

R-1006



Design and Characteristics of the Twice-Over Rotation Grazing System

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Twice-over rotation grazing is a variation of the deferred-rotation grazing system, which involves grazing three or more native pastures in rotation based on the growth stages of key species. In twice-over rotation grazing, livestock are rotated through the system faster than a once-over rotation grazing system, allowing for periods of regrowth of vegetation and resulting in more acceptable forage for livestock throughout the grazing season. A higher quality vegetative regrowth forage is available for livestock use during the second grazing cycle. Twice-over rotation grazing involves more management of the range resource than seasonlong or continuous grazing and will require more attention to the livestock herd. The management recommendations for this grazing system are based on data collected at the Central Grasslands Research Center from 1983 through 1990.

System Design

Number of Pastures

The twice-over rotation grazing system can be implemented with three, four or five pastures. Generally, four pastures are recommended to maximize forage and livestock production while minimizing fencing and water development costs. Four pastures allow for greater flexibility of use than three pastures while still providing desirable amounts of forage and good livestock responses.

Pasture Size

Size of each pasture should be considered on the basis of potential forage productivity from the land, numbers of acres involved in the system, herd size, and number of herds. Maximum or minimum size of individual pastures is determined by the number of animals desired in one herd. A minimum of 40 acres per pasture is suggested to eliminate overcrowding, but smaller pastures may be desired if total land or animal numbers are limited.

Each pasture should be similar in herbage production potential, making some pastures larger than others if dominated with low producing range sites (such as shallow-to-gravel and thin-upland sites). An evaluation of your rangeland should be performed before fencing the pastures. Knowledge of range sites (see Circular R-580, Range Site Identification) and their herbage potential will aid in determining correct pasture sizes. Technical help to determine your range production and carrying capacity is available from your county agent and local Soil Conservation Service office.

Pasture Layout

The twice-over rotation grazing system is relatively simple to design and, generally, can be modified from the producer's current grazing operation. Since many livestock producers already have multi-pastures, designing a twice-over rotation grazing system may mean just adding one or two new fences, or simply changing the rotation of the livestock herd. Pasture layout will generally be determined on water availability, range site productivity, and distance from home base. The layout can range from development of separate pastures (Figure 1), a centrally located pasture center (Figure 2), or fan-shaped radiated fences from a pasture center (Figure 3). The fan-shaped design has been used successfully at the Central Grasslands Research Center near Streeter.

Separate pastures must have a sufficient amount of water in each pasture to maintain the livestock

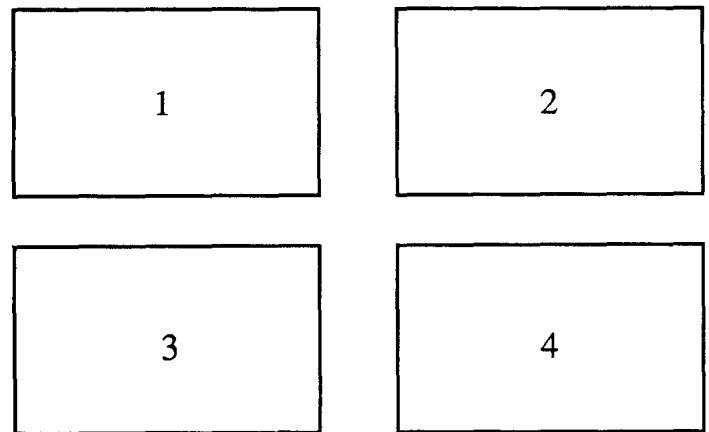


Figure 1. A four-pasture grazing system with pastures not sharing a central point. Three or five pastures may also be designed.

