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FEASIBILITY OF A SHEEP COOPERATIVE FOR GRAZING LEAFY SPURGE

Randall S. Sell

Dan J. Nudell

Dean A. Bangsund

F. Larry Leistritz

Tim Faller

Department of Agricultural Economics

Agricultural Experiment Station

North Dakota State University

Fargo, North Dakota 58105

INTRODUCTION

There are three general methods of controlling leafy spurge in the upper Great Plains: 1) chemical, 2) cultural, and 3) biological. Each has limitations on its applicability and effectiveness such that any one method will probably not be practical on all leafy spurge infestations. Use of herbicides is often limited because of environmental and labeling restrictions as well as economic considerations. Tillage and reseeding are often not practical because of the topography of infested areas and economic considerations. Biological control (insects) has provided excellent control in certain conditions but not in others (Bangsund et al. 1997). Another form of biological control, which has been shown to be economical, is grazing with sheep (Bangsund et al. 1999).

Similar to using herbicides to control leafy spurge, the use of sheep grazing does not eradicate the weed; yet it can control the infestation. Sheep grazing of leafy spurge can have a two-fold benefit: 1) decrease the density of the infestation and thereby allow cattle to graze and 2) sheep can directly generate revenue which may provide positive returns. Utilizing a benefit-cost analysis, Bangsund et al. (1999) showed that under season-long grazing strategies with good management (sheep performance), even in less economical situations (low density infestations, small patches of leafy spurge within larger pastures enclosed with new fence), sheep grazing would be economical. Another method of analysis used by Bangsund et al. (1999) was a least-loss analysis, where the economic loss which would occur if leafy spurge was left uncontrolled was compared to losses incurred with control. Thus, even if control results in negative returns, the control method may still be recommended, providing the loss from control is less than the economic loss of allowing the infestation to expand unabated. The only scenarios in which not using sheep grazing controls were better than implementing a sheep grazing enterprise were with poor management, new fencing, and low rangeland carrying capacities.

The use of sheep or goats has been known as an effective method of controlling leafy spurge since the 1930s (Sedivec et al. 1995). However, the majority of ranchers with leafy spurge have not adopted sheep as a potential leafy spurge control tool (Sell et al. 1999b, Sell et al. 1998a, 1998b). A major deterrent to using sheep for controlling leafy spurge is the inability of the ranch operator to provide adequate labor and management for an additional enterprise on the ranch. Ranch operators usually feel that they would not be able to add another job to the work load of the ranch, or they may feel that they can not or do not want to learn the skills necessary to be successful in the production of a different livestock species. Of ranchers recently surveyed in western North Dakota, more than 70 percent felt they did not have the right equipment for sheep, and more than 40 percent indicated they did not have the expertise/knowledge to effectively utilize sheep (Sell et al. 1999b, Sell et al. 1998a, 1998b). Of those ranchers who had leafy spurge, 80 percent grazed only cattle, 18 percent grazed sheep and cattle, and only 2 percent grazed only sheep on their rangeland (Sell et al. 1999b).

This is a summary of an economic feasibility analysis of a cooperatively owned and professionally managed sheep operation for leafy spurge control (Sell et al. 1999a). The objectives of this report were 1) determine the return on investment of the cooperative, 2) determine the proposed structure of the cooperative, and 3) ascertain the amount of capital investment required by members in the cooperative.

The cooperative would be the property of ranchers that have leafy spurge, and sheep from the cooperative would graze the leafy spurge infested rangeland of its members. The flock would be managed as a single unit by a manager hired by the cooperative. A centrally located cooperative, with management strictly dedicated to sheep production, would capture economies of scale in production and exempt the individual ranchers from the burden of learning to manage a new enterprise, while still gaining the benefits of multi-species grazing on leafy spurge infested rangelands. In addition, profits from the sheep operation would accrue to the owners of the cooperatively-owned flock.

PROCEDURES

Three alternative flock management strategies were considered for the cooperative. These were 1) winter lambing, 2) spring lambing, and 3) fall lambing. The primary difference between these alternatives revolves around the timing and length of the lambing season. The necessary equipment, facilities, labor, feed, production, and cooperative member contributions will vary depending on the alternative considered. Each management alternative has unique attributes which will affect its financial performance. Additionally, the logistical challenges facing the distribution and collection of the sheep onto and from the cooperative members' ranches will need to match the requirements associated with the alternatives. After consultation with range scientists, it was determined that the effects of removing the ewes from leafy spurge in August were unknown. It is possible that leafy spurge control would be reduced if the grazing season ended early in the summer. Therefore, the financial feasibility of the fall lambing scenario was not analyzed.

