SHARP BROS. SEED CO.

BOX 140
HEALY, KS 67850
620/398-2231

101 EAST 4th ST RD
GREELEY, CO 80631
970/356-4710

2004

IRRIGATED PASTURES

Sharp Bros. Seed Co. helped to pioneer the use of irrigated pastures in the High Plains area of Kansas, Colorado, Oklahoma and Nebraska.

We recommend the following ten ground rules for any irrigated pasture program.

1. Select a proper site with good soils and adequate water for proper irrigation.

2. Properly prepare an adequate seedbed.

3. Use only the best seed of the proper varieties in an adapted mixture.

4. Do the seeding with a narrow row drill with depth bands. Use a nurse crop if blowing could be a problem.

5. Do not maximize use on the pasture until it has been established for one year.

6. Fertilize with 200-250# of N per year. Apply small amounts throughout the year. Apply P and K per soil test.

7. Use pasture rotation. Use three to five pastures. Generally use the pastures seven days and stay off at least twenty-one days to allow adequate regrowth.

8. Do not graze closer than four inches stubble height. Leave some leaf area to aid rapid recovery.

9. Allow a period of rest in the fall before frost to build up root reserves. This forage can be utilized after frost without plant injury.

10. Don't short any of the above as any one factor can limit your potential profits from irrigated pasture.

FACTORS THAT INFLUENCE BEEF CATTLE PRODUCTION FROM IRRIGATED PASTURE 1/

James T. Nichols, B. R. Somerhalder and D. C. Clanton 2/

The development of center-pivot irrigation in the late 1960's has been the primary force behind the increased use of irrigated pasture for livestock production in the Great Plains Region. Irrigated pasture is not a new concept for forage production. However, the development of new equipment and technology was necessary before it achieved the level of popularity it now holds. Flood irrigation and non-automated sprinkler irrigation have not been feasible in many instances because of limitations imposed by topography, sandy soils and high labor requirements.

Present indications suggest that irrigated pasture can play an increasingly important role in beef cattle production. Increased livestock numbers in addition to improved livestock performance through better forage programs are possible.

The feasibility of irrigated pasture for a particular farm or ranch unit rests on two primary considerations.

1. Whether irrigated pasture can fill a forage need cheaper than it can be supplied by other means; or provide high quality forage during a time when existing forage resources cannot—thus becoming a complement to the total program.
2. The ability of the producer to manage effectively to achieve high levels of production.

Production levels and degree of success achieved by different producers vary widely. A survey of 25 irrigated pasture producers in Nebraska indicated that AUM's (Animal Unit Months) of forage produced per acre varied from a low of 5.4 to a high of 18.0 with most at 10 to 13 AUM's/A

1. 3/ Five years of grazing data from irrigated pasture at the North Platte Station averaged about 13 AUM's per acre
2. These large discrepancies in yields are at least in part due to managerial ability of the producer, but may be influenced by site capability.

Many factors influence irrigated pasture productivity. Some relate to development decisions, whereas others are management considerations. All influence the final level of production. There are six of primary importance to consider: 1) Soils and site selection; 2) Pasture stand; 3) Irrigation; 4) Fertilization; 5) Grazing management; and 6) Livestock response. Each of these factors has an influence on total pasture productivity as

ultimately expressed by the performance of the grazing animal. Early decisions relating to choice of site, soils and pasture stand are relatively permanent and not readily changed once development starts.

1/ Prepared for: Nebraska Irrigation Short Course, Nebraska Center for Continuing Education, University of Nebraska, Lincoln. Jan. 14-15, 1974.

2/ Associate Professor of Agronomy, Associate Professor of Agricultural Engineering and Professor of Animal Science, University of Nebraska, North Platte Station.

3/ Numbers correspond to references at the end of article.

Site and Soil Factors

In general fields capable of high crop production can be productive for irrigated pasture. However, since much development for irrigated pasture is on sites that have not been under cultivation, cropping history is not always available to indicate site potential. Other indicators must be used. In many cases, marginal lands are being developed that were not considered suitable before the advent of center-pivot irrigation. The following are general guidelines for sites that may present management problems or should not be developed (3):

1. Avoid areas with sandy soils that require extensive shaping. Wind erosion and soil fertility problems become more difficult to solve when the surface soil is removed.
2. Saline or alkali soils that restrict planting the commonly recommended mixtures are not desirable. Lower production can be expected when substituting grasses that are tolerant to these conditions.
3. Sites intermixed with subirrigated and dryland within the same area have inherent management problems. Water management becomes difficult because some sites are excessively wet while others may need irrigation.
4. Areas with closed drainages or "pot holes" can develop into ponds or excessively wet spots under irrigation and should be recognized as potential problems in equipment operation and crop loss.

Sandy soils have some advantages over finer textured soils high in silt and clay for irrigated pasture. Soil compaction and forage loss from livestock trampling is not as severe. Also, water erosion in wheel tracks on rolling terrain is not normally a problem. However, the fertilization program becomes more complex and expensive on extremely sandy soils and on some sites it becomes difficult to achieve an acceptable level of production.

Within Nebraska's range area relatively level dry valleys of the Sandhills are some of the

most acceptable sites for irrigated pasture development. These soils are generally darker, finer textured and present fewer fertility problems than those of surrounding dune-like terrain.

Pasture Stand

Establishing the right grasses and/or legumes in a good stand is essential for high production. Recommended mixtures for most conditions are presented in table 1. Whether or not to use alfalfa as part of the mixture rests with the producer and his ability to minimize the bloat problem. Commercially available bloat preventatives can suppress bloat if consumed by the grazing animal at least every 12 hours. Timely irrigation and fertilization of recommended grass mixtures at the North Platte Station has shown that good production can be realized without a legume. However, the importance of legumes in irrigated pasture mixtures has not been resolved.

Eight grasses are being evaluated under permanent set irrigation by grazing with yearling steers at the North Platte Station (2). At this time, adequate data is not available to make changes in the mixtures suggested in table 1.

Differences in plant cover, soil texture, terrain, past cropping history, weediness, and susceptibility to erosion are factors that influence acceptable seedbed preparation for pasture establishment (3)

Characteristics of a properly prepared seedbed are as follows:

1. Firm, but have sufficient loose soil to permit shallow coverage of seed. This helps insure that small grass and legume seeds make good contact with soil particles which retards drying and accelerates seedling emergence.
2. Free of competition from weeds and existing grass cover. Annual weeds have a faster growth rate and can readily smother out grass or legume seedlings. Established perennial grass cover is extremely competitive and will not permit seedling establishment. Therefore, seeding into rangeland without seedbed preparation has generally failed.
3. At least the upper 3 feet of the soil profile should be moist prior to planting. This aids in maintaining a moist soil surface during seedling emergence. Light, frequent irrigation is necessary for soils that dry rapidly and have low water holding capacity.
4. Adequate soil fertility is essential for rapid seedling growth. Sandy soils are inherently low in plant nutrients. Fertilizer rates based on soil tests should be applied during seedbed preparation and be incorporated into the upper soil profile.

Pastures can be seeded in either spring or early fall. Oats can be seeded at 20 lb/A for protection from wind erosion on sandy soil.

Table 1. Recommended Mixtures for Irrigated Pasture in Nebraska.

Mixture No. I		
	PLS/A (Pure live seed)	**Approx. % of seed**
Orchardgrass (Sterling)	5	57
Smooth Brome (Lincoln)	10	24
Alfalfa (Dawson)	5	19
Total	**20**	**100**
Mixture No. I I		
Orchardgrass (Sterling)	7	77
Smooth Brome (Lincoln)	10	23
Total	**17**	**100**

Fertilization

A balance of essential soil nutrients is necessary for irrigated pasture production. Soil tests should be made to determine what elements are needed in what quantities. Analyses of irrigation water can be helpful when used in conjunction with soil tests, especially for soils which may need the application of micronutrients. Nitrogen is necessary for all pastures, except pure stands of legumes. For legumes, phosphorus is of primary importance.

During 5 years of irrigated pasture production on very fine sandy loam soils at the North Platte Station, 225-250 lb of N and 50 lb of $P_2 0_5$ were applied annually. Soil tests did not indicate a buildup of N to depths of 36 inches (4). This fertilization program was adequate to maintain good pasture production.

Suggested rates of nitrogen application are given in table 2 based on stocking rate and residual soil nitrogen (5)

Nitrogen should be applied in small increments of about 20-30 lb/A several times throughout the growing season. The convenience of injecting nitrogen solutions into the irrigation water makes this easy and practical. For other fertilizers, applications one time each year are adequate, preferable each fall or prior to spring green-up.

Table 2. Suggested Nitrogen Rates for Irrigated Pasture (From Rehm & Knudsen, 1973)

Desired stocking rate	Pounds of nitrate-nitrogen/acre in the soil to 6 ft.		
	0 - 50	50 - 100	100 - 150
Yearlings/A	Nitrogen application (lb/A)		
3	180	120	80
4	240	180	140
4+	270	240	200

Irrigation

High pasture production can be maintained throughout the growing season if a readily available supply of soil water and fertility is maintained. Applications of ¾ - 1 inch applied as frequently as needed will maintain adequate soil moisture on all soil types. Frequent replenishment of soil water in the upper root zone is necessary for optimum grass growth. Properly designed, automated sprinkler irrigation is well suited to perform this function.