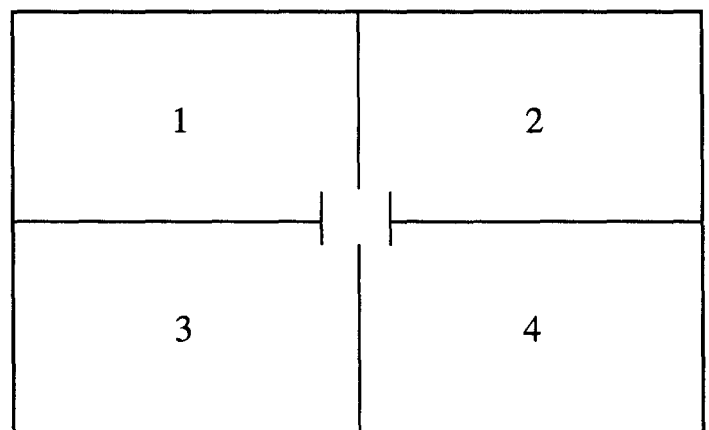


Figure 2. A four-pasture grazing system with a centrally located pasture center.

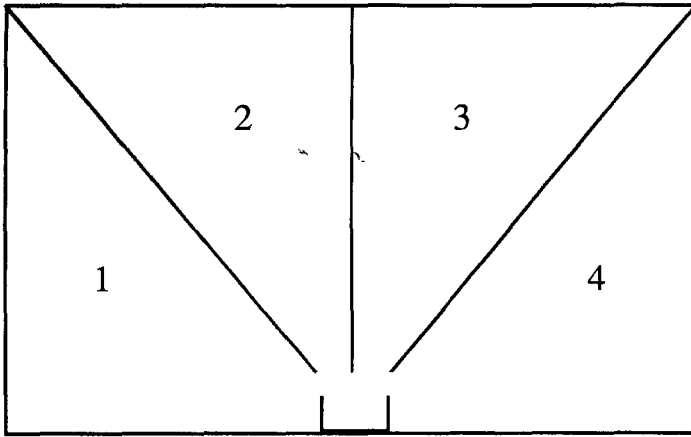


Figure 3. A four-pasture fan-shaped radiating cell design with centrally located watering supply.

herd. The fan-shaped or centrally located designs may or may not need a central watering supply, depending on availability of water in each pasture.

Water

Water is a critical component when designing the pasture layout. Sufficient water must be supplied to meet the daily needs of the livestock herd plus an emergency supply in case of drought or inadequate water levels.

A separate pasture layout design can meet the needs of a grazing system if water is not limited. When water supplies do not meet the minimum requirements for the livestock herd in each pasture, a central watering facility may be desired. Wells may be developed in pastures with insufficient water or located where two or more pastures meet so that one tank can serve several pastures. In some cases, water can be piped from a well to pastures with insufficient water. Stockponds can also serve as permanent water sources, either in individual pasture or as a centrally located water source for all pastures.

Fencing

Permanent or temporary fences can be used in the design of the twice-over rotation grazing system. Boundary fences should be conventional four- or five-strand barb wire or their equivalent. Three- or four-strand barb wire fences have provided adequate control of cattle as interior and boundary fences. Woven fences control sheep, but five-strand barb wire fences have been adequate if the bottom wire is about five to six inches above ground level.

Electric fencing is commonly used when implementing grazing systems, particular when interior cross fences are used (ex. fan-shaped design). All cross fences need not be charged, only those pastures controlling livestock need to be electrified.

Two-wire cross fencing will control cattle. The top wire, approximately 28 to 30 inches from the ground, is charged while the bottom wire is grounded. Electric fences controlling sheep need at least three wires with four being optimum (two hot, two ground). Fiberglass posts are commonly used in electric fences, but steel and wooden posts can be substituted.

Fences should be designed for maximum ease of handling and minimum stress on the livestock and vegetation. Fencing design consideration should be given to creeks, topography, range sites, potholes, roads, etc. to maximize forage production potential among pastures.

Operations

Rotation Cycle

Rotation dates will vary with forage production potential in each pasture, plant growth, and plant species. Initially, rotation dates should be based on calendar dates, then, after considerable experience with the grazing system, on the growth stage of the vegetation.