There are also many similarities in the scenarios. Flock size for all scenarios was 5,000 ewes. All replacements were purchased. Terminal sires were used, and all lambs were sold at 125 pounds in each scenario. Ewes for the cooperative were assumed to be western white-faced. These animals are typically a cross of Rambouillet, Columbia, Targhee or some combination of these breeds. They can be expected to weigh 140 to 170 pounds and shear 8 to 10 pounds of wool grading 60's or 62's. Feed costs were adjusted for the differing amounts of weight added to lambs post-weaning depending on the management scenario used. Production coefficients of the winter and spring lambing scenarios are shown in Table 1.

Table 1. Production Coefficients of Winter and Spring Lambing Scenarios

	Winter	**Spring**
Number of Ewes	5,000	5,000
Marketed Number of Lambs	6,000	6,000
Lamb Selling Weight (lbs)	125	125
Market Lamb Price ($/cwt)	$76	$76
Number of Rams	100	100
Ram Purchase Price ($/head)	$200	$200
Cull Ewe Selling Price ($/cwt)	$26	$26
Cull Ram Selling Price ($/cwt)	$13	$13
Ewe Purchase Price ($/head)	$100	$100
Ewe Replacement Rate [1]	20%	20%
Ewe Death Loss Rate	5%	5%
Ram:Ewe Ratio	1:50	1:50
Roughage Used Per Year (tons)	2,650	1,800
Grain Used Per Year (tons)	1,860	965
Hay Price ($/ton) [2]	$51.50	$51.50
Grain Price ($/ton) [3]	$79.80	$79.80
Total Investment Per Ewe [4]	$301.05	$215.71

[1] One thousand replacements purchased and 750 cull ewes sold each year.

[2] Long term average hay prices in North Dakota are $59 for alfalfa and $39 for grass hay. This price represents a weighted average of 60% alfalfa and 40% grass hay (North Dakota Agricultural Statistics Service, various years).

[3] Represents feed barley price per bushel of $1.90.

[4] For a complete description of the facilities and other capital investments in each scenario, please refer to Sell et al. 1999a.

A comparison of the balance sheets for the winter and spring lambing alternatives reveals the total assets required for the spring lambing scenario are nearly 30 percent less than the winter lambing alternative (Table 2). The additional assets required for the winter lambing scenario are based on additional buildings and facilities

($244,000), additional equipment ($58,000), and additional operating capital ($125,000). The additional buildings are predominantly the insulated lambing barn and cold lambing lots (Figure 1). The additional equipment for the winter lambing scenario includes creep feeders, additional feed wagon, and a grinder mixer.

Table 2. Total Assets and Equity Requirements for 5,000 Ewes Under Winter Lambing and Spring Lambing Scenarios

	Winter Lambing	Spring Lambing	Percent Difference
Current Assets	$250,000	$125,000	50.0
Intermediate Assets	718,700	660,700	8.1
Long Term Assets	536,553	292,845	45.4
Total Assets	1,505,253	1,078,545	28.3
Equity Requirment	50%	50%	
Total Equity	$752,627	$539,273	
Member equity/ewe	$150.53	$107.85	

*Image not available. Please contact the Hettinger Research Extension Center for a Printed Copy

Figure 1. Schematic Drawing Comparing Proposed Facilities for Winter and Spring Lambing Scenarios

Cooperative Members Contribution

A rancher/member's investment in the cooperative accomplishes two things 1) it entitles the member to share in the potential returns/losses resulting from the operation of the cooperative and 2) it requires the member to provide summer pasture according to the number of shares owned. Prospective members to the cooperative would be required to contribute equity and may have to add fencing to their existing pastures. Cooperative member equity investment per ewe was $150 and $108 for the winter and spring lambing scenarios, respectively (see Table 1).

Two alternatives for fencing were analyzed for each scenario, new fence and modified fence. In addition, fencing requirements for each scenario are different because of the different size/age composition of the flocks grazed. Lambs are weaned prior to the grazing season in the winter lambing alternative and do not graze on cooperative member's pastures. The necessary fencing requirements for mature ewes were assumed to be an additional 2 barbed wires added to an existing 3- to 4-wire fence or construction of a new 6-wire fence. For the spring lambing scenario, the lambs graze with the ewes on the leafy spurge pastures. This scenario requires an additional 3 wires added to an existing 3- to 4- wire fence or construction of a new 7-wire fence. Fencing costs (construction, repair, depreciation) were amortized over a 20 year period (Table 3).

