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This NebGuide discusses factors and principles of plant growth that influence irrigated pasture production; suggests management practices that allow irrigated pastures to express their production potential; and suggests stocking rates for various levels of production and classes of cattle.

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Grazing management has a major impact on the production potential from irrigated pasture. Proper management practices can maximize pasture production -- poor management ultimately results in unacceptable production levels. This NebGuide discusses factors and principles of plant growth that influence irrigated pasture production; suggests management practices that allow irrigated pastures to express their production potential; and suggests stocking rates for various levels of production and classes of cattle.

irrigated pastures are a high investment enterprise which requires grazing management designed to maximize returns. The best grazing system must be used to ensure high yields of nutritious forage with good seasonal distribution of growth, and to maintain pastures in proper balance of productive species over several years.

To accomplish this, some consideration must be given to using the plants so they are efficient in production, and yet also survive grazing. These are the basic reasons that a "graze-rest" system of grazing management is considered necessary. On irrigated pasture, a properly planned and managed rotation system is superior to continuous grazing when season-long use is planned. Maximum, sustained grazing capacity cannot be achieved unless some type of "graze-rest" system is used.

Relating Plant Growth Factors to Management

Several principles directly influence the productivity of forage species used for irrigated pasture. The amount of harvestable forage any pasture will produce is largely related to how it is used. In general, the more closely and frequently plants are grazed, the less their total production.

There are three general principles related to plant growth that influence pasture production: 1) maintenance of adequate leaf area for photosynthesis (carbohydrate production) and subsequent plant growth; 2) maintenance of extensive plant root systems for water and nutrient absorption; and 3) maintenance of sufficient food

reserves stored in the crowns for rapid recovery after grazing.

Adequate leaf area must be maintained if plants are to make appreciable growth. In order for a plant to grow and produce harvestable forage, it must manufacture more food than it uses for maintenance. This is similar to the feed consumed by livestock. A certain amount of the feed is used for maintenance. Any feed over this maintenance requirement contributes to gain. Likewise, the amount of food manufactured by plants that is not used for maintaining vital plant processes is stored or used for new growth of harvestable forage.

Extensive root systems must be maintained for good top growth. Root growth is reduced by continual removal of top growth. Since roots absorb water and nutrients from the soil for use in the plant's growth processes, a reduction in the root system ultimately reduces forage production. Simply stated, the production of root growth is nearly proportional to top growth. If above-ground growth is continually removed, root growth decreases, which in turn decreases top growth because of reduced uptake of water and nutrients.

Sufficient food (carbohydrate) reserves stored in the root system must be maintained for rapid recovery after grazing and for stand maintenance. Carbohydrates stored in roots, crowns, rhizomes, and lower stems decline after foliage is removed by grazing. Stored root reserves are critically low for several days, recovering after the leaf area is replaced, usually by three weeks. The amount of carbohydrate reserves removed from storage increases as the intensity and frequency of grazing is increased. Since the energy to start new growth must come from carbohydrate reserves until enough leaf area is developed to supply the needs of the plant, the food reserves are lowered each time a plant is extensively defoliated. Therefore, it is desirable to limit the number of tides a plant is defoliated as well as to provide adequate intervals between leaf removal.

Since plants manufacture food primarily in their leaves, the amount of leaf area determines how much food can be manufactured above what is required for plant maintenance. This excess food is subsequently used for more plant growth and forage production or is required to initiate new growth after grazing. If plants are continually grazed and not allowed to maintain adequate leaf area, forage production will be seriously impaired. When grazing is continued too long, plants are weakened and ultimately may die, essentially from starvation. Conversely, if more than adequate top growth or leaf area is maintained, plants may lose efficiency because shading of the lower leaves does not permit photosynthesis. In either case, efficiency is reduced and grazable forage declines.

Two Management Practices

The following management practices summarize the plant growth factors previously discussed into two concepts that can be applied to managing irrigated pasture under a "graze-rest" system.

- ***Limit the number of times a plant is grazed*** by using the forage in a particular pasture for a few days and then allowing it a protected period for regrowth. Continued grazing of the same plants over an extended period of time requires that the plants start new growth repeatedly, thus lowering stored food reserves and reducing root systems. The result is pastures in low vigor with weakened plants.
- ***Maintain sufficient residual leaf area*** to keep the plants productive by moving livestock to the next pasture when about 40 percent (8 to 10 inches stubble height) of the forage remains. Pastures should not be overused and kept in a state of insufficient leaf area. They should also not be allowed to grow to the point of decreased efficiency and overmaturity. In both cases, animal performance will be reduced because of low forage quality or reduced consumption. When overused, the quantity of available forage limits animal performance. When plants are left ungrazed to become overmature, decreased palatability and quality of forage reduces animal gains.

These two principles can be applied to pastures with different physical layouts, but they remain the same. The following pasture systems take advantage of the "graze-rest" management concept.

