Agricultural Economics Report No 435 **January 2000**

FEASIBILITY OF A SHEEP COOPERATIVE FOR GRAZING LEAFY SPURGE

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Acknowledgments

The authors wish to thank Frayne Olson, Quentin Burdick Center for Cooperatives, North Dakota State University, for his assistance and advice during this study. Also, Scott Birchall, Carrington Research Extension Center was instrumental in providing important information for this study.

This study contributes to an integrated pest management demonstration project, titled *The Ecological Areawide Management of Leafy Spurge* (TEAM Leafy Spurge). Financial support for the project and this study was provided by the Agricultural Research Service, United States Department of Agriculture. We express our appreciation to this organization for their financial support and to Drs. Gerald Anderson and Lloyd Wendel, principal investigators for TEAM Leafy Spurge.

Thanks are extended to Norma Ackerson for document preparation and to our colleagues who reviewed the manuscript.

The authors assume responsibility for any errors of omission, logic, or otherwise.

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ABSTRACT

This report presents an economic feasibility study of a 5,000 head, cooperatively owned, sheep operation for leafy spurge control. The objectives 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.

Three sheep flock management alternatives were initially considered for the cooperative. These were 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 (stocking rate of 1 ewe and lambs per acre of leafy spurge). 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.

HIGHLIGHTS

This report presents an economic feasibility study of a cooperatively owned and professionally managed sheep operation for leafy spurge control. The objective of this analysis is to investigate the feasibility of establishing a cooperatively owned sheep flock for the purpose of grazing leafy spurge. Specifically, the objectives 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 cooperative members would be required to contribute 50 percent equity to the cooperative and provide 4 to 6 months grazing for the sheep. 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.

Three sheep flock management alternatives were initially 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. 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 (stocking rate of 1 ewe and lambs per acre of leafy spurge). 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.

FEASIBILITY OF A SHEEP COOPERATIVE FOR GRAZING LEAFY SPURGE

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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 re-seeding 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).

Herbicides are often an acceptable method of controlling leafy spurge. Use of herbicides on rangeland does not eradicate the weed; however, they control the weed and help prevent expansion. Bangsund et al. (1996) conducted breakeven and least-loss analyses of 15 herbicide treatment programs modeled over a twenty-year period. Results revealed that about half of the treatments brokeven at a rangeland grazing capacity of 0.65 AUMs/acre (benefits of recouped grazing would outweigh treatment costs at higher grazing capacities). The most economical treatment (least expensive while still providing adequate control) brokeven at 0.5 AUMs/acre, based on broadcast spraying of a one-acre patch. Broadcast spraying on large leafy spurge patches (50 acres) was not economical; however, perimeter spraying (spraying outside portion of the patch to prevent expansion) was economical on large infestations.

Using insects to control leafy spurge is promising when the insects actually exhibit some type of control on the plant community. Biological control (as defined here) is the control of leafy spurge through the deliberate use of natural enemies (i.e., insects) to reduce the density of leafy spurge below an economic threshold (Harris et al. 1985). Biological control of leafy spurge is currently viewed as a possible widespread, economical management tool for controlling the weed (Hansen et al. 1997). If the insects can be obtained at no expense (free except for time to collect and release), then biological control may be an economic option for controlling leafy spurge. However, while in some specific environmental conditions, insects have proven to be very effective, in many other cases the insects have exhibited insufficient effect on the plant community.

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

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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 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. 1999, 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. 1999, 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. 1999).

This report presents an economic feasibility study of a cooperatively owned and professionally managed sheep operation for leafy spurge control. The objective of this analysis is to investigate the feasibility of establishing a cooperatively owned sheep flock for the purpose of grazing leafy spurge. Specifically, the objectives are 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 sheep flock management alternatives were initially 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.

There are also many similarities in the three scenarios studied. 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 ewes. These animals are typically 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. A more detailed breakdown of the ration by type of animal or stage of production is provided in Table 2.

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] Thus 1,000 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 the 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 the Facilities and Equipment for Winter and Spring Lambing Options section.

Table 2. Ration Composition by Roughage and Grain, by Stage of Production

Production stage	Roughage or Pasture	Grain
Dry ewe	4 lb	0 lb
Late Gestation	4 lb	1 lb
Lactation	4 lb	2 lb
Flushing	4 lb	1 lb
Rams	6 lb	1/4 lb [1]
Lambs [2]	20 percent	80 percent

[1] Reflects annual use, allocated 91 pounds per year, per ram.

[2] Expected performance: 0.7 pounds gain/day, feed conversion 6.5 pounds feed/pound gain.