The rotational schedule of the twice-over rotation grazing system being studied at the Central Grasslands Research Center is set up on calendar dates. The cattle graze one pasture for 20 days and are then rotated to the next pasture. Each of four pastures is grazed for 20 days, twice throughout the grazing season for a total of 40 days per grazing season (Table 1). This system allows for 60 days of rest between each rotation.

A productive native mixed grass prairie is composed of both cool and warm season species. If a pasture is grazed at the same time each year or is overgrazed in a given year, the balance of cool and warm season species can be upset, resulting in a less productive system. **Alternating the first pasture grazed each year is essential to maintaining the**

Table 1. A four year grazing schedule for a four-pasture twice-over rotation grazing system based on 20 day grazing periods per cycle per pasture.

| Date | Days Grazed | Pastures | | | |
|---------------|-------------|----------|------|------|------|
| | | 1 | 2 | 3 | 4 |
| May 28-Jun 16 | 20 | 1990 | 1991 | 1992 | 1993 |
| Jun 17-Jul 6 | 20 | 1993 | 1990 | 1991 | 1992 |
| Jul 7-Jul 26 | 20 | 1992 | 1993 | 1990 | 1991 |
| Jul 26-Aug 15 | 20 | 1991 | 1992 | 1993 | 1990 |
| Aug 16-Sep 4 | 20 | 1990 | 1991 | 1992 | 1993 |
| Sep 5-Sep 24 | 20 | 1993 | 1990 | 1991 | 1992 |
| Sep 25-Oct 14 | 20 | 1992 | 1993 | 1990 | 1991 |
| Oct 15-Nov 3 | 20 | 1991 | 1992 | 1993 | 1990 |

balance of cool and warm season grass species. Start the grazing season in pasture one the first year and in pasture two the second year, leaving pasture one to be grazed last in each rotation cycle in year two. The third year grazing should begin in pasture three, and on the final year of the cycle grazing begins in pasture four. On the fifth year the cycle will start over again in pasture one.

Range Readiness

Range readiness for grazing can never be over-emphasized in proper grazing management. **No grazing system can improve the productivity of the range resource if native range is grazed too early.** Grazing should not begin until about May 20 in southcentral North Dakota and late May in northern North Dakota for proper management of the range resource. Generally, the three- to four-leaf stage on native grasses is a recommended guideline for range readiness.

The use of complementary pastures seeded to introduced domestic grasses is recommended if earlier spring pastures are required. Crested wheatgrass and smooth brome grass are the two most common grasses utilized for spring pastures in North Dakota. Grazing can begin on crested wheatgrass by late April or early May and on smooth brome grass in early May in North Dakota. The three-leaf stage is the recommended guideline when these plant species are ready for grazing.

Grazing Periods

Range sites differ significantly in forage production potential and need to be considered when determining pasture size and length of grazing periods. Each range site is associated with a soil type. The use of soil maps may help you determine range site composition. Determine forage potential of each area to be fenced and adjust fencing layout accordingly.

Records

Records are essential when implementing a rotational grazing system. Records provide the information to make wise, informed decisions and need to be kept in a manner that allows easy analysis and immediate access. A well kept grazing record form will provide the information necessary to make proper decisions. (A sample grazing record form is attached at the end of this circular.)

Vegetation and Livestock Responses

Vegetation

Plant vigor appears to be improved and forage production increased with twice-over rotation grazing when compared to seasonlong grazing. Spot grazing is decreased but will still occur, especially at lower stocking densities. The density of brush species such as western snowberry did not change on the trials at the Central Grasslands Research Center.

Livestock

Producers may wish to increase the stocking rate to achieve the desired forage responses and produce a return on the investment. Studies at the Central Grasslands Research Center showed an increase in stocking rate of 40 percent on the four-pasture twice-over rotation grazing system compared to U.S. Soil Conservation Service recommended rates for seasonlong grazing (Table 3). Both treatments were stocked to utilize no more than 50 to 60 percent of the above ground foliage. More beef was produced per acre with four-pasture twice-over rotation grazing due to an increased stocking rate achieved with the grazing system. Three- or five-pasture twice-over rotation grazing can also be implemented with increased stocking rates achieved.

