about the Fourth of July, pastures typically regrow less rapidly. The grazing manager has several alternatives for adjustment to this change in plant growth.

1. Reduce the number of livestock, adjusting for specific pasture growth conditions.
2. Stock slightly low (for the Spring period) from the beginning, but adequate for the hotter, summer season. Some "extra" feed may build up on the pasture to permit extending grazing periods to 4 days after the Fourth of July. This would result in rest periods of 28 days.
3. Provide supplemental feed.
4. Stock adequately for the summer season and during rapid Spring growth do not graze or reduce grazing to create an extra "buffer" paddock. This can be grazed during periods of slow plant growth. This "buffer" paddock might be hayed in June and allowed to regroup for a later grazing period.

Option 1 can be very effective in increasing total carrying capacity but requires more flexibility. Many managers select option 2.

FLEXIBILITY AND ADJUSTMENTS

Intensive grazing management plans should be flexible. The following are observations from some managers useful for making beneficial adjustments. If hard, dry cow patties seem

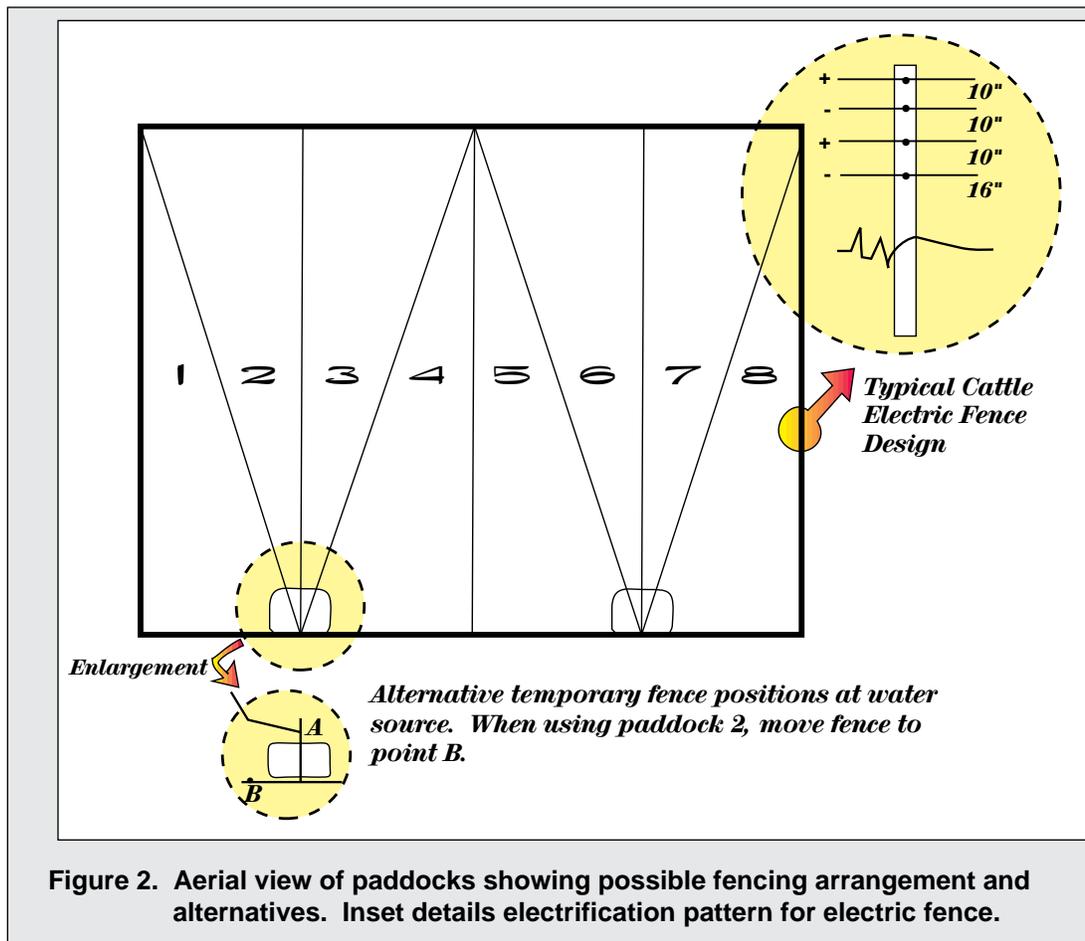
to be accumulating, it is frequently a symptom of low stocking density. More livestock per acre will tend to break up or reduce the occurrence of cow patties. Another alternative to reduce manure accumulation is irrigating immediately after grazing. This is not always feasible.

Another symptom of low stock density is the appearance of pastures that are "getting ahead" of the cattle. Forage is still tall after the planned three (3) days of grazing, or the plants are beginning to mature as evidenced by developing seed heads. Solutions are to increase livestock density, increase grazing duration on the pasture or mechanically cutting the excess. The excess, if practical, might be baled. Increasing grazing duration is only a temporary solution since the result is more days of growth on the next pasture which will result in even more excess forage when it is grazed. If the excess is great enough a hay cutting might be taken instead of grazing that pasture.

