Economic Value of Crested Wheatgrass: A Case Study

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ABSTRACT: The purposes of this paper are to define as a case study the economics of crested wheatgrass seedings when grazed under traditional spring/fall grazing patterns, and to contrast this with seeding economics when the stand is an integral part of a deferred/rest rotation grazing system. The major conclusion is that crested wheatgrass seedings will not always be profitable. The seeding must "fit-in" and alleviate seasonal forage constraints on the ranch.

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INTRODUCTION

This study is a part of the Saval Ranch Research and Evaluation Project. In May 1978, the Saval Ranch, Bureau of Land Management (BLM), Soil Conservation Service (SCS), United States Forest Service (USFS), University of Nevada-Reno and the Agricultural Research Service (ARS) entered a cooperative agreement to evaluate the effects of livestock grazing management systems on livestock production, vegetation, fish and wildlife and their habitat, watershed hydrology, water quality, economic factors, and other resource values.

This paper concentrates on the economics of developing a crested wheatgrass (Agropyron desertorum) seeding as part of a proposed grazing system to be implemented on the Saval Ranch in 1985. The analysis considers expected benefits and costs and as such reflects an ex ante analysis. Only livestock benefits are considered.

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STUDY AREA

The Saval Ranch is located approximately 45 miles (72 km) north of Elko in northeastern Nevada (Figure 1). The ranch operation contains approximately 49,105 acres (19,873 ha), including lands owned and managed privately (7,557 acres; 3,058 ha), and lands managed by the Bureau of Land Management (25,908 acres; 10,485 ha), and the Forest Service (15,640 acres; 6,330 ha). Nearly 4,200 acres (1,700 ha) of existing crested wheatgrass stands are included.

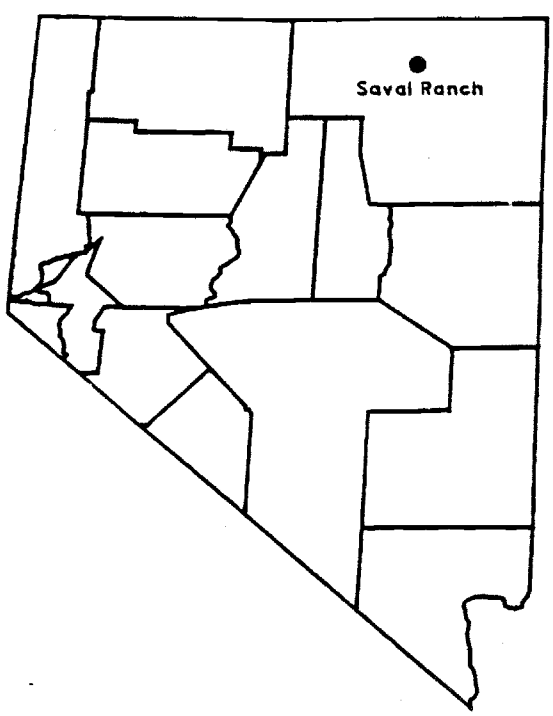

Figure 1.—Location of the Saval Ranch.

The ranch has operated as a cow/calf operation. On January 1, 1983, 713 brood cows were maintained on the ranch (including first-calf heifers). For a more complete description of forage resources, livestock production levels, and costs of production see Torell et al. (1985).

PROCEDURES

Two alternative grazing patterns are considered. First, the economics of the seeding is considered when it is grazed every year under traditional spring/fall use. Second, the economics of the proposed Saval grazing system is outlined, which includes the crested wheatgrass seedings evaluated in this study.

Production costs, grazing/hay resources, "typical" livestock production practices, and production levels were obtained for the Saval Ranch (Torell et al. 1985) and were used to develop a profit maximizing linear programming (LP) model. The model allocates resources (e.g. hay, grazing forage) to livestock so as to maximize ranch income (returns over variable costs). It captures the interrelationship between classes of resources, seasonal livestock forage requirements, and seasonal forage availability. Total seasonal grazing resources are considered in relation to the "optimal" (profit maximizing) management strategy. Beef prices, costs of production, and "typical" livestock production levels are considered explicitly. As a result, the model is a tool for estimating how range improvements and implementation of the proposed grazing management system would affect optimal livestock production and net ranch income.