Surface irrigation may be used on medium to fine textured soils (fine sands, silt, clay). Properly designed automated surface irrigation systems can be managed to apply 2 inches of water per irrigation as often as required. Without automation, this method requires a compromise between frequency and amount of irrigation because of greater labor requirements. This has often contributed to a summer slump in pasture production. This slump has not been as severe with automated sprinkler irrigation.

The choice of an irrigation system in governed by several factors, namely, soil type, topography, water quality, labor, available capital and the desirability of applying chemicals and fertilizer with irrigation water. Animal trails and gopher holes, which can be a constant problem for surface irrigation, are minor problems with sprinkler irrigation.

Sprinkler irrigation can be used successfully on shallow or sandy soils where surface irrigation is unsuitable. Soil texture is a major factor that must be taken into account in irrigation management. The limited water holding capacity of sandy soils necessitates frequent irrigation to maintain adequate soil water in the upper root zone. The soil profile should be moist at least to 36 inches. Also, because of the low water holding capacity, frequent irrigation will reduce the chances of water and fertility movement beyond the root zone. In this respect, the primary concern is movement of nitrogen, which is highly soluble and moves with the wetting front.

Productive irrigated pasture has required an average of 35.0 inches of water per season at the University of Nebraska, North Platte Station, for the five years 1968-72. This includes both rainfall and irrigation. Irrigation is a matter of supplementing rainfall. Irrigation

requirements will increase or decrease according to the rainfall received during the growing season (4).

Soil moisture should be monitored for proper irrigation scheduling. Applying irrigation water when the root-zone storage capacity is full, wastes energy, water and to some extent fertility. Conversely, inadequate watering limits pasture growth. Monitoring for proper irrigation can be done with a soil probe or moisture sensing devices (8,9).

Grazing Management

Irrigated pastures are expected to produce an abundance of forage season-long. This requires that vital plant processes be continually active from spring to fall. Timely irrigation and fertilization, plus stimulation of plant regrowth by grazing, subjects pasture plants to continuous physiological stress. Minimizing these adverse effects by management procedures such as rotation grazing can be beneficial (3).

Using several pastures in a rotation grazing scheme allows the practice of grazing for a short period of time and then resting by moving the animals to another pasture. This second pasture is in turn grazed for a short period of time and then allowed to regrow. This sequence is continued until all pastures are used and then the process is repeated. With the more common grasses used for irrigated pastures, approximately 25-28 days are necessary for regrowth after a pasture is used. This resting interval may vary with the grass used. If a five-pasture system is used and each pasture is grazed about 7 days, the period of non-use for a particular pasture would be approximately 28 days. Moving livestock should be based on forage availability rather than on dates, but an attempt should be made to achieve approximately 28 days of rest before the next grazing use of a particular pasture. An exception to this is that during the first grazing use, in the spring, it is desirable to move the cattle through the rotation sequence more rapidly on a 2 – 4 day schedule to keep the last pasture in the rotation from heading and becoming too rank. Following this flush of spring growth, the longer rotation sequence should be followed.

There are two general management practices that can be applied to irrigated pasture under a rotation grazing system:

1. Limit the number of times a plant is grazed during the grazing season by using the forage in a particular pasture during a period of a few days and then allowing it to regrow unhampered. Continuous grazing of the same plants over an extended period of time requires the plants to start new growth repeatedly, thus lowering stored root reserves and reducing the extensiveness of root systems. Consequently, pastures of low vigor with weakened plants are a result.
2. Maintain sufficient leaf area to keep the plants productive by moving livestock to the next pasture when at least 25 percent of the forage remains. This retains leaf area for rapid recovery after grazing. Pastures should not be over utilized and

kept in a state of insufficient leaf area. Neither should they be let grow to the point of decreased efficiency and over-maturity. In both cases, animal performance will be impaired because of reduced forage consumption. When over utilization is practiced, the quantity of forage available limits animal performance. When left ungrazed to become over-mature, decreased palatability and quality of forage reduces animal gains.

Following these management practices becomes especially important when pastures are grazed in a season-long program if high production is to be maintained.

Livestock Response

The end product of the entire irrigated pasture system is the response obtained from the grazing animal. This becomes the final measure of pasture productivity. If cattle are used that will not respond favorably, the previous factors become of secondary importance.

Cows and calves can be grazed on irrigated pastures throughout the growing season and produce calves comparable to or heavier than calves on cows grazing native range (6). Yearling cattle and weaned calves for late fall grazing, can effectively use irrigated pasture (7).

With yearling cattle there are two considerations that can have a primary influence on gain produced per animal:

1. The genetic ability of the animals to make efficient gains.
2. Previous treatment—i.e., if they have been wintered for high gains, then high summer gains on irrigated pasture should not be expected. This is not unique to irrigated pasture. The same relationship applies to any summer grazing program.

Summary

Each of these six factors of production have been considered and discussed separately but in reality are components of a total production system. Weakness in any one factor reduces the expected response of the entire system. For example, poor grazing management suppresses the expected response to good water and fertility management because of low plant vigor. Likewise, the best in water, fertility and grazing management is of little significance if applied to poorly adapted grasses and legumes; or if inherent soil and site problems restrict plant growth. Using the proper kind of grazing animal permits the best expression of the capability of the pasture system to produce beef.

References

1. Perry, Robert E. 1972. 1971 Survey of 25 Producers of Irrigated Grass and/or Alfalfa. Univ. of Nebraska North Platte Station.

2. Nichols, James T. 1973. Pasture Irrigation, A new Angle to an Old Practice. Univ. Nebraska Farm and Ranch Quart. 19:12-14.

3. Nichols, James T. 1971. Establishment and Utilization of Irrigated Pastures. Proceed., II Range Beef Cow Symp. P 103-111.

4. Somerhalder, B. R. 1972. Center-pivot Sprinkler Irrigation on Pasture. Proceed., Univ. of Nebraska Irr. Short Course. P 153-161.

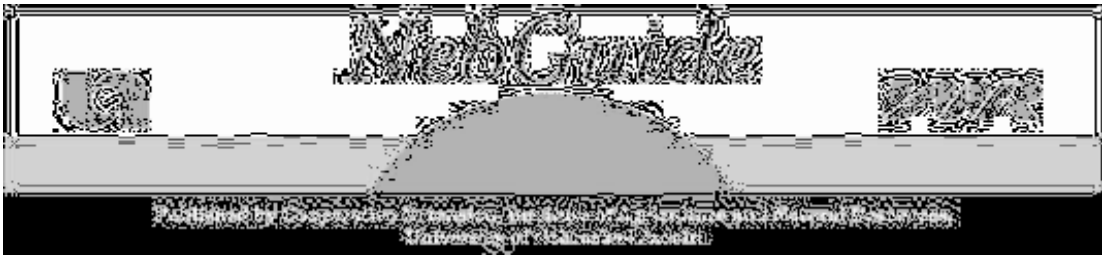
5. Mehm, George and Delno Knudsen. 1973. Fertilizing Irrigated Pastures. Univ. of Nebraska NebGuide. G73-3.

6. Clanton, D. C., J. T. Nichols and B. R. Somerhalder. 1971. Univ of Nebraska Beef Cattle Prog. Rpt. EC 71-218. p16-21.

7. Somerhalder, B R., D. C. Clanton, and J. T. Nichols. 1969. Pasture Irrigation with a Center-pivot System. Univ. of Nebraska North Platte Station Progress Rpt. 13 p.

8. Fischbach, Paul E. Scheduling Irrigation by Electrical Resistance Blocks. Univ of Nebraska EC 71-752.

9. Fischbach, Paul E. and John C. Steele. Field Moisture Test for Determining When to Irrigate. Univ. of Nebraska EC 55-700



Perennial Plants for Irrigated Pasture

This NebGuide discusses the use of perennial plants for permanent irrigated pasture. It does not include the use of annuals such as sudan, rye and wheat.

James T. Nichols, Extension Range and Forage Specialist

[Previous Category] [Catalog] [Order Info]

- Important Plant Characteristics
- Why Not Water Native Range?
- Cool- vs Warm-Season Grasses
- Cool- and Warm-Season Grass Mixtures
- Legumes for irrigated Pasture
- Grass-Legume Mixtures
- Grasses and Grass Mixtures
- Why Seed a Mixture?
- Seed Known Cultivars
- Recommended Plants for irrigated Pasture

Seeding the correct grasses and legumes is important for high production from irrigated pasture. The best management cannot overcome the shortcomings of poorly adapted species which lack the characteristics necessary for high production. (For more information, see NebGuide *G81-563, Grazing Management of irrigated Pastures*, available from your county Extension office.) Selecting the right plant materials is an important decision which should be made early in the planning stage.

This NebGuide discusses the use of perennial plants for permanent irrigated pasture. It does not include the use of annuals such as sudan, rye and wheat.

Important Plant Characteristics

Several plant characteristics are important when considering what to plant for irrigated pasture. Plants must be: 1) adapted to and tolerant of the climatic, soil and site conditions; 2) genetically and physiologically capable of producing high forage yields, and able to respond to high levels of fertilizer and irrigation to achieve a high grazing capacity; 3) readily consumed by the grazing animal and of good nutritive value; 4) persistent and tolerant to grazing pressure for a reasonably long pasture life; 5) capable of good regrowth after grazing for sustained season-long production; 6) capable of being readily established by using good cultural practices and equipment which is easily obtainable; 7) compatible with other species when used in a mixture.