Grazing Management Systems

Control of grazing animals is necessary to apply the principles of plant growth to grazing management. When and how intensively the animals graze is important. Unlike continuous grazing, a properly designed and managed grazing system can provide adequate control. Separately fenced pastures, or some other means of providing a "graze-rest" sequence, are needed during the growing season. Alternate ways to accomplish this are discussed later.

Four-to-six pasture rotation system. Rotation grazing is the practice of grazing a particular area for a short period of time and then resting it by moving the animals to another pasture. This new pasture is also grazed for a short period of time and then allowed to regrow. This sequence continues until all pastures are used and then the process is repeated.

From four to six pastures are normally sufficient to start a rotation system. A five-pasture system is standard for many producers. The number of pastures is often determined by the resources available. For example, a producer with two center pivots may divide each into three segments, resulting in a six-pasture system.

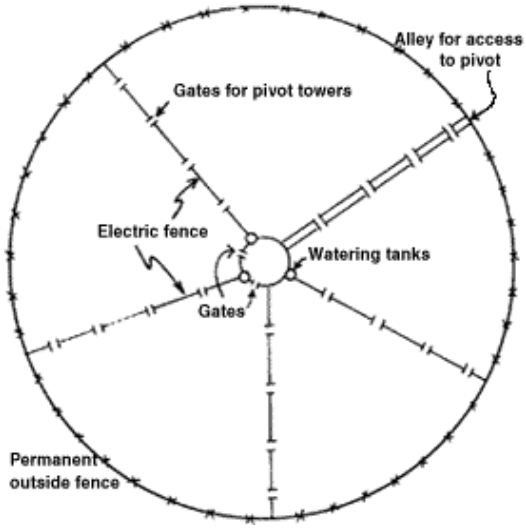

Figure 1. Typical cross-fencing and water development for a five-pasture rotation system. Note that corners are fenced out and not grazed with the irrigated pasture.

When properly irrigated and fertilized, most grasses used for irrigated pasture need approximately 25 to 28 days for regrowth after a pasture is grazed. This may vary with the species planted. If a five-pasture system is used and each pasture is grazed about seven days, the rest period for a particular pasture would be approximately 28 days. Base livestock movement on forage availability rather than on dates, but try to have approximately 28 days of rest before the next grazing period of a particular pasture. This rule is modified in the early spring when cattle are moved more frequently to lightly and rapidly graze the pastures to keep the grasses from heading. If forage production exceeds the rate of grazing removal, it may be necessary to hay one segment of the pasture or to add more cattle.

Figure 1 shows a typical layout for irrigated pasture under a center-pivot sprinkler. The same practices can be applied to any pasture, regardless of shape, as long as the number of pastures are sufficient to permit an adequate growth period. For example, a producer may divide two circles into three pastures each and rotate among the pastures and between the circles. The six pastures allow proper application of good grazing management just as well as five pastures in one circle. The primary difference is that livestock are on each pasture for a shorter period of time. The rest interval before a pasture is regrazed remains the same--approximately 28 days.

irrigated pasture - alternate forage system. Rotating between an irrigated pasture and some other source of forage provides the same "graze-rest" sequence of grazing management as a four to six pasture rotation on irrigated grass. For example, the irrigated pasture can be grazed until the proper degree of use has taken place. The cattle are then rotated to native range or other forages for about 28 days until the irrigated pasture has regrown. They are then moved back to the irrigated pasture and the sequence is repeated. This system can be used with a minimum of cross fencing and still adhere to the grazing principles previously discussed.

The effect of alternating different forages on animal performance has not been fully determined. Grazing cow-calf pairs at the University of Nebraska Sandhills Agricultural Laboratory showed no adverse effects under this system. However, the effects of moving yearling cattle from one type of a forage to another may be detrimental to gains. Take care to match up the grazing capacity of different forage resources so that adequate

time is allowed for pasture recovery.

irrigated pasture - haying system. By combining a grazing program with haying, intervals of pasture rest can be incorporated into the overall system that meet the plant's growth requirements previously discussed. An example is as follows: Graze the entire pasture with cow-calf pairs under a continuous use system from spring until after the breeding season (about July 1); remove cattle and let the pasture regrow for about 30 days (first rest period); hay the pasture; let the pasture regrow for fall use after freeze (second rest period), possibly by weaned calves.

There are many modifications of this example, but it is important that periods of rest without removing the top growth are part of the system to allow the plants to regain vigor. This system does not allow as many rest periods early in the season as those previously described.

Stocking Rates

Because stocking rates depend on pasture productivity, they are highly variable. Several factors influence production. Among the most pronounced are 1) soil and site capability; 2) level of production inputs (irrigation water, fertilizer, grazing management); and 3) pasture stand (plant species and adequacy of stand). It is obvious that these factors need to be considered and stocking rates adjusted accordingly. The different levels of production shown in *Table I* reflect these production variables, ranging from low to high. Low production may be a result of a poor site, lack of fertilizer or other factors. High production requires that all production factors be near optimum.