Annualized fencing costs incurred by the cooperative member assuming a 50-acre pasture which is 100 percent infested with leafy spurge ranged from $1.59/ ewe for the winter lambing alternative to $1.84/ewe for the spring lambing alternative. Construction of new fencing was generally about five times more costly than modifying an existing fence. For new fence, the average annual cost per ewe was between $0.10 to $0.25/ewe more for the spring lambing scenario than the winter lambing, assuming the infestation size was equal to the pasture size. The smaller the infestation size relative to the pasture size, the greater the fence cost of the spring lambing scenario relative to the winter lambing scenario.

Table 3. Annual Fence Costs per Ewe by Pasture Size and Leafy Spurge Infestation

Pasture Size				leafy Spurge	Infestation	(acres)		
acres	Fence		50	100	150	200	250	300
			-----------	-----------	------cost /	ewe------	-----------	--------
Winter	Lambing	Total Cost						
50	New		$1.59	na	na	na	na	na
	Modify		$0.29	na	na	na	na	na
100	New	$2,197	$2.20	$1.10	na	na	na	na
	Modify	$405	$0.40	$0.20	na	na	na	na
200	New	$3,051	$3.05	$1.53	$1.02	$0.76	na	na
	Modify	$572	$0.57	$0.29	$0.19	$0.14	na	na
300	New	$3,706	$3.71	$1.85	$1.24	$0.93	$0.74	$0.62
	Modify	$701	$0.70	$0.35	$0.23	$0.18	$0.14	$0.12
Spring	Lambing	Total Cost						
50	New	$1,844	$1.84	na	na	na	na	na
	Modify	$429	$0.43	na	na	na	na	na
100	New	$2,551	$2.55	$1.28	na	na	na	na
	Modify	$607	$0.61	$0.30	na	na	na	na
200	New	$3,552	$3.55	$1.78	$1.18	$0.89	na	na
	Modify	$859	$0.86	$0.43	$0.29	$0.21	na	na
300	New	$4,320	$4.32	$2.16	$1.44	$1.08	$0.86	$0.72
	Modify	$1,052	$1.05	$0.53	$0.35	$0.26	$0.21	$0.18

Source: Bangsund et al. 1999

na--not applicable.

RESULTS

Expected annual net income for the baseline winter lambing scenario was a negative $61,000 (Table 4). Net income in this case approximates profitability of the proposed coop. It represents returns after depreciation on buildings, equipment, and the ewe flock. It does not include an opportunity cost for equity capital. The baseline model for the spring lambing scenario generated a positive annual net income of $124,000.

Return on investment for a prospective cooperative member, assuming a 50-acre leafy spurge infestation in a 100-acre pasture, ranged from 16 to 21 percent, depending on whether new or modified fence was used. Return on investment for the winter lambing scenario was negative.

Sensitivity analysis was conducted to determine returns for the cooperative with respect to critical variables, such as lambing percentage and lamb selling price. The lambing percentage is an often used indicator of flock management. The lambing percentage is generally proportional to the number of lambs sold per ewe. The lamb selling price cannot be directly manipulated through management (except through forward contracting or other various marketing schemes); however, assuming there are lambs to sell, it is a critical variable to determine financial viability of the cooperative. To determine the impact of changing these variables, the highest and lowest lamb selling price in the past 10 years was used in the model (North Dakota Agricultural Statistics Service, various years) (Table 4). Also the selling price of lambs and the percentage of lambs sold were changed independently to determine when the cooperative was at a breakeven point with respect to each variable (i.e., there was zero net income and no patronage would be returned to the members).

The high price alternative is the only alternative which provided a positive return (5%) on investment with the winter lambing scenario (Table 4). The feasibility of this alternative seems unlikely as a price level this high was only attained 1 out of the past 10 years. In fact, the lowest lamb price at which the cooperative would breakeven was $84.10/cwt. This price level was only attained 2 out of the past 10 years (North Dakota Agricultural Statistics Service, various years). The percentage of lambs sold per ewe would also have to increase from 120 percent/ewe to 133 percent/ewe. Alternatively, the lowest price at which the spring lambing scenario would operate at breakeven was $59.51/cwt. This price was exceeded in 7 out of the past 10 years (North Dakota Agricultural Statistics Service, various years). The minimum number of lambs sold per ewe for the spring lambing scenario to breakeven is 0.94 lambs/ewe. The North Dakota state average lambs sold per ewe from 1994 through 1998 was 1.26 lambs/ewe (North Dakota Agricultural Statistics Service, various years).