To determine the benefits and costs of developing the new crested wheatgrass seeding on the Saval Ranch, several alternative management scenarios were considered. First a management alternative (e.g. LP run) was established which reflected optimal (profit maximizing) production without the new 2,430 acre (983 ha) seeding under season-long grazing. This established a benchmark against which other management strategies reflecting optimal livestock production with the new seeding could be compared. The resulting difference reflected the estimated net annual livestock benefit from adding the seeding when traditional grazing patterns are followed. This net annual benefit was assumed to accrue every year over a 50 year planning period. After discounting this flow of returns to present value, the cost of the seeding and the cost of the purchased livestock were subtracted, and the present net worth of the seeding was estimated.

Two management options were considered for traditional season-long grazing patterns. First, the economics of the new seeding was considered when winter feed (hay) was the limiting factor of production. This reflects the existing situation on the ranch. As a second option, fertilizing hayland on the ranch was considered. It was estimated that one-third of available hayland (564 acres; 228 ha) on the ranch could be fertilized (Torell et al. 1985). Hay yields on fertilized acres would be expected to increase by 1.25 tons/acre (2.8 MT/ha). The cost of the fertilization program was estimated to be $40/acre ($98.89/ha).[1]

The economics of the Saval Ranch grazing system was considered using procedures similar to those used for traditional season-long grazing patterns. That is, a benchmark was established which reflected optimal production without the grazing system. Selected years of the grazing system were then simulated to estimate optimal livestock production under the proposed system. For the grazing system analysis, it was assumed that 1/3 of available hayland was already being fertilized (as outlined above), and range forage was the limiting factor of production.

Range Improvement Costs

Range improvements amounting to an estimated $149,381 have been implemented on the Saval Ranch since 1981 (Torell et al. 1985). Over half of this expense ($78,204) was for implementation of the new 2,430 acre (983 ha) crested wheatgrass seeding. Other improvements include new fence construction, fence reconstruction, and water developments[2]. In addition, it was estimated that an additional $43,545 of water developments may need to be implemented as a part of the proposed Saval grazing system, bringing total expenditures for range improvements to an estimated $192,926 (Torell et al. 1985). Maintenance costs of these improvements were estimated to be about $2,400 per year.

The costs incurred in plowing and seeding the new crested wheatgrass seeding on the ranch are outlined in Table 1. The total cost is estimated to be $32.18 per acre ($13.02/ha). Seed cost of $10.70 per acre ($4.33/ha) accounts for one-third of this expense, considerably higher than if a monoculture of crested wheatgrass had been planted.

As outlined in Table 1, in addition to crested wheatgrass (Agropyron desertorum), pubescent wheatgrass (Agropyron trichophorum), Russian wildrye (Elymus junceus), ladak alfalfa (Medicago sativa), small burnet (Sanquisorba minor), and sweet clover (Melilotus officinalis) were also planted.[3] Planting these additional species increased seed cost by $7.30 per acre ($2.95/ha). This means that the cost of the seeding was increased by 29 percent to avoid planting a crested wheatgrass monoculture.

Saval Ranch Grazing System

Under the proposed management plan for the Saval Ranch, crested wheatgrass seedings will be grazed under a 3-pasture, deferred-rotation system with one pasture grazed only in the fall every year. BLM native range will be grazed under a 3-pasture, rest-rotation pattern with one pasture rested every year. USFS range will be grazed as a 2-pasture, deferred-rotation system with grazing starting on the early pasture on July 1 and on the late pasture on August 16.

[1] For an economic analysis of this fertilization scheme, see Torell et al. (1985).
[2] A complete listing of specific range improvements implemented is provided by Torell et al. (1985).
[3] Even though several forage species were planted I will follow tradition and refer to the seeding as a "crested wheatgrass seeding."

Table 1.--Plowing and seeding costs for the implemented crested wheatgrass seeding on the Saval Ranch.