No one plant species has all of these characteristics, but mixtures can be formulated to combine the best ones from several plants into a pasture stand that will meet the producer's needs.

Why Not Water Native Range?

When rangeland with a good stand of native grasses is being developed for irrigation, it may seem that the existing grasses could be used for irrigated pasture. However, the potential production is much lower for the water and fertilizer applied than that which could be realized from grasses more suited to an irrigated pasture environment. When orchardgrass was compared with native grasses under irrigation and different levels of fertilizer, a much smaller yield was evident from the native grasses (*Table I*). Thus, native range should be considered only on a short-term basis until other grasses can be seeded, but not as a permanent irrigated pasture program.

Table I. Production of irrigated orchardgrass compared to irrigated native range at three levels of nitrogen (N) fertilizer, 1975-76. (From Fifth Annual Progress Report, Sandhills Agricultural laboratory 1977-75.)

	Dry matter production*	
N	***Orchardgrass***	***Native range***
lb/A	*lb/A*	*lb/A*
0	4,863	3,839
150	9,288	6,922
225	10,551	6,817
300	11,264	7335

Cool- vs Warm-Season Grasses

Irrigated pastures are almost exclusively seeded to cool-season grasses for the following reasons:

1. Total seasonal production is less for warm-season grasses because they are not actively growing during as much of the growing season as cool-season grasses. In Nebraska, irrigated cool-season grass can be stimulated to be productive during the hot part of the summer, but warm-season grasses cannot be made to grow during early spring and fall when soil and air temperatures are cool.
2. As a group, cool-season grasses are better adapted to the environment of an irrigated pasture, responding more readily to water, fertilizer and proper grazing management.
3. The time of primary growth for cool-season grasses more nearly coincides with that of critical forage needs of most livestock producers, especially when used in conjunction with warm-season native range.

Cool- and Warm-Season Grass Mixtures

Mixing cool- and warm-season grasses in the same stand for use as irrigated pasture to obtain

sustained season-long production is not advisable. Difficulty of stand establishment and, more importantly, management problems for the benefit of either component nullifies any apparent advantages. If both types of grasses are desired, plant them as separate stands and manage them according to their respective needs.

Legumes for irrigated Pasture

Legumes do not require nitrogen fertilizer for high forage production--a cost advantage over grasses. However, other factors must be considered before assuming that legumes are the best and most economical way to produce irrigated forage for grazing. Bloat of the grazing animal is a major problem with some legumes. Some are non-bloating, but have other limitations such as poor forage quality and yield. The ideal, highly productive, non-bloating legume has yet to be developed.

There are several legumes that have been evaluated for use as irrigated pasture, including alfalfa, birdsfoot trefoil, cicer milkvetch, sainfoin, ladino clover and various other clovers. Of these, only alfalfa appears to warrant serious consideration as an irrigated pasture plant for Nebraska. A lack of research on their potential, or other limitations associated with a particular species precludes recommending any of the other legumes at this time.

Alfalfa for irrigated pasture is usually seeded in a mixture with grasses, but it may also be used alone. Animal bloat is a problem when alfalfa is grazed. There are no non-bloat causing alfalfas, although some of the grazing-types are reported to be less likely to cause bloat when seeded with grasses because of slower recovery after grazing. Hay-type alfalfas are more productive than grazing-types, which accounts for their wider use for grazing.[1]

Under irrigated pasture conditions, alfalfa should only be grazed when an anti-bloating compound is fed. Poloxalene (Bloat Guard[2]) will prevent bloat if consumed daily by the grazing animal.

The three common methods of feeding poloxalene to the grazing animal on pasture are: 1) mix with grain and bunk feed; 2) feed in block form, free choice; and 3) feed in a molasses mix, free choice (lick wheel).

Research suggests that production levels and animal performance on alfalfa pasture are highly variable, but are generally comparable to well fertilized grass pasture. However, alfalfa is not as productive for early spring or late fall grazing as cool-season grass, and although alfalfa can be readily established, it is not as persistent or as well adapted to grazing as cool-season grasses.

Deciding if alfalfa should be planted for irrigated pasture depends on whether or not bloat protection can be achieved, and the costs of bloat protection in relation to those of fertilizing pastures of cool-season grasses with nitrogen.

Cicer milkvetch is a non-bloat causing legume that has received renewed attention for its potential as an irrigated pasture crop. Pasture trials at the University of Nebraska North Platte Station have indicated that animal gains from steers on cicer milkvetch are considerably lower than those on either irrigated alfalfa or cool-season grasses. It is also slower and more difficult to establish than alfalfa or grass. Lutana is the most common cultivar seeded at this time, although a newly released cultivar, Monarch, is reported to have improved seedling emergence. Early spring and fall production of cicer milkvetch is comparable to alfalfa, but not as high as for grass pastures.

Cicer milkvetch should not be discounted for use as irrigated pasture under specific conditions, but it does not appear to be as suitable as either grass or alfalfa.

Sainfoin and birdsfoot trefoil are legumes that do not cause bloat, but they are not recommended for irrigated pasture in Nebraska. Sainfoin is better adapted to dryland rather than irrigated pasture conditions. Birdsfoot trefoil has been used successfully for pasture in the cornbelt states under non-irrigationd conditions, but under irrigation it has shown a poor rate of recovery after grazing.

Ladino clover has not been evaluated for irrigated pasture in Nebraska. However, research in other states indicates that it causes bloat like alfalfa, but usually does not produce as well.

Other clovers that might be considered include red and alsike clover. Trials have not been evaluated in Nebraska for irrigated pasture use, but these legumes are commonly seeded in subirrigationd meadows. Their potential for irrigated pasture is not impressive since, due to short plant longevity, they must re-seed themselves to remain part of the stand. Under intensive grazing practices, natural re-seeding would not occur. These clovers can also cause bloat when grazed.

Grass-Legume Mixtures

Alfalfa is the most common legume mixed with grass for irrigated pasture. Recommended seeding rates and mixtures are shown in *Table II*.

Animal bloat can also be a problem with alfalfa-grass mixtures. The precautions mentioned for alfalfa also apply to alfalfa-grass mixtures. Maintaining the desired proportions of alfalfa and grass in the stand can be manipulated to some degree by proper fertilization.

Grasses and Grass Mixtures

Stands of individual grasses or mixtures of grasses are more commonly seeded in Nebraska than legume or legume-grass mixtures for irrigated pastures. Recommended seeding rates and mixtures are given in *Table II*.

Table II. Recommended mixtures and species for seeding irrigated pastures in Nebraska.*

		Seeding rate		
Species		***Pounds PLS/A****	***Composition of mixture (%)***	***Seeds per sq. ft.***
I	Orchardgrass	6	74	90
	Smooth bromegrass	10	26	31
	Total	**16**	**100**	**121**
II	Orchardgrass	5	64	75
	Smooth bromegrass	4	10	12
	Meadow bromegrass	7	11	13
	Garrison creeping foxtail	1	15	17
	Total	**16**	**100**	**117**

Species		*Pounds PLS/A***	*Composition of mixture (%)*	*Seeds per sq. ft.*
III	Intermediate wheatgrass	22	100	45
IV	Alfalfa	10	100	50
V	Orchardgrass	5	62	75
	Smooth bromegrass	8	21	25
	Alfalfa	4	17	20
	Total	**17**	**100**	**120**
VI	Orchardgrass	5	57	75
	Smooth bromegrass	3	7	9
	Meadow bromegrass	5	7	9
	Garrison creeping foxtail	1	13	17
	Alfalfa	4	16	20
	Total	**18**	**100**	**130**

Refer to discussion by species for suggested varieties.
****PLS = Pure live seed: PLS—Germination x purity***

Table III gives a comparison of animal gains from single species grass stands. All gains were considered acceptable for irrigated pasture although there are some differences among grasses.

Table III. Steer gains for live grass under irrigated pasture conditions, North Platte station. All values are 3-year averages.

	Spring-summer grazing period with yearlings		*Fall grazing period with calves*		
Grass	***ADG., lb***	***Gain/A***	***ADG., lb***	***Gain/A***	***Total Gain lb/A***
Orchardgrass	1.49	716	1.05	224	940
Smooth bromegrass	1.71	705	0.91	136	841
Meadow bromegrass	1.64	770	0.86	121	891
Garrison creeping foxtail	1.68	777	1.11	183	960
Intermediate Wheatgrass	1.77	856	0.88	156	1012

Orchardgrass, a cool-season bunch grass, has gained wide acceptance as an important irrigated pasture grass. It starts growth a little later in the spring than other grasses described here. However, its ability to sustain production during the summer and late fall makes it an important part of irrigated pasture mixtures. Extreme cold and lack of snow cover can contribute to winter kill on orchardgrass, especially if improper irrigation, fertilization and grazing management have preceded a severe winter. Certain cultivars are more winter hardy than others. Those that have been used successfully in Nebraska include Sterling, Napier, Latar and Potomac, with a preference for the first two because of

better winter hardiness.