Table 4. Sensitivity Analysis for Winter Lambing and Spring Lambing Scenarios

	Winter Lambing1	Spring Lambing2

Income	Expected	Low Lamb Selling Price	High Lamb Selling Price	Lowest Feasible Lambs Sold Per ewe	Lowest Feasible Price	Expected	Low Lamb Selling Price	High Lamb Selling Price	Lowest Feasible Lambs Sold Per ewe	Lowest Feasible Price
Net income (after Depr.)3	($60,728)	($263,228)	$44,272	$1,022	$22	$123,722	($78,786)	$228,714	$214	$39
Net income/ewe	($12.15)	($52.65)	$8.85	$0.20	$0.00	$24.74	(15.76)	$45.74	$0.04	$0.01
Percent earnings/loss returned	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Hypothetical Cooperative Member										
Pasture Size	100	100	100	100	100	100	100	100	100	100
Acres of leafy spurge	50	50	50	50	50	50	50	50	50	50
Ewes/shares needed	50	50	50	50	50	50	50	50	50	50
Capital required to purchase shares	$7,526	$7,526	$7,526	$7,526	$7,526	$5,403	$5,403	$5,403	$5,403	$5,403
Investment in additional 'new' fence4	$2,197	$2,197	$2,197	$2,197	$2,197	$2,551	$2,551	$2,551	$2,551	$2,551
Investment in additional 'modified' fence4	$405	$405	$405	$405	$405	$607	$607	$607	$607	$607
Member equity returned	($607)	($2,632)	$443	$10	$0	$1,237	($788)	$2,287	$2	$0
Return on investment (new fence)5	(6.2%)	(27.1%)	4.6%	0.1%	0.0%	15.6%	(9.9%)	28.8%	0.0%	0.0%
Return on investment (modified fence)5	(7.7%)	(33.2%)	5.6%	0.1%	0.0%	20.6%	(13.1%)	38.1%	0.0%	0.0%

[1] The expected lamb selling price was $76/cwt, low lamb selling price was $49/cwt, high lamb selling price was $90/cwt, lowest feasible lambs sold/ewe was 1.33, and the lowest feasible lamb selling price was $84.10/cwt.

[2] The expected lamb selling price was $76/cwt, low lamb selling price was $49/cwt, high lamb selling price was $90/cwt, lowest feasible lambs sold/ewe was 0.94, and the lowest feasible lamb selling price was $59.51/cwt.

[3] No opportunity cost charged to member equity.

[4] Assuming a 100-acre pasture.

[5] Investment assumed to include equity capital and fencing material, no charge included for member labor.

The total (over 10 years) and annualized loss of AUMs to cattle from a 50-acre infestation of leafy spurge was determined at carrying capacities ranging from 0.4 to 0.6 AUMs per acre (Table 5). The net returns resulting from the use of a common herbicide treatment program were also calculated (Bangsund et al. 1996). The use of a recommended herbicide treatment program annualized over 10 years will not result in positive returns at carrying capacities from 0.4 to 0.6 AUMs/acre. However, the economic loss which results with the use of this herbicide treatment program will be less than the loss from not treating the leafy spurge at carrying capacities of more than 0.5 AUMs/acre.

Annual net returns (calculated at $15/AUM for AUMs gained, less annualized cost of grazing, plus patronage) resulting from using the spring lambing scenario in a 100-acre pasture, with a 50-acre leafy spurge infestation at various carrying capacities were calculated (Table 5). Assuming the cooperative does not pay any patronage (operates at breakeven), the annual net return from grazing the sheep would be negative; however, the resulting net loss would be less than not treating the infestation at carrying capacities of 0.5 AUMs/acre and higher. If the cooperative returns $12.00/ewe or $600 annually, the net returns are positive. In this case, the returns are the value of the AUMs which are gained (valued at $15/AUM) as a result of grazing the sheep on leafy spurge infested rangeland. The annual net returns increase as the carrying capacities are increased. If the cooperative generates returns equal to expectations (see Table 5), then the annual net returns are increased by more than $600 for the 50-acre infestation.