Expense Category	Total Cost for 2,430 Acres		Cost Per Acre	
Plowing				
Contract Plowing	$30,254		$12.45	
Repair	6,318		2.60	
Subtotal		$36,572		15.05
Seeding				
Contract Seeding	12,150		5.00	
Seeder Repair	875		0.36	
Seed[1]	26,000		10.70	
Subtotal		39,025		16.06
General Expenses				
Transport of Plow and Seeder	840		0.35	
Non-Use of Range for 1 year (310 AUMs x $5.70)	1,767		0.73	
Subtotal		2,607		1.08
Total		$78,204		$32.18

[1]Per acre seeding costs: 5 lbs. crested wheatgrass @ $.68; 2 lbs. pubescent wheatgrass @ $1.47; 2 lbs. Russian wildrye @ $ 0.85; 0.5 lbs. ladak alfalfa @ $1.14; 0.5 lbs. small burnet @ $3.55; 1 lb. sweet clover @ $0.30

The objectives and rationale of the Saval Ranch grazing system as outlined in the Saval Coordinated Management Plan (USDI Bureau of Land Management 1981) are as follows:

A. Improve livestock distribution on all pastures by 1) implementing grazing systems with proper fencing, 2) providing water developments away from major creek bottoms, 3) having the permittee provide at least one range rider, and 4) having the permittee place salt a minimum of one-quarter mile from waters, with subsequent salting on the same location.

B. Improve range condition from poor to good and increase production to 60 percent of potential within 15 years after implementation of the grazing system on 3,639 acres (1,473 ha). Improve range condition from fair to good and increase production to 70 percent of potential within 15 years after implementation on 30,948 acres (12,530 ha)

C. Increase hayland production from the current 1600-1800 tons (1,455-1,636 MT) to 3000-3400 tons (2,727-3,090 MT) within 6 years.

D. Eliminate active headcutting of streams directly affecting or threatening Lahontan Cutthroat Trout habitat within 3 years after implementation.

E. Minimize forced moves of cattle for management or distribution so as to maximize weight gain.

F. Increase calf crop from 70 to 80 percent (based on number of calves weaned as a percentage of total cows exposed) within 10 years after implementation of the grazing system.

G. Increase weaning weights from 350 to 450 pounds and increase yearling weights from 650 to 750 pounds within 20 years after implementation.

In the economic analysis of the grazing system, the expected benefit is assumed to differ slightly from the objectives of the grazing system as outlined above. Calf crop was assumed to increase from 80 percent to 85 percent seven years after implementation of the grazing system. This adjustment was made because the Saval Ranch should be able to achieve an 80 percent calf crop (the average calf crop in Elko County as reported by Myer and Hackett [1981]) through improved breeding

management without the grazing system. An 80 percent calf crop has been assumed in the seeding economics analysis under traditional grazing patterns, and as the starting point under the grazing system.

After the grazing system has been in place for seven years, selling weights of livestock sold are expected to reflect levels similar to those outlined under objective G of the grazing management plan. Average selling weight of heifer calves was assumed to be 398 pounds (181 kg) and yearling steers were expected to weigh 728 pounds at sale (331 kg).

A major expected livestock benefit of the grazing system will be increased livestock forage availability and grazing capacity due to better livestock distribution, water developments, seedings, and herding. In the economic analysis of the grazing system, it was assumed that grazing capacity on all Federal and private rangelands (native rangeland and seeded areas) would increase by 25 percent, including the additional forage from the new seeding. This level of increase is based upon objective B of the Saval Grazing Management Plan. The assumed pattern of forage increase is outlined as Figure 2.[4]

RESULTS

The additional species were planted to improve wildlife habitat. While wildlife benefits/impacts are not considered explicitly in this study, the extra seed cost has apparently not produced positive economic benefits. A July 1982 evaluation of the success of the seeding rated stands of Russian wildrye, sweet clover, alfalfa, and small burnet as "failures," based upon a success rating scale developed by Hyder and Sneva (1954). It was estimated that stands of forbs were very sparse—0-5 percent stocked (Stager et al. 1983). This means that the stand had, on average, only one forb plant/25 ft^2 (one plant/7.6 m^2)—a very sparse plant density. The stand of crested wheatgrass and pubescent wheatgrass was considered a "success."

Traditional Grazing Pattern—Hay Limiting

When hay acreages are not fertilized, such that winter feed supplies limit livestock production, optimal herd size would be 670 brood cows (Torell et al. 1985). With the addition of an estimated 972 AUMs from the seeding, with all other grazing resources held constant, optimal herd size was estimated as 734 brood cows. Management as a cow-calf/yearling operation with all steer calves carried over for sale as yearlings was estimated to maximize profit.