Smooth bromegrass is a cool-season, sod-forming grass used widely for irrigated pasture and under dryland conditions in eastern Nebraska. It is included in mixtures because of its early growth and because it has rhizomes that help fill voids which may develop in a stand. It does not produce as well during the hot summer as some grasses, and should not be seeded alone for irrigated pasture. Winter hardiness, seedling vigor and rapid stand establishment are rated high for smooth brome. Suggested cultivars include Lincoln, Lyons, Lancaster, Regro and Baylor.

Meadow bromegrass is a cool-season grass with a bunch-type growth form. It reproduces vegetatively by vigorous tillering. Seedling vigor, winter hardiness and stand establishment are excellent. It also makes excellent early growth and has good recovery after grazing. Because of its lax growth form, meadow brome is more suited for use in a mixture than when seeded alone. Regar is the only cultivar available.

Garrison creeping foxtail is a cool-season, sod-forming grass. Like Reed canarygrass, it is well adapted to wet site conditions, but is considered to be of better forage quality. It should be included in mixtures for irrigated pastures that have wet areas or spots that may have standing water during part of the growing season. Garrison is also adapted to normal site conditions. It is tolerant to both moderately acid (pH 5.6-6.0) and moderately alkaline (pH 7.9-8.4) soils and has survived a pH of 9.0 on wet soils.

Although seedling vigor is poor and seedlings are slower to establish than other recommended grasses, tests have shown that Garrison can be successfully established with other grasses in a mixture. It spreads rapidly by rhizomes, which helps it compete during establishment and also fills in any voids in the stand. Garrison is the only cultivar available.

Intermediate wheatgrass, a cool-season, sod-forming grass, has provided excellent quality forage under irrigated pasture conditions when seeded in pure stands. In comparison with other grasses, it has produced excellent animal performance and gains (*Table III*). It has not persisted when seeded in a mixture with other highly competitive grasses. Thus, it is recommended as a single species stand.

Intermediate wheatgrass has excellent seedling vigor and provides good early spring and late fall grazing. It does not produce as well during the hot summer as orchardgrass or meadow brome. Seedhead development is about two weeks later than other grasses commonly used for irrigated pasture, and it can be used later in the spring grazing cycle and still not be headed. It is tolerant of moderately high soil pH (8.0-8.5) and can be seeded on sites that may be poorly suited for other grasses. Slate is the only cultivar recommended because of its known capability under irrigated pasture conditions.

Why Seed a Mixture?

Since no single grass or legume has all of the desirable traits and qualities, mixtures are formulated from comparable components which will have some identifiable purpose in the pasture stand. Each component is expected to contribute something of value.

The components must be similar enough in animal preference and competitive ability to be managed with the others, and yet be diverse enough to contribute something that the others cannot.
Single species stands are sometimes desirable and may simplify management since that species'

requirements can be more easily met than where several species are growing together. However, single species stands are more susceptible to depletion by disease, winterkill, etc., and are not as likely to fit all the growing conditions found within a pasture.

Seed Known Cultivars

Plant materials selected for irrigated pasture should consist of known cultivars. Cultivars are selected to express important traits of a particular species and can have an impact on the performance of an irrigated pasture. Choosing superior cultivars is just as important as choosing the right species.

Recommended Plants for irrigated Pasture

Table IV lists the recommended grasses and legumes for seeding irrigated pasture in Nebraska. Recommended seeding rates and mixtures are presented in *Table II*. These recommendations are considered the most likely to succeed as irrigated pasture based on the information now available.

Table IV. Common name, Latin name and number or seeds per pound for plant materials recommended for seeding irrigated pasture.

Common name	***Latin name***	***Seeds/lb****
Alfalfa	(*Medicago sativa*)	220,000
Garrison creeping foxtail	(*Alopercurus arundinaceus*)	750,000
Intermediate wheatgrass	(*Agropyron intermedium*)	88,000
Meadow bromegrass	(*Bromus beibersteinii*)	80,000
Orchardgrass	(*Dactyls glomerata*)	650,000
Smooth bromegrass	(*Bromus inermis*)	135,000

*Based on average values, individual lots of seed may vary.

[1]See NebGuide *G77-357, Alfalfa Variety Selection*, for comparative tests of alfalfa cultivars.

[2]Bloat Guard is the registered trademark of Smith Kline and French Laboratories. Mention of this product does not imply endorsement by the Nebraska Cooperative Extension Service, but is used only for illustrative purposes.

File G567 under: RANGE AND FORAGE RESOURCES
Forages
Issued September 1981; 15,000 printed.

Electronic version issued August 1996

mailto:pubs@unl.edu?subject=Comments from G567

Beef Production and Water Use Efficiency of Eight Irrigated Pasture Grasses 1/

James T. Nichols and Milan J. Moore 2/

INTRODUCTION

Six factors that influence beef cattle production from irrigated pasture were discussed in the proceedings of the 1974 Nebraska Irrigation Short Course.
These factors were listed as

1. Soils and site selection
2. Pasture stand
3. Irrigation
4. Fertilization
5. Grazing management
6. Livestock response.

Each of these factors influence total pasture productivity, not independently but as components of a total production system. Their combined effects are ultimately expressed as animal gain per acre. This paper will consider only number (2) "Pasture stand" and more specifically, a relative comparison of the productivity and efficiency of water use among eight irrigated pasture grasses.

The productivity that can be expected from any irrigated pasture is closely related to the species of grasses that are seeded. Grasses differ in inherent productivity and suitability for irrigated pasture production. When irrigation is used as a stimulus to production, the efficiency of water use becomes closely associated with pasture production and animal gain per acre.

DESCRIPTION OF STUDY

Grasses Studied: Eight grasses were established as individual stands in late April and early May of 1972. Table 1 lists the common name, scientific name and variety of each grass. All grasses seeded were cool-season grasses and include those considered to be the most promising for irrigated pasture use.

Table 1. Grasses evaluated for irrigated pasture.

	Common name	Scientific name	Variety
1.	Orchardgrass	Dactylis glomerata	Sterling
2.	Reed canarygrass	Phalaris arundinaces	Ioreed
3.	Meadow bromegrass	Bromus beibersteinii	Regar
4.	Smooth bromegrass	Broms inermis	Lincoln
5.	Russian wildrye	Elymus junceus	Vinall
6.	Tall fescue	Festuca arundinacea	Kenmont
7.	Garrison creeping foxtail	Alopecurus arundinaceus	1/
8.	Intermediate wheatgrass	Agropyron intermedium	Slate

1/ Varieties have not been selected for this species.

-1- Prepared for: Nebraska Irrigation Short Course, Nebraska Center for Continuing Education, University of Nebraska, Lincoln. Jan 24-25, 1977. Support for this project was received in part from the Office of Water Research and Technology, U.S. Department of the Interior under Public Law 88-379 and the Nebraska Water Resources Center.

-2- Professor of Agronomy (Range & Forage) and Graduate Assistant, respectively.

Study conditions and management:

1. Each grass was treated as a separate pasture management unit. The overall management procedure was to allow each grass to express its productive potential by subjecting it to as near optimum management and growing conditions as possible.
2. Yearling steers were grazed from May 1 to September 10. Weaned calves were grazed starting October 15 for at least 28 days. This interval between use by yearling steers and weaned calves provided a 35 day fall deferment from grazing for all grasses.
3. A rotation grazing system with five sub-pastures was used for each grass. Each sub-pasture was grazed about 5-7 days allowing 20-28 days for grass recovery between uses. Grazing pressure was adjusted to the available forage by adding of removing animals as necessary to maintain a proper degree of forage utilization. A designated number of animals were retained on each grass during the entire grazing season for determining average daily gain over the entire grazing season.
4. All grasses were fertilized the same with a three year average of about 260 lb nitrogen, and 50 lb of phosphate per acre per year.
5. Each grass was watered independently according to the soil-water status of each pasture to maintain near optimum growing conditions. This required an average of about 28 inches of irrigation water applied during each growing season. Annual precipitation averaged about 16 inches.

GRASS AND ANIMAL PERFORMANCE

Grazing Capacity indicates the relative amount of forage produced by each grass providing palatability is similar among grasses (table 2). Poor animal acceptance of forage from tall fescue increased the grazing capacity beyond what could be expected based on actual dry matter production. Tall fescue averaged 16.8 AUM's per acre for the three years of the study (table 2) but produced less animal gain than other grasses (table 3). Values for other grasses ranged from a high of 13.5 AUM's per acre for orchardgrass to a low of 9.9 for Russian wildrye. Grazing capacity alone is not adequate to evaluate grasses unless forage quality is known. For example, tall fescue provided the highest AUM's of grazing but produced the lowest total animal gain per acre because of low quality forage.

Table 2. Average grazing capacity of eight irrigated pasture grasses (1973-75)

	Spring & Summer Use	Fall Use	Total 1/
	Yearling Days/A	Calf Days/A	AUM's/A
Orchardgrass	463	208	13.5
Reed canarygrass	402	135	10.9
Meadow bromegrass	447	144	12.1
Smooth bromegrass	397	148	11.1
Russian wildrye	372	114	9.9
Tall fescue	614	209	16.8
Garrison creeping foxtail	442	166	12.3
Intermediate wheatgrass	456	177	12.8
Average	**449**	**163**	**12.4**

1/ AUM = Animal Unit Month. Defined as the amount of forage required to maintain one mature cow (1000 lb) for one month. Yearling steer = .65 AUM. Weaned calf = .50 AUM.