Table 5. Comparison Annualized Costs and Returns Over 10 years for Uncontrolled, Using Herbicides, and Grazing Sheep on a 50-Acre Leafy Spurge Infestation

Uncontrolled	Infestation1	
AUMs/Acre	Annual Average AUMs Lost	Value Lost AUMs
0.4	20.34	($305)
0.5	25.39	($381)

0.6	30.47	($457)		
Herbicide	Application2			
AUMs/Acre	Average Annualized Cost	Value of Gained AUMs	Annual Net/ 50 acres	
0.4	$565	$183	($382)	
0.5	$565	$229	**($336)**	
0.6	$565	$275	**($290)**	
Sheep Grazing	(zero patronage)			
AUMs/Acre	Average Annualized Grazing Cost3	Value of Gained AUMs	Partonage	Annual Net/ 50 acres4
0.4	$600	$184	$0	($416)
0.5	$600	$230	$0	($370)
0.6	$600	$276	$0	($324)
Sheep Grazing	(annual partonage equals	average investment)		
AUMs/Acre	Average Annualized Grazing Cost3	Value of Gained AUMs	Patronage5	Annual Net/ 50 acres4
0.4	$600	$184	$600	**$184**
0.5	$600	$230	$600	**$230**
0.6	$600	$276	$600	**$277**
Sheep Grazing	(expected patronage)			
AUMs/Acre	Average Annualized Grazing Cost3	Value of Gained AUMs	Patronage5	Annual Net/ 50 acres4
0.4	$600	$184	$1,237	**$821**
0.5	$600	$230	$1,237	**$867**
0.6	$600	$276	$1,237	**$914**

Note: Annual net/50 acres in **BOLD** represent returns which are "least-loss" (loss is less than loss of not treating infestation).

[1] Assumed patch expansion of 2 radial feet per year, and AUMs valued at $15, initial patch density 30 percent. A 30 percent (80-120 stems per square meter) patch density translates into essentially no cattle grazing within the patch.

[2] Assumed $5/acre application cost and chemical treatment program annualized over 10 years of .25 lb/acre of Picloram and 1.0 lb/acre of 2,4-D. Application and chemical costs equaled $18.83/acre in treatment year. Infestation was treated 6 out of 10 years for an annualized treatment cost of $11.30/acre.

[3] Annualized grazing cost is comprised of total equity invested in cooperative ($5,393) plus modified fencing costs for 100 acre pasture ($607) amortized over 10 years plus equals $600.

[4] Equals annual avg. AUMs gained (@$15/AUM) minus annual avg. cost of grazing, plus patronage. Returns would be lower with new fencing.

[5] Annual patronage is $12.00/ewe (i.e., $600/50 shares; patronage equal to original investment).

[6] Annual patronage is $24.74/ewe (i.e., $1,237/50 shares; expected results).

CONCLUSION

This report presents the feasibility for a 5,000 ewe flock cooperative whose members would use the sheep to control leafy spurge. Three scenarios were initially investigated 1) winter lambing, 2) spring lambing, and 3) fall lambing. The fall lambing scenario was determined to be infeasible because of logistics associated with gathering and transportation of pregnant ewes and lack of grazing pressure on leafy spurge throughout the grazing season.

The total capital investment per ewe for the winter lambing scenario was more than the spring lambing scenario - - $301 and $216, respectively. The expected net income generated by the winter lambing scenario was negative. The minimum break-even lamb selling price or lambs sold per ewe for the winter lambing scenario was $84.10/cwt and 1.33, respectively. The spring lambing scenario returned $124,000 annually. The minimum breakeven lamb selling price or lambs sold per ewe for the spring lambing scenario was $59.51/cwt and 0.94, respectively. The expected return on investment (50% equity) for cooperative members with the spring lambing scenario, assuming a 50-acre leafy spurge infestation in a 100-acre pasture and new fence, was 16 percent. Return on investment with modified fence increased to 21 percent. While these returns are not a guarantee of success for the spring lambing alternative, they do provide an indication of the potential that such a cooperative may have.

For large infestations (more than 50 acres) it is difficult, if not impossible, to find a control program which will generate positive returns to control (except biological control). Often a producer's only recourse is to simply "limit the losses" of the infestation. Returns/losses from no control, recommended herbicide control, and grazing sheep from the spring lambing cooperative were compared. If the cooperative generates slightly less than ½ of expected returns, the cooperative members can expect positive returns from controlling leafy spurge with sheep. However, if the cooperative does not generate a positive return, then the producer is better off to use herbicides or not attempt to control the infestation.

There are a number of limitations of this study. The model parameters such as labor requirements, conception rates, lambing percentage, variable and fixed input costs, ewe and ram selling and purchasing prices were fixed. The value of these coefficients will likely change over time, and this impact was not investigated. This study only analyzed the performance of a large scale cooperative. There may be situations where a larger cooperative may be able to capture greater economies of scale or alternatively a smaller scale cooperative is more practical given the logistical characteristics of leafy spurge infestations within a region. Sheep stocking rates were not changed based upon rangeland carrying capacities. Labor availability was not assumed to be a constraint. This may or may not be the case given the current record low unemployment rates in North Dakota.

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