Gross benefits from the seeding were estimated to be $22,991 (Table 2). Annual production costs were estimated to increase by $16,047. The resulting net annual livestock benefit is then $6,944. Thus, the net annual benefit to the ranch is positive. However, this does not consider the costs of the seeding or of additional brood stock purchased in order to utilize the additional forage. After discounting the $6,944 annual flow of returns to present value, the cost of the seeding and purchased livestock were subtracted. The resulting net present value was estimated to be minus $20,167 (Table 2). The internal rate of return was then 6.26 percent and the benefit/cost (B/C) ratio was less than one. If the only livestock benefits were additional early spring or fall forage, and additional forage for herd expansion, then the seeding cannot be considered beneficial. Based on the B/C ratio, benefits were estimated to be only 93 percent of costs. There are at least three reasons why this is the case. First, the Saval Ranch has a considerable number of acres of existing crested whestgrass (4,200 acres; 1,700 ha). These stands are generally adequate for spring forage requirements. Second, winter feed is the most limiting forage resource on the ranch. Developing additional grazing resources does not solve the more important need for winter feed. Without developing or improving existing hayland production on the ranch, additional grazing forage will only add to the existing forage balance problem. While hay could be purchased from off the ranch, this is not a profitable alternative on a large scale basis as shown by linear programming analyses. The third reason why the seeding would not yield positive economic returns is the diverse seed mixture. As mentioned earlier, the policy of "not planting a monoculture of crested wheatgrass" increased seed cost by $7.30 per acre ($2.95/ha) or by $17,738 for the 2,430 acre seeding. Had this expense not been incurred, the present net worth of the seeding would

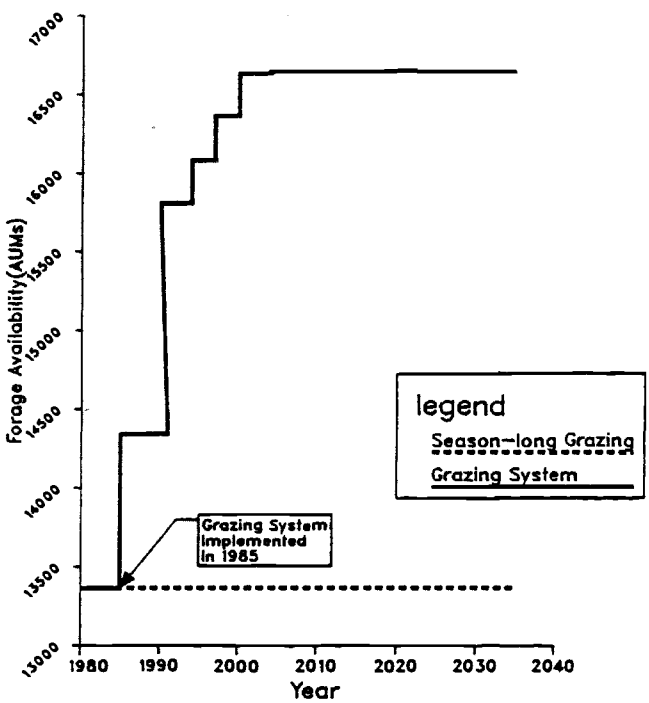

Figure 2.—Total annual forage availability under "traditional" grazing and under the Saval Ranch grazing system.

[4] For an additional discussion of the rationale used, the interested reader is referred to Torell et al. (1985).

Table 2.--Benefit/cost analysis of the implemented seeding under traditional grazing patterns when winter feed is the limiting resource.