Average daily gain (ADG) of yearling steers during the spring and summer and for calves during the fall indicates the forage quality of the eight grasses (table 3). Spring and summer gains were acceptable for all grasses, except those from tall fescue which were less than half compared to other grasses. The ADG for weaned calves in the fall was poorest for tall fescue and Reed canarygrasses.

Table 3. Average daily gain (ADG) and gain per acre for eight irrigated pasture grasses. All values are an average for three years (1973-75).

SPECIES	ADG (lb) Yearling Steers, Spring and Summer	ADG (lb) Weaned calves, Fall	Gain /A1/ (lb)
Orchardgrass	1.49	1.05	940
Reed canarygrass	1.58	0.42	727
Meadow bromegrass	1.64	0.86	892
Smooth bromegrass	1.71	0.91	842
Russian wildrye	1.70	0.81	728
Tall fescue	0.72	0.58	562
Garrison creeping foxtail	1.68	1.11	960
Intermediate wheatgrass	1.77	0.88	1012
Average			**833**

1/ These values are the sum of gains from individual weigh periods which are calculated from ADG and animal numbers during that period.

Gain per acre expresses the total production capability of each grass. Since this figure is a product of the grazing capacity of the grass and the ADG of the grazing animal it more completely estimates the relative productivity among grasses. Intermediate wheatgrass followed by Garrison creeping foxtail, orchardgrass, meadow bromegrass and smooth bromegrass were the highest producers (table 3). Tall fescue, Russian wildrye and Reed canarygrass were less productive and considered less desirable as irrigated pasture grasses.

WATER USE EFFICIENCY

The soil water status of each grass was monitored independently and maintained at near optimum conditions by irrigation. The quantity of water, including precipitation, that was used by each grass provided a basis for determining relative efficiency of water for producing cattle gains. Five grasses, orchardgrass, meadow bromegrass, smooth bromegrass, Garrison creeping foxtail and intermediate wheatgrass were the most efficient (table 4). The most productive grass, intermediate wheatgrass, was more than twice as efficient as the least efficient grass, tall fescue. Since steer gains are the end product of an irrigated pasture system, this value is more meaningful than water-use efficiency based on dry-matter production. For example, tall fescue produced as much dry matter and more steer days of grazing than other grasses, but was low in efficiency of water use because of poor animal performance.

Certain periods of the growing season were more efficient in producing animal gains than others. This relationship is shown in Figure 1 where steer gains produced per month were highest in the spring and early summer when water use was the lowest. Since precipitation is highest in the spring,

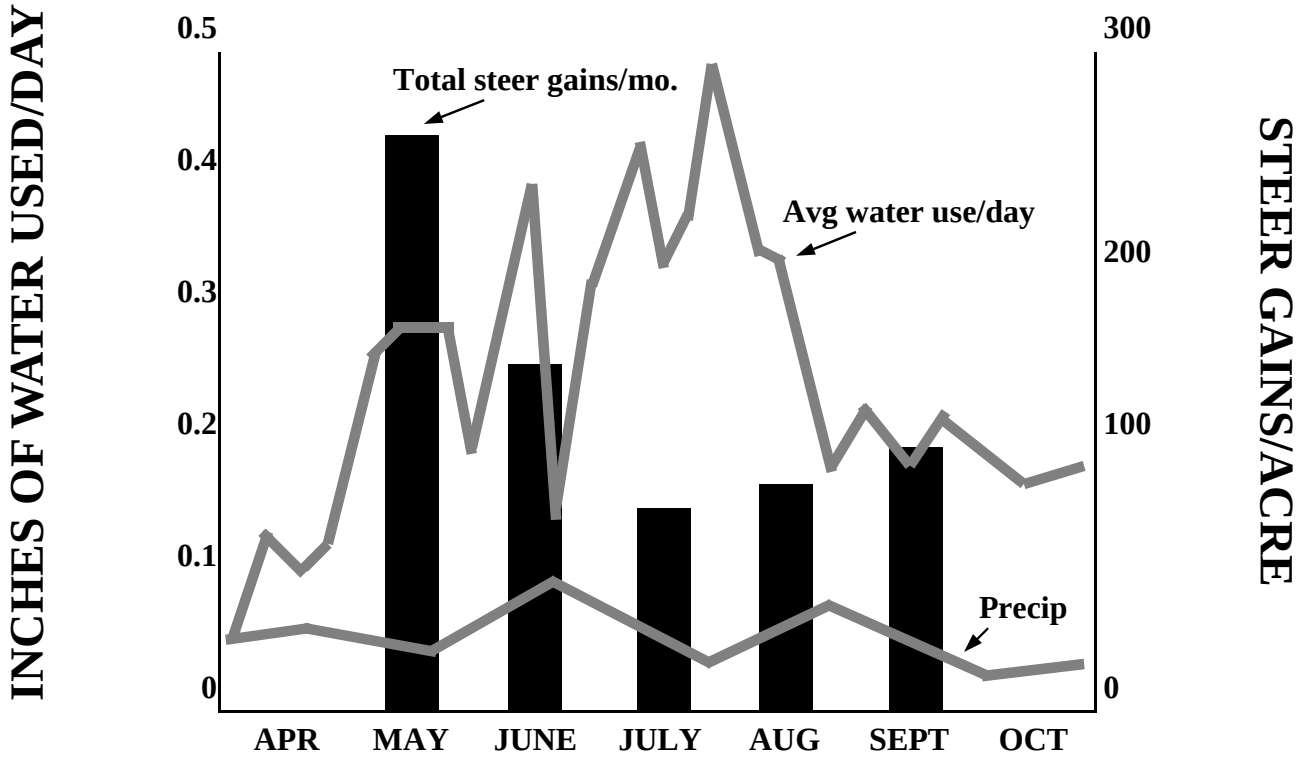


FIGURE 1. Average steer gains per month as related to average water use per day and precipitation for the 1974 growing season. Values are averages over 8 grasses. Water use is the amount of total water received from precipitation and applied by irrigation to optimize soil water for plant growth.

this also reduces the need for irrigation water during this period. During the months of July and August, gains are lowest but water use is the highest. The high water use period during the summer months coincides with weather condition which are conducive to high water use by evapotranspiration and high evaporative loss from sprinkler irrigation.

Table 4. Pounds of animal gain per acre produced per acre-inch of irrigation water applied for eight irrigated pasture grasses.

	1973	1974	1975	3-yr-avg
Orchardgrass	34.0	27.4	39.9	33.1
Reed canarygrass	29.0	25.6	25.6	26.5
Meadow bromegrass	34.5	30.8	31.5	32.0
Smooth bromegrass	25.4	32.2	36.1	31.3
Russian wildrye	27.7	21.3	27.9	25.2
Tall fescue	17.0	16.8	22.7	18.6
Garrison creeping foxtail	32.0	28.8	37.0	32.4
Intermediate wheatgrass	44.2	34.2	41.3	39.2

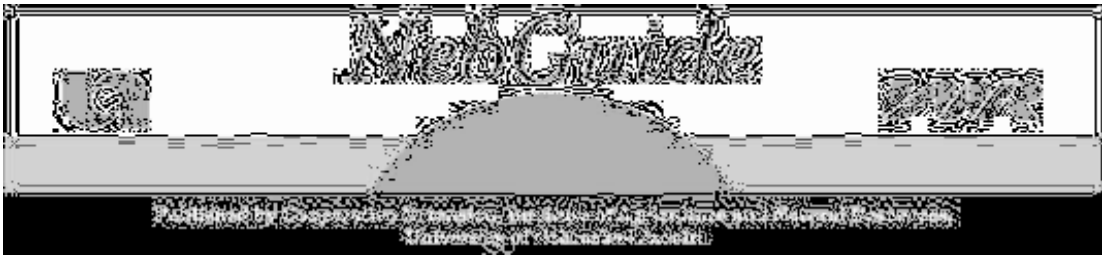
MANAGEMENT CONSIDERATIONS

Figure 1 suggest that certain management alternatives could reduce the amount of water used during the growing season for irrigated pasture production. A considerable increase in the total seasonal water-use efficiency could be accomplished by irrigation primarily in the spring and fall when forage production and animal gains are higher and water use is lower. This is possible for grass production, but could not be a consideration for annual grain production. Grain crops require that growth processes be active until completion of the life cycle terminates in the formation of grain. However, the growth of perennial grasses used for irrigated pasture can be interrupted during the time of least efficient water use (July and August) and then resumed in the late summer and fall when more favorable growing conditions prevail. During the months of July and August, it may be feasible to exclude this grazing period in an irrigated pasture program. This would require alternate sources of forage or modification of livestock programs to fit these condition.

Periods of most efficient water use coincide with the time when irrigated pastures are of greatest value as a complementary forage crop to rangeland. Early spring and late fall grazing to extend the "green feed" period beyond what is possible with rangeland has been shown to be a desirable practice.