Winter Lambing

The winter lambing flock will lamb in January, February and March (Table 3). The winter lambing scenario requires adequate facilities to house nearly the entire ewe flock and their lambs during those months. This includes a 100 by 250 foot cold lambing barn containing a 50 by 100 foot warm room. In addition, six cold barn shelters would be required. Lambs will be weaned after 60 days and will go directly to the feedlot for finishing. Ewes will start summer grazing of leafy spurge pastures as dry ewes. Lambs are projected to be sold at 125 pounds at 6 months of age, in the months of July through October. Breeding season will commence August 1 and will run through October. Ewes will be bred in three groups so that 1/3 of the ewes will lamb each in January, February and March. The winter lambing flock will be the most capital and labor intensive scenario.

Spring Lambing

The spring lambing scenario is designed to reduce capital investment and labor requirements of the cooperative. The scenario includes wintering ewes outside. Lambs would be born in the month of May (Table 4). Shelter for a small fraction of the lambing group would be available. As lambs are born and grouped, they will be hauled directly to pasture and raised as pairs. Lambs would be weaned and removed from pasture in the month of August. This is to attempt to avoid the increase in lamb predation as the current year's crop of coyote pups begin to hunt. Dry ewes will stay on pasture. Lambs will be transferred to the cooperative's facility to be finished to market weight. This scenario reduces labor and building investment, but increases the risk of predation.

Fall Lambing

A third scenario is much more management intensive and revolves around lambing the flock in August and September (Table 5). This scenario provides many of the same reductions in capital investment that are available with spring lambing. It also decreases the predation risk since ewes will be hauled back to the central facility prior to lambing. Fall lambing reduces the amount of time the ewes

can remain on pasture and requires that feedstuffs be adequate to support lactation. It does allow marketing of lambs into a traditionally strong market period and keeps facility costs low. It may require a small winter lambing facility to handle the lambing of ewes that do not breed in the fall season. 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, only the feasibility of winter and spring lambing were analyzed. In the event that additional research indicates that the early removal of grazing animals does not affect leafy spurge control or that effective predator control measures can be developed to allow the ewes to lamb on pasture, the fall lambing alternative may be reinvestigated.

Table 3. Winter Lambing Management Calendar

	Major Management	Ewe Location	Lamb Location	Ram Location
January [1]	Lamb January Ewes	1 group of 1,750	with ewes	Ram facility
February [2]	Lamb February Ewes	1 group of 1,750	with ewes	Ram facility
March [3]	Lamb March Ewes Wean Jan Born Lambs	1 group of 1,750	Jan on Feed Feb/Mar with ewes	Ram facility
April [4]	Wean Feb Born Lambs	3 groups of 1,750	Jan/Feb on feed Mar with ewes	Ram facility
May [5]	Wean March lambs	Ewes available to go to pasture	All lambs in feedlot	Ram facility
June [6]	Pasture ewes	Pasture	All lambs in feedlot	Ram facility
July [7]	Pasture ewes Sell Jan Lambs	Pasture	All lambs in feedlot	Ram facility
August [8]	Pasture ewes Sell Feb Lambs Breed Jan Ewes	Pasture	All lambs in feedlot	With Jan Group
September [9]	Pasture ewes Sell March Lambs Breed Feb Ewes	Pasture	All lambs in feedlot	With Feb Group
October [10]	Drylot ewes Breed March Ewes	3 groups of 1,750	Most lambs sold	With Mar Group
November [11]	Drylot Ewes	3 groups of 1,750	No lambs	Ram facility
December [12]	Drylot Ewes	3 groups of 1,750	No lambs	Ram facility

[1] January ewes are in a warm lambing facility. Balance of ewes are in winter drylots. January ewes are on lactation diet, Feb. ewes are on late gestation diet, Mar. ewes are on winter diet. Lambs are with ewes and rams are in ram facility.

[2] January ewes have moved to cold housing, Feb. ewes are in lambing facility. All lambs are still with ewes and rams are in ram facility. January and Feb. ewes are on lactation diet and Mar. ewes are on late gestation diet.

[3] March ewes are in the warm lambing facility, Feb. ewes are in cold housing. January lambs are weaned, ewes have gone back to the winter drylot and lambs are in the feedlot. Feb. and Mar. ewes are on lactation diet, Jan. ewes are on dry ewe diet.

[4] The Feb. lambs are weaned and in feedlot, Jan. and Feb. ewes are in drylot. Mar. ewes are in cold housing. Mar. ewes are on lactation diet, Jan. and Feb. ewes are on dry ewe diet.
[5] All lambs are weaned and in the feedlot. Ewes are available to go to pasture.
[6] Lambs in feedlot and ewes on pasture.
[7] Lambs in feedlot and ewes on pasture. Some of the early Jan. lambs will begin to go to market.
[8] Ewes are still on pasture. Breeding begins for the Jan. group. Some lambs are being sold.
[9] Ewes are still on pasture. Lambs are being sold at an increasing rate. Breeding begins for Feb. group.
[10] Begin bringing ewes back to the facility. Breeding begins for Mar. group. Market lamb sales are nearly complete.
[11] All ewes are back at facility and are in winter drylots. Jan. ewes are on gestation diet. Final lambs are sold. Rams are back in ram facility.
[12] Ewes in drylot, Jan. ewes on late gestation diet, Feb. and March ewes on gestation diet. No lambs are left in feedlot. Rams are in ram facility.