Any increases in stocking rate should be compared to the recommended U.S. Soil Conservation Service stocking rates for your region. If your pastures are already overstocked, a grazing system will not allow you to increase stocking rates.

How much the stocking rate can be increased will vary according to the previous year's stocking rate and range condition. Stocking rate increases may be minimal or none if rangeland was overstocked before the system was implemented. Stocking rate increases from 15 to 40 percent of the present stocking rate may be achieved if the pastures were properly stocked in previous years and if range condition is good to excellent.

Probably the greatest benefit following the initiation of the twice-over rotation grazing system is improvement of grazing distribution and rest to the plants after defoliation. Higher stocking densities encourage the use of more available forage by livestock.

An initial stocking rate increase on the grazing system should be no more than 15 to 25 percent above the recommended rates by the U.S. Soil Conservation Service for each range condition class. Therefore, if a pasture is judged in poor, fair, good, or excellent condition, a 15 to 25 percent increase

Table 3. Forage production, utilization, and livestock performance on a three-pasture twice-over rotation grazing from 1983-1984, four-pasture twice-over rotation grazing system from 1985-1990 and seasonlong grazing from 1983-1990 on the Central Grasslands Research Center, Streeter, North Dakota.

| Year | Forage | | Livestock | | | |
|---|---------------------|-----------------|-----------------------|-------------|-----------|--------------------------|
| | Production (lbs/ac) | Utilization (%) | Number cow/calf pairs | Days grazed | Calves | |
| | | | | | ADG (lbs) | AG/A ^a (lb/a) |
| ----- Three-pasture twice-over rotation grazing (240 acres) ----- | | | | | | |
| 1983 | 2159 | 56 | 40 | 153 | 1.75 | 47.6 |
| 1984 | 2104 | 45 | 45 | 153 | 2.08 | 49.3 |
| Mean | 2132 | 50 | 42.5 | 153 | 1.92 | 48.5 |
| ----- Four-pasture twice-over rotation grazing (320 acres) ----- | | | | | | |
| 1985 | 2592 | 52 | 65 | 160 | 2.20 | 57.0 |
| 1986 | 3132 | 48 | 65 | 161 | 2.16 | 60.6 |
| 1987 | 3439 | 50 | 65 | 160 | 2.36 | 66.6 |
| 1988 ^b | 1382 | 55 | 65 | 105 | 2.16 | 46.1 |
| 1989 | 2354 | 63 | 65 | 160 | 2.73 | 78.3 |
| 1990 | 2426 | 60 | 65 | 160 | 2.55 | 72.5 |
| Mean | 2553 | 55 | 65 | 151 | 2.36 | 63.5 |
| ----- Seasonlong grazing (320 acres) ----- | | | | | | |
| 1983 | 2220 | 67 | 40 | 153 | 1.76 | 35.4 |
| 1984 | 2353 | 54 | 45 | 153 | 2.08 | 37.6 |
| 1985 | 2828 | 58 | 45 | 160 | 2.09 | 40.2 |
| 1986 | 3424 | 59 | 45 | 161 | 2.20 | 42.4 |
| 1987 | 4059 | 51 | 45 | 160 | 2.43 | 47.5 |
| 1988 ^b | 1538 | 47 | 45 | 105 | 2.22 | 33.6 |
| 1989 | 2468 | 53 | 46 | 160 | 2.81 | 58.6 |
| 1990 | 2604 | 55 | 46 | 160 | 2.59 | 52.1 |
| Mean | 2687 | 56 | 44.6 | 152 | 2.27 | 43.4 |

^aADG - Average Daily Gain, AG/A - Average Gain per Acre.