SUMMARY

A comparison of eight grasses for use as irrigated pasture indicated that orchardgrass, smooth bromegrass, meadow bromegrass, Garrison creeping foxtail and intermediate wheatgrass produced the highest gain per acre and made the most efficient use of precipitation and irrigation water. The remaining three grasses, tall fescue, feed canarygrass and Russian wildrye were less productive and required more water per pound of gain. During early spring and summer, steer gains were made with less water used than during July and August. This suggests that management alternatives could improve on the seasonal efficiency of water use for irrigated pasture by using other sources of forage during the least efficient production period or by modifying livestock programs.



Grazing Management of Irrigated Grass Pastures

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.

James T. Nichols, Extension Specialist--Range Management

[Previous Category] [Catalog] [Order Info]

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.

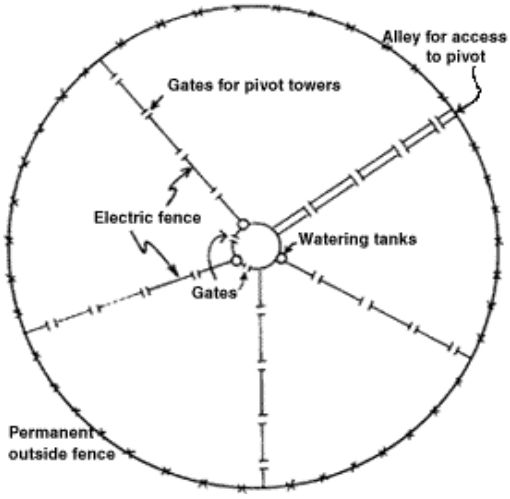
Grazing Management Systems

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 p asture 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 1. 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	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 mature bull	1.25	1.2	1.3	1.4	1.7	1.8	1.9	2.1	2.2
Mature cow with calf, 4 months	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 pounds non-lactation cow for one month.

File G563 under: Range and Forage Resources
B-7, Pasture Management
Issued August 1981; 15,000 printed.

Electronic version issued October 1996
mailto:pubs@unl.edu?subject=Comments from G563

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Kenneth R. Bolen, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

COOL-SEASON OPTIONS

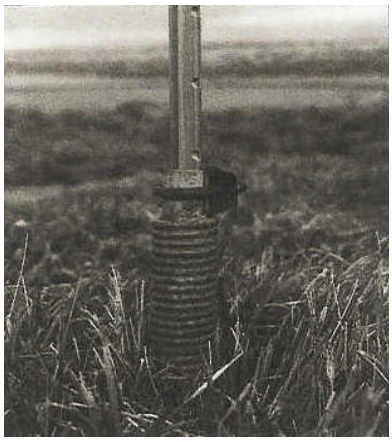
A 314-ACRE IRRIGATED GRAZING SYSTEM ADDS NECESSARY FLEXIBILITY WHILE REPLACING 9,000 ACRES OF DRY RANGELAND

Pushing land and beef production to the limit is a prime management technique for Sam Hands.

His beef herd benefits from intensified herd health, nutrition, and genetic management, which has pushed average weaning weight from 420 lbs. in the 1960s to more than 600 lbs. in 1986.

Hands' Triangle H Grain and Cattle Co., Garden City KS, didn't end with the beef. The company has incorporated a rotational grazing system on 314 acres of cool-season irrigated pasture and 105 acres of improved native grass to further push beef production averages to between 700 to 800 lbs. of beef per acre.

Included in that program is a 160-acre circle planted in 1976 to Sharps Brothers Mixture #6 seed (smooth brome, meadow, orchard grass, Slate intermediate wheatgrass and Garrison creeping foxtail); a 130-acre circle planted in 1973 to half brome, a fourth fescue, a fourth orchard grass; and a 24-acre flood piece planted in 1973 to smooth brome and orchard grass.



This spring device allows the pivot wheels to push the fence over when making irrigation rounds.

Hands figures an equivalent-managed cow herd on all sandhill pasture would require about 9,000 acres and would be producing only 30 lbs. of beef per acre.

The combination of the intensive management program and irrigated pasture allows him to push his beef and crops to the maximum production limit. The program integrates cattle and crops into a balanced program and may very well be an example for farmers in the future.

Hands became interested in cool-season grasses when the family expanded the partnership's cattle herd in the early 1970s.

The grain and cattle company, which consists of Hands (cattle); his brothers, Greg (finances) and Cedric (grain handling and storage); and their father, Fielding (overall adviser), owns the cattle and equipment, but rents 5,400 acres for farm crop production.

By Becky Ohlde - Irrigation Age-March 1987

Irrigation plays a major role in the farming operation with 32 out of the 34 quarters irrigated under fold or center-pivot.

"We've always had cows and really thought they'd been our most efficient means of cleaning up crop residue and utilizing the grains that didn't get harvested," Hands says. "This method also helps us reduce volunteers in the up-coming year's crop, which reduces costs."

But as the herd grew, they found they were going to be short of available pasture. Options included finding sandhill grassland, using temporary pasture, or going into cool-season irrigated pasture.

The extreme high land prices in the 1970s favored the latter. The option meant running 300 to 350 cows on less than an acre per cow-calf unit.

Not only was this the least expensive option, the family was also able to develop poorer quarters for the pastures that were more strategically located. The cool-season grasses have proven to be a more stable pasture system, and one that isn't dependent on the weather while adding a lot of flexibility.

Timing, though, is a major advantage. "The pasture is ready to use by the time the cows come off of spring wheat or winter residue pastures. And, when the grass is needing to be relieved in the fall, the volunteer wheat or early corn residues pasture is again available," he says. "The timing fits real well."

Hands discovered a major problem with the pasture system almost immediately. "We had one water trough in one corner and we turned the cows and their calves in there and they'd only utilize one-third of the circle because that's all the further they needed to go for their groceries," he says. 'One-third of it was being abused and two-thirds of it was just stockpiling."

He solved the inefficiency by splitting the two circles into fourths, creating eight paddocks and a rotational grazing system.

When grazing "mows" the grasses to a desired level, the cattle are moved to the next paddock. Says Hands, "Now they'll

Putting it all together

Sam Hands wasn't the first in his area to use an irrigated cool-season grazing system. It still wasn't easy putting the pieces together. Consultations with grass experts weren't productive because they'd say, " 'We know the grasses but not under your conditions.' They were real reluctant to give recommendations. I had to rely some on my neighbors."

He started by planting sudan in two adjoining circles in the spring. It was grazed until August, when he removed the cattle and shredded the sudan. He applied a starter fertilizer and drilled grass seed into the residue, then irrigated to grow the newly seeded grass and bring back the sudan.

The sudan died with the killing frost, making a good cover to protect the new cool-season grasses. The new grasses grew on into winter dormancy, then started anew in April.

Grazing started that spring on the circles, while his flood irrigated pasture was being planted for fall grazing. "The beautiful part is that we never lost any grazing time," he says.

He fought problems others had had — overgrazing and parasite infestation — by stocking his pasture at a level that was going to get him through the tough summer months.

The normal practice was to graze two cow-calf units per acre, which was too much pressure for the grass. "We never reached that level," he says, "because the grass was all we had to exist on for six months. Others had feeding capabilities that I didn't have. During the dormant season they fed supplemental feed and I couldn't."

Palatability, too was a problem he faced, one he blames on lack of knowledge and experience in grass management. The less palatable grasses — fescue on the 130-acre circle and intermediate wheatgrass on the 160-acre circle — just weren't being utilized.

For his system to work, the grasses must be of equal palatability. Rotating helped rectify the problem. He also used an experimental plant growth regulator that suppresses seedhead production and increases grazing efficiency.

Hands suggests careful analysis of grass varieties. "A lot of grass mixtures are put together from a seasonal standpoint, mixing grasses that reach their growth spurts at different intervals to provide reliable grazing all of the time."

Limiting factors are water and nutrition. Cool-season grasses are best adapted when they get at least 36 in. of rainfall a year. Hands says the average annual rainfall is 15 to 18 in. in Garden City, KS. He irrigates with at least another 20 in. of water annually.

He equates fertilizer needs to that of corn — about 250 lbs. Of N per year. Soil tests are taken in July. In late August of September, a third of the nitrogen needed for the coming year is applied, allowing the plants to develop a good healthy root system for the winter. If only nitrogen is needed, he fertigates. If phosphorus, potash of any other nutrients are needed, he applies a dry form.

He applies another third of N in February in dry form. From April through mid-June, 30 lbs. Of nitrogen is fertigated in three separate applications following grazing.

Hands started rotational grazing in 1983 by dividing the 130-acre circle into four parts, the adjoining circle was divided in half in 1984 and into fourths in 1985. He is now using the two circles in an eight paddock rotation.

almost tell you when it's time to move.

Seven paddocks are rested at an average of 25 rest days per paddock between grazing, he says. If the grass in one of the paddocks gets ahead, it's baled for hay.

By keeping the grasses at a more productive level, Hands found the grazing system has minimized the amount of dormancy and seed production in the grasses, helped control overgrazing, and offered good weed control.

The big expenses, he says, are in irrigation and fertilization. Despite the costs, he believes the grazing system gives him an increased output per acre in beef and grass production.

After changing to the rotational grazing system, Hands realized that it would be more efficient to run one cow herd instead of two. So, in 1984 the stated to phase-out the fall cow herd — a process that took two years to complete.