Animal numbers. The number of animals that an irrigated pasture can support are a function of three variables: 1) pasture productivity; 2) class of animal (cow, calf, yearling, etc.); and 3) projected time (days, months) that livestock will stay on pasture. Greater numbers can be grazed for a short period of time than if grazing is to be season-long. Also, more yearling cattle can be grazed for a given length of time than mature cows. Without considering all of the variables, stocking rate projections are meaningless. For example reports of high livestock numbers per acre are often misleading unless the duration of grazing and class of livestock are also known.

The suggested stocking rates shown in *Table I* take into account the different levels of pasture production for different classes of cattle for the entire grazing season. These rates should be used as a guide, with adjustments made for differences in pasture production during different segments of the growing season.

Seasonal pasture production. irrigated pastures do not grow at the same rate over the entire growing season. Forage production is highest in the spring and early summer, declining during the hot summer months until night temperatures begin to cool in late summer. An abundance of fertilizer and irrigation water can reduce this decline, but cannot eliminate it. This fact is important because stocking rates cannot be maintained at the same level season-long without some adjustment. When forage supplies become low, animal performance is severely reduced. The three primary ways to compensate for seasonal differences in production are reducing the number of cattle, reducing the time cattle are on pasture, and adding more area or other forage resources into the system.

Setting stocking rates. Select a level at which you expect your pasture to produce from *Table I*. For example, if you expect to produce 12 AUMs per acre want to stock it with yearling steers (13 to 17 months of age), the average number of yearlings the pasture should graze season-long is 3.7 per acre. Since irrigated pastures do not produce the same season-long, some adjustments need to be made to fully use the forage. The following techniques can be used to accomplish this. They are only general guidelines and can be adapted and modified for different livestock management programs.

1. Increase stocking rate by about 25 percent early in the season (May 1 to July 1), and reduce numbers by the same amount after July I. This technique works very well if two different groups of cattle are grazed

for the two different segments of the growing season.

2. Set cattle numbers for three-fourths of the pasture area, reserving one-fourth for hay harvest. For example, a 132 acre pivot would be stocked on the basis of 100 acres. Graze the hayed portion after the pasture regrows, thus increasing the acres for grazing by 25 percent for the remainder of the pasture season.
3. Increase the available forage resources during mid- to late-season by incorporating a pasture of sudan or sorghum-sudan hybrid into the forage program. This provides grazing for 25 percent of the cattle for the remainder of the season. Other forages can also be used for the same purpose.

Spring Turnout and Grazing Management

In central Nebraska, irrigated cool-season grasses will normally begin new growth by early April. Although it is tempting to graze pastures when they first "green up," this can severely reduce production for the remainder of the growing season. Do not graze pastures in the spring until 8 to 10 inches of new growth have developed. This normally occurs by the first week of May in central Nebraska and somewhat later in the west and northern part of the state.

There are two main reasons to delay spring grazing until "grazing readiness" is reached: 1) cool-season grasses need a period of uninterrupted spring growth to gain vigor for sustained production, and 2) pastures can be stocked to maintain animal numbers for an extended period. This is especially important when pastures are used for breeding purposes. There is a potential for disruption of the estrous cycle when the type of forage is changed.

Fall Grazing Management

The management of irrigated grass pastures during the month prior to freezing temperatures can have an impact on overall pasture productiveness and stand maintenance. During this time, cool-season grasses should be replenishing carbohydrate reserves in the roots and crowns for overwintering and the start of new growth the next spring. Intensive grazing during this fall period can hinder this process.

A management technique that is excellent for condition of the pasture and that also fits into many livestock management programs is to end the summer grazing program about September 1 to give the pasture a rest and regrowth period prior to "freezeback." Fall grazing can begin after October 1, providing grazing that can continue until the readily available forage (85%) is used. However, cattle should not graze beyond this point or be fed roughage on pasture. Grazing weaned calves is an excellent way to use fall regrowth.

Table I. Average number of animals (stocking rate) per acre for common classes of livestock and different levels of productivity during spring and summer.

Class of cattle	Animal unit (A.U.)	Low-----Relative level of pasture production-----High							
		Animal unit months (A.U.M.) of forage produced per acre, season-long[1]							
		(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
		----Average number of animals per acre for grazing season----							
Mature cows, replacement heifer 24 months or older (maintenance or gestation)	1.0	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8
Mature cow with calf, birth to 3 months or	1.25	1.2	1.3	1.4	1.7	1.8	1.9	2.1	2.2

mature bull									
Mature cow with calf, 4 months to weaning	1.4	1.0	1.1	1.3	1.4	1.6	1.7	1.8	2.0
Mature cow with calf, average for pasture season	1.35	1.1	1.2	1.3	1.5	1.6	1.8	1.9	2.1
Weaned calves to 12 months	.50	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6
Yearlings, 13 to 17 months	.65	2.2	2.3	2.8	3.1	3.4	3.7	4.0	4.3
Yearlings, 18 to 24 months	.80	1.6	2.0	2.3	2.5	2.8	3.0	3.3	3.5
[1]Animal unit month (A.U.M.) is defined as the amount of forage required for one 1,000 pound non-lactating cow for one month.									

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