^b1988 was a severe drought year, grazing season shortened by 55 days.

Source: Barker and Nyren. 1991. 1990 Grass and Beef Review. NDSU-Central Grasslands Research Center, Streeter, North Dakota. p 10.

Wienhold. 1985. M.S. Thesis. North Dakota State Univ. Fargo, North Dakota.

would be based on the assigned rate for each condition class. Future stocking rate increases, or decreases, will be based on range improvements resulting from increased plant vigor, which will increase forage production and improved range condition.

Good record keeping should be maintained to help determine the adjustments in stocking rates. Records should include: 1) days grazed per pasture for each season, 2) forage usage (light, medium, heavy) for each pasture during each grazing period, 3) precipitation records, and 4) livestock production records. A sample grazing record form is provided.

Wildlife Benefits

Studies at the Central Grasslands Research Center provided positive information on the effects of twice-over rotation grazing system on wildlife production. Upland nesting waterfowl production increased on the system because of improved nesting habitat (Table 4). Nesting habitat for sharp-tailed grouse and upland nesting nongame birds was also improved on the twice-over rotation grazing system when compared to seasonlong grazing at the Central Grasslands Research Center.

The twice-over rotation grazing system provides temporarily undisturbed cover on areas of the system during the nesting season and also minimizes competition for forage with other grazing herbivores. Flexibility of use provided by the numerous pastures

is a positive feature of any grazing system. The flexibility allows modifications in use to benefit wildlife and should be included in the grazing plan.

Conclusion

The twice-over rotation grazing system is an option for livestock producers to eliminate seasonlong grazing on native rangelands. Implementing a grazing management plan in livestock operations to maximize forage production and economic return from an acre of land is strongly suggested. Twice-over rotation grazing is just one of many grazing system that can be considered. The system will help maximize forage production while maintaining or improving the range condition. It allows flexibility in a grazing operation without intensive management and high fencing costs. The system at the Central Grasslands Research Center showed increased livestock production as well as increased wildlife production over seasonlong grazing.

Table 4. Waterfowl nesting success and number of successful nests per 100 acres comparing twice-over rotation grazing and seasonlong grazing at the Central Grasslands Research Center, Streeter, North Dakota from 1983-1989.

| Treatment | Acres | Number of nests | Mayfield nesting success percent | Number of successful nests/100 ac. |
|---------------------|-------|-----------------|-------------------------------------|------------------------------------|
| Twice-over rotation | 594 | 549 | 34.7 | 6.6 |
| Seasonlong | 320 | 216 | 26.6 | 4.6 |

Source: Sedivec et al. 1990. In Proceedings: Can Livestock Be Used as a Tool to Enhance Wildlife Habitat. U.S.D.A. Forest Serv. p 72-92.

GRAZING RECORDS

Year _____

Grazing System # _____

| Month | Number of Days Grazed | | | | | | Precipitation |
|--------------------------|-----------------------|---|---|---|---|---|---------------|
| | Pasture | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| January | | | | | | | |
| February | | | | | | | |
| March | | | | | | | |
| April | | | | | | | |
| May | | | | | | | |
| June | | | | | | | |
| July | | | | | | | |
| August | | | | | | | |
| September | | | | | | | |
| October | | | | | | | |
| November | | | | | | | |
| December | | | | | | | |
| Total days per pasture | | | | | | | |
| No. of acres per pasture | | | | | | | |

Total acres of grazing system _____

Number of livestock grazed _____

Total number of days grazed _____

Stocking rate _____

First pasture being grazed this year _____

Starting date of grazing season _____

Rotation dates (date moved to next pasture) _____

Cont. _____

Cont. _____

Date of calf weaning _____

Last date of grazing on pasture _____

Yearly precipitation _____

Average calf weights going on pasture _____

Average calf weights coming off pasture _____

Average weaning weights _____

Forage usage (light, medium, heavy) _____

(Make extra copies of grazing record forms for future years use.)



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