"Both herds really worked for us in a lot of respects," Hands says. "In some ways the fall herd was most ideal because of the fact that during the fall the cows were on good crop residue and would cycle well. The calves were good size coming onto the grass and really could take advantage of it."

By making the shift in the cow herd, he was able to better concentrate labor. He believes the shift gave them a greater number of calves to work with in a stocker program because the calves were weaned in the fall.

And, by acquiring a growing yard, they could spend more of their fall time, in addition to farm schedules, working with receiving and preparing stockers for the stocker program.

He calls his newly-acquired growing and pre-conditioning yard a "rehabilitation yard. The kind of cattle that go through our yard are almost totally opposite from the cattle we produce in our cow herd. They're basically somebody else's misfits that we buy at the sale."

Sam Hands demonstrated the flexible movement of a post. His family-owed company has successfully used mitigated cool-season grazing rotation foe several years

Once he has the cattle conditioned, he moves them to the commercial yard or the pasture. "We're strictly a growing yard, pre-conditioning type of situation. All our finishing is done at one of the commercial yards in the area."

In addition to buying and straightening out their own stocker calves, Hands also offers customer programs.

One might say that Hands has it all — a cow-calf herd, a stocker program and a growing yard. By combining these three programs with the irrigated grasses he can capitalize on an option he made — not one he chose.

AGRONOMY DEPARTMENT REPORT

College of Agriculture
University of Nebraska-Lincoln
Lincoln, Nebraska

Miscellaneous
Report No. 2
March 1973

IRRIGATED PASTURES NEED FERTILIZER

W. J. Moline, George Rehm and J. T. Nichols

Sound Fertility Management – Is One Key to Successful Irrigated Pastures and Haylands.

The popularity of irrigated pastures for pasture has increased in Nebraska. This is the result of improvements in irrigation equipment readily available water, and the current profit picture of beef cattle production.

Most irrigated pastures contain a mixture of grasses and legumes. Special attention must be given to the fertilizer program because the rates of added nutrients will change yields as well as percentages of grasses and legumes.

Fertilizer studies with irrigated pastures were conducted in Holt County and at the North Platte Experiment Station. Beginning in 1970, several rates of nitrogen (N), phosphorus (P) and Potassium (K), were applied to an established mixture of bromegrass, orchardgrass and alfalfa under irrigation at each location.

Increased Yields

Yields from the Holt County location show that forage production was increased by the application of both N and P with the combination of N and P producing the highest yields (Table 1). N rates up to 225 lb/acre increased yields but higher rates produced no significant increases. Yields were also increased by phosphorus rates up to and including 80 lb/acre. There was no significant yield response from applied potassium.

At North Platte, yields increased from added N but not from phosphorus (Table 2). Yields at this site increased with N rates up to 800 lb/acre. It is doubtful, however, if the use of these high rates of N would be economical.

The difference in P response at the two locations is explained by the soil levels of available P. The Dunday soil at the Holt County site is very low in available P (4 ppm) while the Bridgeport soil at North Platte has a very high level (36 ppm).

Data in Tables 1 and 2 show that higher yields were recorded at North Platte. This difference may be due, in part, to the number of cuttings taken and the frequency of water application plus a longer growing season. Four cuttings were taken at North Platte, three at the Holt County site. Water may have been limiting at one or more times during the season at the Holt County site while ample water was applied at North Platte.

Field experiments suggest that irrigated pastures require from 200 to 225 lb N/acre for best production. The P requirements will vary with the level of available P in the soil. For soils testing low in P, a yearly application of 40-50 lb P_2O_5/acre (20-22 lb P/acre) may be necessary to maintain pasture production. More fertile soils need smaller amounts.

There is some concern about changes in the composition of grass legume pasture that result from added fertilizer. The Holt County pasture was 80 to 85% grass. The alfalfa component increased and the grass decreased with high rates of nitrogen.

Although these studies did not show a response to potassium this nutrient is needed for alfalfa production on soils with low potassium levels. Some sandy soils in Nebraska are low in K. Potassium should be applied to help maintain the alfalfa.

In addition, several studies have shown that sulfur and lime are needed for alfalfa production in some situations. The lime requirement can be determined by a soil test. Generally, sulfur will be required on sandy soils, and an application of 100 lb sulfur per acre should last for three years.

Forage Quality

In evaluating response to fertilizer, quality as well as quantity of forage must be considered. Protein content as well as the percentage of digestible dry matter was measured on samples collected from Holt County.

Applied fertilizer had no consistent effect on percentage of digestible dry matter in the irrigated forage. This percentage appeared better related to the relative amounts of grasses and alfalfa in the mixture.

Application of N increased the protein content of irrigated forage, but the addition of P and K had no effect on this value. Taking the protein content as well as the amount of forage produced into consideration, the use of N significantly increased the total amount of protein produced on a per acre basis (Table 3). This protein produced in the forage need not be supplied from another source.

Conclusions

Information from fertility studies with irrigated pastures in Nebraska shows:

1. Application of from 200 to 225 lb N per acre is necessary for good pasture production. The usefulness of higher rates is questionable.
2. Use of P is needed on soils with low or very low soil test levels of this nutrient. Yearly applications of 40-50 lb P_2O_5 per acre may be needed.
3. Although there was no response to potassium at the two sites studied some potash may be beneficial on sandy soils with low levels of this nutrient.
4. Lime should be added according to soil-test results.
5. Sulfur will be needed to maintain alfalfa stands on sandy soils.
6. In addition to increasing yields, the use of N also increases quality of irrigated forage produced from the grass-legume mixtures.

W. J. Moline is Extension Agronomist (Forage Crops), Department of Agronomy, Lincoln. G. W. Rehm is District Extension Specialist (Soils), Northeast Station, Concord. J. T. Nichols is District Extension Specialist (Range Management), North Platte Station.

Table 1. Total forage yields (tons/acre) of irrigated pasture in Holt County in 1971.

P	N (lb/acre)				
(lb/acre)	0	75	150	225	300
0	2.48	3.86	4.67	4.94	4.65
20	3.12	4.51	5.34	5.62	5.34
40	.346	4.86	5.71	6.01	5.75
60	3.62	5.04	5.90	6.22	5.97
80	3.70	5.14	6.02	6.35	6.12

Table 2. Total forage yields (tons/acre) of irrigated pasture at North Platte in 1971.

P	N (lb/acre)				
(lb/acre)	0	75	150	300	300
0	6.34	6.95	7.78	7.92	8.96
30	6.38	6.98	7.50	7.95	8.96
60	6.43	7.03	7.54	7.97	8.96
90	6.49	7.08	7.59	8.02	8.98

Table 3. Total protein production (lb/acre) from the Holt County site in 1970 as influenced by applied N and P.

P	N (lb/acre)				
(lb/acre)	0	75	150	225	300
0	185	503	744	907	992
20	235	565	817	922	1090
40	261	603	868	1054	1164
60	264	618	894	1093	1214
80	243	609	897	1108	1241

Planting the proper grasses is vital for irrigated pastures

By D. Bruce Bosley
Extension Director/Agronomist
Morgan County, CO

A few High Plains farmers are using irrigated pastures as an alternative to raising corn or other animal feeds.

This land use can simplify seasonal work overloading and may reduce farm equipment needs by elimination most planting, tillage and harvesting operations. Whether to use a field for raising crops or raising grazing forage is a matter of personal preference. Either use can support a profitable farm enterprise. Because irrigated crops are well understood, this column will focus on irrigated pastures.

Seeding the correct perennial grasses and legumes is important for high production from irrigated pasture. The best management cannot overcome the shortcomings of poorly adapted species, which lack the characteristics necessary for high production. Selecting the right plant materials is an important decision, which should be made early in the planting stage.

Several plant characteristics are important when considering what to plant for irrigated pasture. Plants must be: adapted to and tolerant of the climatic, soil and site conditions; genetically and physiologically capable of producing high forage yields, and able to respond to high levels of fertilizer and irrigation to achieve a high grazing capacity; readily consumed by the grazing animal and of good nutritive value; persistent and tolerant to grazing pressure for a reasonable long pasture life; capable of good regrowth after grazing for sustained season-long production; capable of being readily established by using good cultural practices and equipment, which is easily obtainable; and compatible with other species when used in a mixture.

Cool-season introduced grasses are much more productive than native range species and warm season grasses under irrigated and fertilized conditions. Research yields of fertilized and irrigated orchardgrasses, a cool-season grass, are nearly double that of native grasses managed under the same conditions. Yearling steer performance on spring and summer grazed irrigated cool-season pastures may be as much 1.7 pounds average daily gain, and 850 pounds gained per acre.

Cool-season grasses are better adapted to the environment of an irrigated pasture, responding more readily to water, fertilizer and proper grazing management. Cool-season grasses can be stimulated to be productive during the hot part of the summer, but warm-season grasses cannot be made to grow during early spring and fall, when soil and air temperature are cool. The time for primary growth for cool-season grasses more nearly coincides with a that of critical forage needs of most livestock producers.

Grass-legume mixtures can be useful in improving the forage quality of the pasture to improve livestock performances. Of the possible legumes studied, only alfalfa appears to warrants serious consideration for inclusion in pasture mix.

Animal bloat is a problem when alfalfa is grazed. All alfalfa varieties have potential to cause bloat. However grazing types are less likely to bloat, especially when inter-seeded with grasses. Use of anti-bloat supplements. Along with other practices, can further overcome bloat problems when grazing alfalfa-grass pastures.