FACILITIES

Pastures of approximately the same size work much better than unequal sized pastures when used in a rotational system. Sometimes instead of thinking how to divide pastures into eight units (or whatever number are planned), one needs to consider what existing pastures can be grazed together to make eight units. Frequently 3-4 existing pastures can be easily split into two or perhaps three pastures each, making a total of 8 units.

Figure 2 shows a typical layout. Two water troughs provide drinking water for all 8 pastures. Perimeter fencing can be barbed wire or newer style high tensile smooth wire fence. Smooth wire fence may be built to provide for electrification. It should be four strands with alternating charged and non charged (grounded) wire. Interior



fencing can be multiple strands of smooth wire, or a single strand of smooth wire or woven plastic/metal wire, commonly marketed as Polywire or the equivalent. Limited experience suggests the wider Polytape is more visible, but may be less resistant to deterioration than Polywire.

Chargers should be high voltage (about 5,000) but low amperage - "New Zealand" type. These are very resistant to grounding out. The most important aspect of the energizer is adequate and proper grounding. If the fence does not work, always check the ground first.

Fence posts can be wooden or metal T posts with insulators, or nonconducting posts such as plastic or special nonconducting wood, such as ironwood. Single wire interior fencing can use short, plastic tread-in posts that are easily moved. In addition, they are short and flexible enough for wheel lines to move over them.

A wide variety of fence "posts" are now available for specific installations such as pivoting types for center pivot irrigation systems, and tumble wheels, which facilitate moving.

When livestock drinking water is shared by numerous pastures, as shown in Figure 2, sacrifice areas or areas of heavier use occur near the water. In the illustration in Figure 2 for paddocks 5, 6, 7 and 8, this sacrifice area is minimized. The design does not require additional water development. However, due to the small portion of the water trough available, adequate flow to quickly fill the tank should be available. The inset illustrates for paddocks 1 and 2 an alternative arrangement that increases trough space but suffers from a larger sacrifice area. A single trough is shared by paddocks 1 and 2 with the fence being moved to permit fuller use of the trough. The manager would have to weigh these various consequences for each application.

IRRIGATION

Besides drinking water, irrigating intensively grazed pasture systems is the second major difficulty. Fencing and grazing management strategies should be designed with existing irrigation systems in mind. With rapid cattle rotation and typically more fencing, irrigation can be difficult.

Irrigation systems should be designed and operated to provide adequate amounts of water in a timely manner. Amounts required can be closely estimated by using evapotranspiration (ET) information. ET data estimates the amount of water used or lost through evaporation from soil and transpiration of plants. Historical data from many locations is available and current season data may be available through your land grant university or local Cooperative Extension office. Adequate irrigation will insure water is not a limiting factor in crop production and resultant grazing potential.

Rotational grazing can be accomplished with either sprinkler or flood irrigation. It is usually not recommended to irrigate while cattle are on a pasture. However if this has been a historical and acceptable practice, it could be continued with rotational grazing.

Wheel line sprinklers usually cannot be used when the lines are perpendicular to fences creating physical barriers to cattle movement throughout the paddocks. Wheel lines parallel to fences can be moved over fencing and are compatible with rotational grazing. Center pivot irrigation systems with their high supply lines can be used in conjunction with break over (pivoting) fence posts.

Regardless of irrigation system, many growers attempt to irrigate immediately after grazing. This may facilitate regrowth and certainly appears to reduce or eliminate any fecal deposits. The critical factor is to design the

grazing system to work in conjunction with the irrigation system: during the growing season provide irrigation to satisfy crop needs, thereby avoiding water as the limiting resource.

CATTLE SELECTION AND MANAGEMENT

No specific breed restrictions apply to intensive grazing systems. Breeds with Brahma influence can be used successfully, although extra care to avoid their agitation maybe important. As with set stocking, steers and heifers are typically not grazed together; however, from the grazing response standpoint this is not a problem. Similarly large differences in animal weights should be avoided, but no more so than with other grazing management schemes.

Some grazing managers have found whistling or making some distinctive sound when moving cattle leads to a "learned" response. Cattle will be trained to move when the sound is repeated.

Ideally cattle should be trained to an electric fence before putting them on a pasture. The only reason for this is to avoid the possible labor involved in gathering cattle if they should break a fence. An ideal time to train cattle is when cattle are confined in a well enclosed area. A short strip of electric fence can be constructed, perhaps across a corner of a familiar corral, and a small amount of hay placed on the ground on the opposite side of the electric fence. As the cattle smell the hay they will get acquainted with the electric fence. This will not harm cattle and they will learn about electric fences in a controlled and safe manner.

