FENCE DESIGNS FOR IMPROVED RANGELAND MANAGEMENT

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Open range in the western United States is a pretty sight but inefficient for livestock production. It's been estimated that the production of livestock from western grazing lands could be increased 50 to 100 percent with intensive management systems and increased developments (USDA, 1972). Much of the projected increase in livestock production would be made through better control of the grazing distribution of livestock.

Fencing is the most effective means of directly controlling livestock grazing distribution to obtain uniform use of all areas and plants, improved livestock performance, and increased carrying capacity of rangelands. However, fencing is only effective when combined with a sound grazing management plan or system.

There has been a great deal of interest in grazing systems over the past few decades. During the past few years this interest has turned to short duration grazing with expectation of greater productivity and profitability from rangelands (Kothmann, 1979; Lewis, 1981). Short duration grazing is a system whereby pastures are stocked heavier than normal for a short time, then given a rest to allow the grazed plants to regrow and gain vigor. The plants native to western rangelands evolved under this pattern of forage harvesting by buffalo and other native herbivores so are well adapted to grazing.

More internal fencing and increased fence maintenance is required with short duration grazing systems. However, fencing costs should be more than recovered from the increased carrying capacity of livestock and the use of new economical fencing materials. In this way a rancher would be able to increase his turnover, livestock, without having to substantially increase his large fixed cost base, land, facilities and equipment.

This article reports on improved designs, new and cheaper materials, and installation and maintenance costs of three internal fence designs used in a short duration grazing system at the Dickinson Experiment Station.

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Materials and Methods

Grazing Treatment

The grazing trial was initiated by June 1981 on the Dickinson Experiment Station ranch headquarters by dividing a half section, 320 acres of typical mixed grass prairie into eight 40-acre pastures (Figure 1). The pastures have been grazed from June to weather dictated removal at a stocking rate of 2.3 acres per animal-unit month or 35 cow-calf pairs. A five-day graze, 35-day rest rotational sequence has been maintained seasonlong for the pastures in the short duration system. Cattle are removed from the trial after proper use of the vegetation is achieved. Cattle were removed September 3, 1981; October 12, 1982 and October 26, 1983 after 69, 111, and 130-day grazing seasons, respectively.

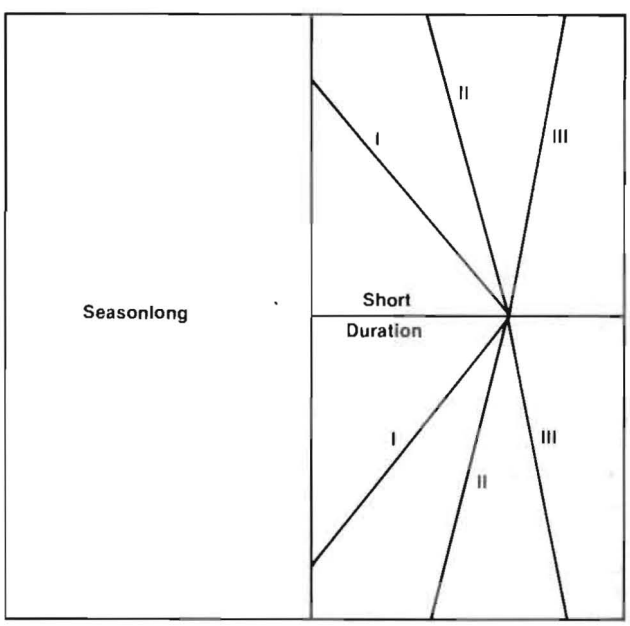

Figure 1. Section 16, Dickinson Experiment Station Ranch showing grazing systems and pasture divisions. Fence designs are as indicated: (I) woodpost, barbed wire, (II) steel post, smooth wire, (III) fiberglass post, smooth wire.

Fence Design and Construction

The three fence types were designed similarly for purposes of comparison. Since end posts are the foundation of any fence, all fences were constructed with a double brace post setup at both ends. Three 5-inch diameter, 8-foot long treated posts were spaced approximately 6.5 feet apart, and a 6.5-feet long, 3½-inch diameter wood post was placed horizontally between and near the top of each pair of vertical posts. Brace assemblies were then wrapped with smooth 12 gauge wire (bottom of outside post to top of center and inside posts).

In-line brace post assemblies consisting of two 5-inch vertical posts and one 3½-inch, 6.5-foot long horizontal post, were located every 220 yards (1/8 mile) in each fence. In some cases additional brace post assemblies were required due to abrupt changes in terrain. These added posts were not calculated into the reported fence costs.

In-line posts for all fence types were spaced 30 feet apart for the entire length of each fence. Each fence consisted of three wires placed 24-36-48 inches from ground level. In the case of electric fences, only the middle wire was insulated and charged. No stays were used in fence construction. A total of approximately 1.2 miles of each fence was constructed (Figure 1).

Detailed labor imputs for construction of fences are unfortunately not available. Because of a short grazing season, the amount of fencing required, laborers numbering from two to eight working between other ranch duties and the need to initiate the grazing trial, labor hours were impossible to record.

Fence Materials

Two fence lines were constructed for each of the three types of fence. The three types were: (I) wood post—three barbed wire fence, (II) steel post—three telephone wire electric fence, and (III) fiberglass post—three high tensile wire electric fence (Figure 1). The materials required per mile for each fence design constructed is summarized in Table 1.

Additional materials necessary for electric fences were omitted from Table 1 and cost analyses due to the variety of systems and models available and their differences in prices. For this research trial a 36-cell solar generation panel charged a 12-volt battery which was connected to a fence energizer. High voltage, copper, double insulated cable was buried 4 feet and connected from the energizer to either a pair of north or south running fences. A switch located near the energizer directed the current to the proper fences.