Table 4. Spring Lambing Management Calendar

	Major Management	Ewe Location	Lamb Location	Rams Location
January [1]	Drylot ewes	3 groups of 1,750	Lambs sold	Ram Facility
February [2]	Drylot ewes	3 groups of 1,750	No Lambs	Ram Facility
March [3]	Drylot ewes	3 groups of 1,750	No Lambs	Ram Facility
April [4]	Drylot ewes	3 groups of 1,750	No Lambs	Ram Facility
May [5]	Lambing ewes	6 groups of 875	With Ewes	Ram Facility
June [6]	Pasture pairs	Pasture	With Ewes	Ram Facility
July [7]	Pasture pairs	Pasture	With Ewes	Ram Facility
August [8]	Pasture pairs	Pasture	Lambs in feedlot	Ram Facility
September [9]	Pasture ewes	Pasture	Lambs in feedlot	Ram Facility
October [10]	Pasture ewes	Pasture	Lambs in feedlot	Ram Facility
November [11]	Drylot ewes	3 groups of 1,750	Lambs in feedlot	Ram Facility
December [12]	Drylot ewes	3 groups of 1,750	Lambs in feedlot	With Ewes

[1] Ewes are maintained in one group of 5,000. Any remaining lambs are sold. Rams are maintained in the ram facility.
[2] The ewes are managed as one group. Rams are in the ram facility. All lambs are gone.
[3] Ewes are managed as one group. Rams are in the ram facility. All lambs are gone.
[4] Ewes switch to the pre-lambing ration. Rams are maintained in ram facility. Ewes are divided into lambing groups for ease of observation.
[5] Ewes lamb in drylot. Singles are bonded and sent to pasture in 2-3 days, twins are bonded and grouped and sent to pasture after 4 to 7 days. Triplets are bummed and sold because they are not strong enough to survive in a range management system.
[6] Pairs are on pasture, pasture selection is based on singles and twins. Rams are in the ram facility.
[7] Pairs remain on pasture.
[8] Management begins especially close vigilance for predation. As soon as predation becomes an issue the lambs are weaned and brought to the feedlot. This is a decision point for the cooperative, lambs can be sold as feeders at this point or can be finished for slaughter weight.
[9] Ewes are maintained on pasture.
[10] Ewes are maintained on pasture.
[11] Ewes are brought back to the cooperative facility. They are fed dry ewe ration until December.
[12] Ewes receive flushing ration. Ewes are bred in December.

Table 5. Fall Lambing Management Calendar

	Management	Ewes	Lambs	Rams
January [1]	Winter dry ewes	1 group of 5,000	feedlot	ram facility
February [2]	Winter dry ewes	1 group of 5,000	lamb sales	ram facility
March [3]	Winter dry ewes	1 group of 5,000	lamb sales	ram facility
April [4]	Flush and breed	breeding	none	with ewes
May [5]	pasture dry ewes	pasture	none	ram facility
June [6]	pasture dry ewes	pasture	none	ram facility
July [7]	pasture dry ewes	pasture	none	ram facility
August [8]	pasture dry ewes	pasture	none	ram facility
September [9]	Ewes in lambing facility	Ewes in cold lambing facility	pairs	ram facility
October [10]	Pairs	Pairs in drylot	pairs	ram facility
November [11]	Wean lambs ewes to drylot	1 group of 5,000	feedlot	ram facility
December [12]	Ewes in drylot Lambs in feedlot	1 group of 5,000	feedlot	ram facility

[1] Ewes are maintained as a group of 5,000. Lambs are in the feedlot and are nearing finished weight. Rams are in the ram facility.
[2] Ewes are maintained as a group of 5,000. Lambs are in the feedlot, the bulk of the lamb sales occurs in February and March. Rams are in the ram facility.
[3] Ewes are maintained as a group of 5,000. Lambs are in the feedlot, the balance of the slaughter lamb sales occurs in March. Rams are in the ram facility. Ewes are fed a flushing diet.
[4] Ewes are bred at the cooperative facility.
[5] The pregnant ewes go to pasture.
[6] Ewes are on pasture.
[7] Ewes are on pasture.
[8] Ewes are on pasture.
[9] Ewes brought back to the cooperative facility to lamb.
[10] Pairs are in drylot.
[11] Lambs are weaned and the ewes go back to winter rations in the drylot. Lambs go to the feedlot for finishing.
[12] Ewes are maintained as a group of 5,000 on winter ration. Lambs are in the feedlot.