Annual Benefits			
Increased livestock sales	$21,028		
Increased grazing fees (972 AUM's @ $2.02)[1]	1,963		
Total annual benefits		$ 22,991	
Annual Costs			
Increased production	15,265		
Seeding maintenance	782		
Total annual costs		16,047	
Net annual benefit			$6,944
Present Values			
Present value of $6,944 (50 years @ 7-7/8%)	86,186		
Present value of $28,800 worth of breeding stock from year 50[2]	651		
Required range improvement investment	-78,204		
Purchase of 64 additional cows and 4 bulls	-28,800		
Present net worth			-20,167
Internal rate of return (IRR)			6.26%
Benefit/Cost Ratio			.93

[1]Although grazing fees reflect out-of-pocket costs for the Saval Ranch, they are merely transfer payments from the point of view of society. Therefore, grazing fees should be excluded from the calculation of the change in net income when deriving the marginal value of forage to society (Brown 1982). Because the additional grazing fees are included in the $15,265 increase in livestock production costs for the Saval Ranch, an equivalent amount, ($2.02 X 972 AUM's = $1,963) is added as a benefit. The $2.02 fee used in the analysis reflects the 1979-81 average of federal lands grazing fees.

[2]In order for the Saval to fully utilize the additional grazing resource, herd size must be expanded by 64 cows and 4 bulls. At the end of the 50 year planning horizon the investment in additional livestock is added back as a benefit. Mature cows were valued at $400 per head, and additional purchased bulls were valued at $800 per head and discounted to present value.

be minus $2,429 as compared to minus $20,167. Thus, had these additional costs not been incurred, the seeding would have been basically a break-even investment under a hay limiting option.

Traditional Grazing Pattern--Hay Not Limiting

Assuming that the Saval Ranch was initially fertilizing 1/3 of available hayland on the ranch (increasing hay production by an estimated 705 tons), then optimal herd size would be 762 brood cows. After adding the seeding, optimal herd size would increase to 816 brood cows (Torell et al. 1985). With sufficient winter feed, the economics of the seeding is positive (Table 3). Range forage now limits livestock production. The switch to positive present net worth when hay is not limiting indicates the importance of considering seasonal forage balance when assessing the need and worth of a crested wheatgrass seeding.

Grazing System--Hay not Limiting

Present net worth of range improvements and the grazing management system was estimated to be $68,090. The internal rate of return was estimated to be 9.54 percent, and the calculated B/C ratio was 1.15:1.[5]

The grazing system, which includes an estimated $192,926 in range improvements, is estimated to be cost effective with benefits exceeding costs based solely on benefits to livestock. Additional expected wildlife and watershed benefits, which were not included in the B/C analysis, would further improve the economics of the grazing system.

It should be pointed out that the analysis presented here does not provide a direct comparison of the economics of crested wheatgrass when grazed under traditional grazing patterns with results obtained under a grazing system. The Saval grazing system includes nearly $115,000 worth of range

[5]The interested reader is referred to Torell et al. (1985) for detail of considerations used in calculating these parameters.

Table 3.--Benefit/cost analysis of the implemented seeding under traditional grazing patterns when range forage is the limiting resource.

Annual Benefits				
Increased livestock sales	$17,742			
Increased grazing fees (972 AUM's @ $2.02)	1,963			
Total annual benefits		$19,705		
Annual Costs				
Increased production	10,251			
Seeding maintenance	782			
Total annual costs		11,033		
Net Annual Benefit			$ 8,672	
Present Values				
Present value of $8,672 (50 years @ 7-7/8%)	107,633			
Present value of $24,000 worth of breeding stock from year 50	542			
Required range improvement investment	-78,204			
Purchase of 54 additional cows and 3 bulls	-24,000			
Present net worth				$5,971
Internal rate of return (IRR)				8.36%
Benefit/Cost Ratio				1.03

improvements in addition to the crested wheatgrass seeding under consideration. Ideally, one would analyze the value of each range improvement individually with specific consideration of benefits and costs. This would allow determination of the contribution of just the seeding to the economics of the grazing system. A direct comparison of economic returns following either traditional grazing patterns or a grazing system would then be possible. However, in practice, it is very difficult to project the contribution of a cross-fence, a water development, or other specific range improvements to forage production and availability. For this reason only an estimate of total benefits of the grazing system was made.

CONCLUSIONS

Crested wheatgrass seedings will not always be profitable. It depends upon the seasonal forage demands of the ranch and how a crested wheatgrass seeding would alleviate any seasonal forage limitations. In fact, the major economic benefit of a seeding is the potential to meet a forage requirement in a limiting forage season. Implementation of a seeding not providing that benefit may be uneconomical.

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