Table 1. Fence materials necessary for constructing one mile of three rangeland fences at the Dickinson Experiment Station Ranch.

	Materials	Design I[a]	II	III
I.	Posts			
	Wood—3½ in diameter	196	22	22
	Wood—5 in diameter	6	6	6
	Steel—5½ ft height	—	174	—
	Fiberglass—5½ ft height	—	—	174
II.	Wire			
	Barbed—rolls (440 yd)	12	—	—
	Telephone—used	—	3 mi	—
	High-tensile—coils (4000 ft)	—	—	4
III.	Miscellaneous			
	Staples	50 lbs/mi	—	—
	Insulators			
	ceramic	—	2	2
	plastic	—	180	12
	Wire clips	—	348	522
	In-line tighteners	—	—	3

[a]Fence designs were: (I) wood post—3 barbed wire, (II) steel post—3 telephone wire electric, and (III) fiberglass post—3 high-tensile wire electric.

RESULTS

Fence costs

Comparative costs of materials used in construction of the three fence designs are summarized in Table 2. No charges were assigned against each fence design for machines and equipment used in construction.

Table 2. Comparative costs (dollars per mile) of three fence designs constructed on the Dickinson Experiment Station Ranch.

	Materials	Design I[a]	II	III
I.	Posts			
	Wood, 3½ in diameter	659	74	74
	Wood, 5 in diameter	36	74	36
	Steel, 5½ ft height	—	435	—
	Fiberglass, 5½ ft height	—	—	466
	Subtotal	695	545	576
II.	Wire			
	Barbed	450	—	—
	Telephone	—	225	—
	High-tensile	—	—	211
	Sub total	450	225	211
III.	Miscellaneous			
	Staples	25	—	—
	Insulators	—	20	3
	Wire clips	—	8	11
	In-line tighteners	—	—	9
	Sub total	25	28	23
	Total	$1170	$798	$810

[a]Fence designs were: (I) wood post—3 barbed wire, (II) steel post—3 telephone wire electric, and (III) fiberglass post—3 high-tensile wire electric.

Material costs varied from $798 to $1170 per mile of fence for the three designs. One fence not used was a steel post — three barbed wire design which would have

a materials cost of $913 per mile. The wood post—barbed wire fence material costs exceeded the two designs used by $362 and 372 per mile. This is a 32 percent increase in material costs for this design.

Post costs were greatest for the wood post—barbed wire fence. Since all fences were designed similarly with posts spaced 30 feet apart, the price per post was the major variant between fences. Posts were $3.36, $2.50 and $2.68 each for wood 3½-inch, steel and fiberglass, respectively.

Barbed wire was two or more times as expensive as either of the smooth wires. Barbed wire was $37.00 per ¼-mile roll for a cost of $450 per mile of three wire fence. Telephone wire was figured at half the price of barbed wire for a cost of $225 per mile of three wire fence. High-tensile wire was priced at $52.70 per coil (4000 ft.) totaling $211 per mile of three wire fence.

Miscellaneous costs of fence construction were minor compared to post and wire prices. Miscellaneous costs ranged from $15 to $19 for the three fence designs.

Certain construction and equipment costs for electric fences were not assigned to these designs due to the great variety and costs of equipment available. However, additional costs would need to be included in electric fence designs to better compare these designs. Additional costs for our electric fences were: 36-cell solar generation panel, $316, rechargeable 12-volt battery, $105; high output fence energizer, $240; and 120-foot high voltage, copper, double insulated cable, $90.

Maintenance Requirement

Climatic conditions are second only to livestock pressure in increasing fence maintenance requirements. Severe climatic conditions are an annual occurrence in North Dakota. Annual temperatures range from highs of approximately 100°F in summer to lows of −40°F in winter. Ice storms commonly occur in late fall and spring. Annual snowfall averages nearly 3 feet in western North Dakota with snowdrifts of 6 feet possible. Where snowdrifts bury fences, spring thaw commonly pulls wires to the ground. Climatic influences have played a significant part in annual fence maintenance requirements in this study.

Annual maintenance has been required of only the steel post—telephone wire fence. Following winter, an average of two eight-hour days of labor has been required to repair winter and/or native herbivore damage. Another average of two eight-hour days of labor has been necessary during the grazing season for this fence design due to livestock pressure. No maintenance has been required for the wood post—barbed wire fence and only one wire repair in the third grazing season has been required of the fiberglass post—high tensile wire fence.

SUMMARY

Fencing can be a cost effective means of improving the condition and increasing the carrying capacity of rangelands when used in a sound management plan. All fence designs studied provided adequate control of livestock grazing an intensively managed, rapid rotation grazing system at the Dickinson Expeirment Station. Smoothwire electric fences with steel or fiberglass posts cost 40 percent less to build when compared to a conventional wood post—barbed wire fence. Smooth wire electric fences have required more maintenance but have been equally effective in controlling cattle when compared to conventional fencing.

REFERENCES

Kothmann, M. M. 1979. Grazing systems — Research report. Proc. Texas Animal Agri. Conf. 6p.

Lewis, J. K. 1981. Grazing systems. Proc. Range Beef Cow Symposium VII. Rapid City, South Dakota. 20p.

USDA, Forest-Range Task Force. 1972. The Nation's range resources — a forest-range environmental study. USDA, For. Serv. For. Research Rep. 19.

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of facilities such as greenhouses, research fields, laboratories, winter nurseries, and other research support. The financial and "lobbying" support of the several crop commodity organizations in North Dakota also is essential to the financial support received from the North Dakota Legislature as appropriated funds, from Congress, and from gifts and grants from private organizations.