The manager of intensively grazed cattle needs to decide who is making the decisions, the cattle or the manager. If an individual animal is causing significant problems, will management bend to the whims of that individual or

will the manager put that problem somewhere else and get going with the program?

ANIMAL HEALTH

Several considerations should be taken to maintain acceptable animal health levels when planning rotational grazing systems. When livestock are managed to more completely utilize pasture, the potential for grazing of harmful plants occurs. As management encourages more complete utilization livestock may consume plants previously avoided.

Potentially increased density of livestock per unit area may also increase the risk of internal parasitism and transfer of contagious diseases. However, specific animal behavior with any grazing system may result in time periods or areas of high livestock concentration, that are conducive to disease transmission. Preventative measures should be adopted.

ECONOMICS

Rotational grazing management plans which include length of grazing, rest periods and other factors ultimately impact stocking rates and economics. Considerable evidence indicates as

stocking rates increase, such as may occur with more intensive rotational grazing, daily gain of individual cattle decrease. This response has been described as linear (see Figure 3). By definition this response to increased stocking rates

when converted to gain per area is curvilinear (Figure 3). These trends are theoretical representations in the graph and specific values and relationships vary.

It is noteworthy to recognize that gain per acre does decrease when stocking levels go beyond some high stocking level. Also illustrated on the graph is the relationship between stocking rate and net returns. This is again a curvilinear response. With traditional stocking rates and economics, net return per acre peaks at lower stocking levels than gain per area. However, this may vary with changes in economics.

Record keeping should permit evaluation of performance for both livestock and pastures. Data collected should permit calculation of amount of livestock gain per acre, daily gains per head, stocking rates, and net returns. Supplemental feeds or additional hay production should also be included.

An example worksheet illustrates the types of information and calculations useful for either planning or evaluating grazing systems.² It is important to understand differences in evaluating alternatives on a per head or per acre basis. Livestock performance has traditionally been evaluated on a per head or individual basis. Grazing systems should also include monitoring and evaluating of land based values.

The computer program facilitates the comparison of alternative grazing strategies. It provides both a per head and per acre value for data. Additionally, the computer program provides some measure of risk and allows consideration of alternatives to alter or reduce risk.

² The computer program for IBM and compatible computers is available from Dan Drake, University of California, Cooperative Extension, 1655 So. Main, Yreka, CA 96097; (916) 842-2711.

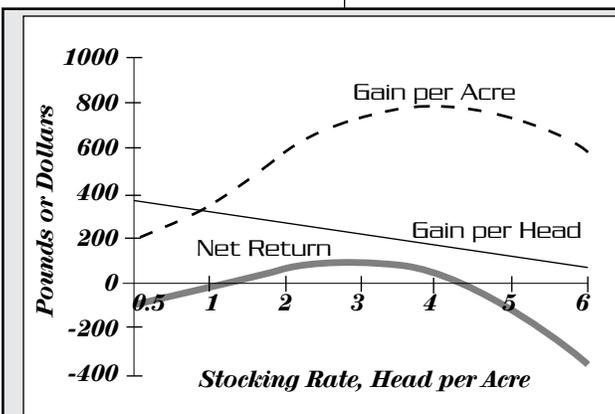


Figure 3. Theoretical responses to stocking rate.

| 204 | RESULTS | | |
|--|---------|---------|----------|
| 205 <u>EXPECTED</u> | Per | Per | |
| 206 | Head | Acre | Total |
| 207 Cattle cost, total | 450.00 | 900.00 | 36000.00 |
| 208 Cattle equity, \$ | 75.00 | 150.00 | 6000.00 |
| 209 Cattle interest, \$ | 18.49 | 36.99 | 1479.45 |
| 210 Pasture cost | 99.63 | 199.25 | 7970.00 |
| 211 Management cost | 71.41 | 142.82 | 5712.82 |
| 212 Pasture & Management Cost | 171.04 | 342.07 | 13682.82 |
| 213 Pasture, Manage. & Cattle Cost | 621.04 | 1242.07 | 49682.82 |
| 214 Gain over total period, lbs. | 250.50 | 501.00 | 20040.00 |
| 215 Total cost per lb. gain | 0.68 | 1.37 | |
| 216 Selling weight, lbs | 750.50 | 1501.00 | 60040.00 |
| 217 Total dollar receipts | 622.92 | 1245.83 | 49833.20 |
| 218 Total receipt minus cattle cost | 172.92 | 345.83 | 13833.20 |
| 219 Profit or loss | 1.88 | 3.76 | 150.38 |
| 220 Breakeven sell price, \$/cwt (cost of prod.) | 82.75 | | |
| 221 Return on equity, % | 2.51 | | |
| 222 Breakeven buy price, \$/cwt | 90.38 | | |

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California Ranchers' Management Guide
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