No single grass or legume has all of the traits and qualities desired for an irrigated pasture. Therefore, mixtures are commonly formulated from compatible components, which will have some identifiable purpose in the pasture stand. The components must be similar enough in animal preference and competitive ability to be managed with the others, and yet be diverse enough to contribute something that the others cannot.

Single species stands are sometimes desirable and may simplify management, since that species requirements can be more easily met than where several species are growing together. However, single species stands are more susceptible to depletion by disease, winterkill, etc.

GREEN & GROWING

Observations on Irrigated Pasture Grasses

By Bruce Bosley, CSU Extension Service

Many farmers are experimenting with developing irrigated pastures to enhance their livestock operations and reduce their reliance on crop production. They are emphasizing more management. Labor, time and equipment on their livestock enterprises and are de-emphasizing the same features on their crop enterprises. I would like to share some observation made during a recent tour of irrigated pastures.

Irrigated pastures are designed as a permanent crop system. This, of course, is relative as much as anything is permanent. But one should expect at least 10 years from a well designed and managed pasture. The features for a good design include: grazing management consistent with the forages and the long-term goals: and efficient and judicious applications of external inputs such as fertilizer, water, fencing, etc. For an irrigated pasture system to be profitable and successful, all four of these features need careful attention. As in all farming operations, proper timing and good planning make the difference between success and failure.

We evaluated many different stand of "Matua" brome that was planted in Morgan County over the past few years. This last winter has been hard on many over wintering annuals and perennial plants and we expected that this would be a good year to evaluate the suitability of this variety of grass. We found some pastures of Matua had over wintered well while others had survived very poorly. The critical aspect seems to have been the degree of grazing in the fall and, to some extent, the amount of water that was available throughout winter and early spring. Sandy knobs and heavily grazed fall pastures had more severe winterkill than heavier soils and light to nonexistent fall grazing. This appears to be a grass variety that is more prone to winterkill than other varieties commonly planted in this area.

We observed another negative feature of Matua. Matua in the well managed pastures was consistently less vigorous than other grass species that we observed on our tour. The crown diameter (a yardstick of health and growth potential) was less and the spring regrowth was disappointing even under the best conditions. All things considered, I am not very impressed with this grass species and don't recommend it for this area of the country.

Regar Meadow Brome, on the other hand looks to be a grass variety worth considering for an irrigated pasture setting. It has good winter hardiness for the High plains region. It has a much better palatability, faster regrowth, and warm season growth during the summer than Lincoln smooth brome. It has good drought tolerance which is an important feature for pastures with limited water resources.

Latar Orchard grass is the most palatable and productive grasses grown in this region. Under good management and high irrigation and fertility applications it is by far the best yielder and best in terms of livestock productivity. It has better winter hardiness than Potomac orchard grass (much better than Matua) but is less hearty than Regar meadow brome. It has some drought tolerance but will not perform as well as Regar meadow brome in short water situations. For these two reasons Latar orchard grass should only be considered in situations where there is plenty of irrigation water and grazing and haying are carefully managed.

I have only talked about three grass varieties and how they fit this region. If you have questions about other species/varieties, pasture blends, irrigated pasture management please feel free to contact me, Bruce Bosley, at the Morgan County Extension Center (970/867-2493).

IRRIGATED PASTURE MIXES - PREMIUM VS BARGAIN

Data based on three year study by Dr. James T. Nichols, Professor of Agronomy, University of Nebraska.

The productivity that can be expected from any irrigated pasture is closely related to the species of grasses that are seeded. Grasses differ in inherent productivity and suitability for irrigated pasture production. When irrigation is used as a stimulus to production, the efficiency of water use becomes closely associated with pasture production and animal gain per acre.

GRASS AND ANIMAL PERFORMANCE

SHARP'S PREMIUM IRRIGATED MIX	**Beef #/acre**	**ADG**	**lbs. of animal gain per acre produced per acre-inch of irrigation water applied.**
30% Orchardgrass	940	1.49	33
20% Inter. Wheatgrass	1012	1.77	39
20% Meadow Brome	892	1.64	32
20% Smooth Brome	842	1.71	31
10% Creeping Foxtail	960	1.68	32
Avg.	**930**	**1.66**	**33.40**
ECONOMY PASTURE MIX			
25% Smooth Brome	842	1.71	31
25% Orchardgrass	940	1.49	33
25% Perennial Ryegrass	500	.72	15
25% Tall Fescue	562	.70	17
Avg.	**711**	**1.16**	**24**

Grazing capacity indicates the relative amount of forage produced by each grass providing palatability is similar among grasses. Poor animal acceptance of forage from tall fescue increased the grazing capacity beyond what could be expected based on actual dry matter production. Tall fescue averaged 16.8 AUM's (animal unit month) per acre but produced less animal gain. Grazing capacity alone is not adequate to evaluate grasses unless forage quality is known. For example, tall fescue provided the highest AUM's of grazing but produced the lowest total animal gain per acre because of low quality forage.

Gain per acre expresses the total production capability of each grass. Grazing capacity of the grass combined with ADG (average daily gain) of the grazing animal, more completely estimates the relative productivity among grasses.

BEFF lbs. Per ACRE

Sharp's	930	
Economy	723	
difference	219	lbs per acre

Gain per acre per inch of irrigated water

Sharp's	33.40	
Economy	24.00	
difference of	9.4	lbs per acre per acre-inch of water

Grazing period through (May 1 - Sept. 10)

Cattle prices figures at $.85/lb

Cost of seed per acre (figured at 25 lbs/acre)

Sharp's	$3.15/lb * 25 lb = $78.75/acre		
Economy	$1.45/lb * 25 lb = $36.25/acre		
	difference of	$42.50/acre	(What a bargain in seed!!)

Return per acre

Sharp's	930 lbs @ .85 per lb = $790.50/acre		
Economy	711 lbs @ .85 per lb = $604.35/acre		
	difference of	$186.15/acre	(Doesn't look like the inexpensive seed mix was a bargain after all !!)

Average Daily Gain

Sharp's	$1.66 lb per hd per day
Economy	$1.16 lb per hd per day
difference -	.50 lb per hd per day

.50 lb per day times 150 days = 75 lbs per hd

75 lbs times $.85 = $63.75 per hd

Net Return

Sharp's	$790.50 - $78.75 (seed cost/acre) = $711.75 per acre
Economy	$604.35 - $36.25 (seed cost/acre) = $568.10 per acre

Since animal gains are the end product of an irrigated pasture system, only grasses with high forage value should be considered.

**********SUMMARY**********

Trying to save $42.50 per acre in seed cost with competitors mixture of inferior producing grasses could rob the rancher/farmer/stockman several thousand dollars in income.

Consider all the factors before choosing your seed mixture.

SHARP BROS. SEED CO.

The goal of **SHARP BROS. SEED COMPANY** is to provide a top quality product for its customers. This is a tradition handed down from over 80 years of involvement in the seed production industry by the Sharp family members. Officially established in 1958 at Healy, Kansas, **SHARP BROS. SEED COMPANY** has emphasized excellence in seeds of native grasses for both public and private use. As markets expanded, new and improved varieties of both warm and cool season grasses, various legumes, forbs and wildflowers were produced for consumers throughout the Great Plains and inter-mountain areas. Now sales of Buffalo Brand seeds from **SHARP BROS. SEED COMPANY** can be found throughout the United States and several foreign countries.

SHARP BROS. SEED COMPANY actively works with conservation agencies, cattlemen's associations, reclamation agencies, farmers, ranchers and prairie restoration groups in a growing number of areas.

SHARP BROS. SEED COMPANY looks forward to serving the needs of its customers into the 21st Century. By continuing quality productions, modern management, and far reaching visions of future service, we will continue to be a leader in our industry.

FOR THE CATTLEMAN-RANCHER:

We specialize in improved varieties of the native grasses. By utilizing quality warm season and cool season grasses, the rancher can provide for year round, dependable supplies of forage for both grazing and hay production.

FOR THE INDUSTRIALIST:

Mine spoils, road and power right-of-ways and unstable earth structures can be transformed into areas of beauty and established vegetation by the use of native grass seeds, some of which have been especially selected for these purposes.

FOR PRESERVATIONIST/PRAIRIE ENTHUSIAST:

Forty-five varieties of warm season grasses and several varieties of cool season grasses can be combined with legumes and wildflowers to re-create just the proper mixture for the restoration of the prairie vegetation in areas no longer supporting these species.

FOR THE CONSERVATIONIST:

Quality wildlife forage, high seed yield and erosion control can be achieved by introducing the seeds of our native grasses. Additional benefits include suitable winter cover for both birds and mammals, generous amounts of residual cover after the growing season is over, and prime locations for spring nesting of wildlife.

FOR THE HOME LANDSCAPE ENTHUSIAST:

Our wildflower and grass seeds offer beauty combined with low maintenance for the home owner. Not only are native grasses and wildflowers attractive, but are also hardy; they thrive under the most adverse conditions and variable soil types.

FOR THE FARMER:

Whether your needs are large or small, our high quality seeds will produce superior stands of wheat, soybeans and/or forage sorghums and do so at very competitive prices.