Facilities and Equipment For Winter Lambing Option

The winter lambing option is projected to be the most capital intensive scenario (Appendix A), due to substantial needs for shelter at lambing time and the increased need for shelter for pairs during the winter months. For example, shelter is needed for 11,100 animals in March. In addition, the equipment needs are increased since the risk of not being able to feed in a timely manner is higher with late gestation ewes and with very young lambs.

Dry ewe facilities are three large lots (Figure 1). The lots are 200 by 500 feet. Each lot will have 1,400 feet of double sided feed bunk (described later in this section) and 300 feet of slotted windbreak fence 6 feet high (facilities and equipment are discussed in greater detail in Appendix B). The lots will include four (4) large scale waterers with a seven foot drinking area. There will be a mercury vapor yard light at each waterer. Each lot will have four 16 foot gates. Fencing will be 39 inch mesh with one row of barb wire on top, with four inch wood posts spaced at ten foot intervals. The winter lots allow for 57 square feet per ewe with 19 inches of feedbunk space per ewe. Total cost for the lots is estimated at slightly over $51,000 including labor but not water and electrical development.

The production flow of animals in the winter lambing scenario is in a circular pattern. Bred ewes are wintered in the three ewe lots. In January, the first lambers are moved from lot A to the lambing barn (Figure 1). As they lamb and are bonded the pairs are moved to hoop house lot 1 until it is at capacity and then lot 2 is filled. In February the ewes from lot B are moved into the lambing facility. As they lamb and are paired up they move as pairs to hoop house lots 3 and 4. In March the ewes from lot C move to the lambing barn and lamb. Ewes and lambs are moved into hoop house lots 5 and 6 as needed. As March ends the lambs in hoop house lots 1 and 2 will be weaned and the ewes will be transferred back to winter lot A until they are sent to pasture. Lambs will remain in the hoop house lots for finishing. In April the lambs in lots 3 and 4 will be weaned and the ewes will be transferred to lot B. Lambs will remain in the hoop house lots for finishing. In May the remaining lambs will be weaned and the ewes will be sent directly to pasture. As ewes come back from summer pasture they will go to the winter ewe lots.

Ewes will lamb in a cold barn that also includes a warm room for pairs immediately post-partum. This barn is 100 by 250 feet in size (14 square feet per ewe) with 14 foot sidewalls. Inside this barn is an insulated area that is 100 by 50 feet to be used for lambing pens. The facility also includes a lot for outside feeding of ewes. Fence for this lot is constructed to the same specification as the dry ewe lots. The feedbunks used are reused from the winter dry ewe lots. Four large feedlot style waterers are included in the lambing barn. The estimated cost of this facility is slightly more than $175,000. This includes all materials and labor except water development.

After ewes and lambs are bonded together, they will move to the cold housing areas. There are six cold housing units projected for this scenario. Each includes a 50 by 100 foot hoop house type building (6 square feet per ewe) and a dry lot (23 square feet per ewe). The hoop house will sit on a 4 foot pony wall and will be open on one end. The lots will be constructed using the same materials as the dry ewe lots. Each pairs' lot will have 4 gates and 2 waterers with mercury lights. Estimated cost per lot not including water and electrical development is about $14,000. The total for all six pairs lots is estimated at nearly $86,000.

Labor requirements for this scenario include two full-time yearly employees. These positions are the manager and an assistant. The manager was budgeted at $40,000 annual salary, including benefits. Additional benefits to the manager would include a home with water and electricity paid. The assistant was budgeted at $25,000 per year including benefits. They will be expected to

manage the operation all year and supervise the seasonal lambing crew. The two permanent employees will be responsible for feeding, veterinary care, predator protection, machinery and facility care and all the other jobs necessary for the successful operation of the cooperative. The winter scenario was budgeted for 3,240 hours of additional labor. This is sufficient to provide 1.5 people per hour for 24 hours per day, seven days per week during the 3-month lambing season. Assuming 50 hours per week, per person this is equivalent to an additional 5 people to assist during the 3-month lambing period. All part-time, seasonal labor was budgeted at $9/hour including benefits.

The winter lambing scenario has annual non-pasture feed needs of approximately 2,665 tons of roughage and 1,865 tons of grain (77,700 bushels of barley). The feed storage area includes four hopper bottom bins with augers holding approximately 16,000 bushels of grain. Roughage is stored on the ground both as it is delivered and after it is ground for feeding. The winter lambing scenario assumes that annual feed needs are contracted with delivery times staggered throughout the feeding period, thereby reducing the amount of grain storage needed and reducing the fire risk associated with large hay storage. Estimated cost of the feed storage area is near $32,000.

Machine storage and repair will occupy a 40 by 80 foot pole building with 14 foot sidewalls. The building will include a 10 by 20 foot employee locker room and restroom. Estimated cost of this structure is $25,000.

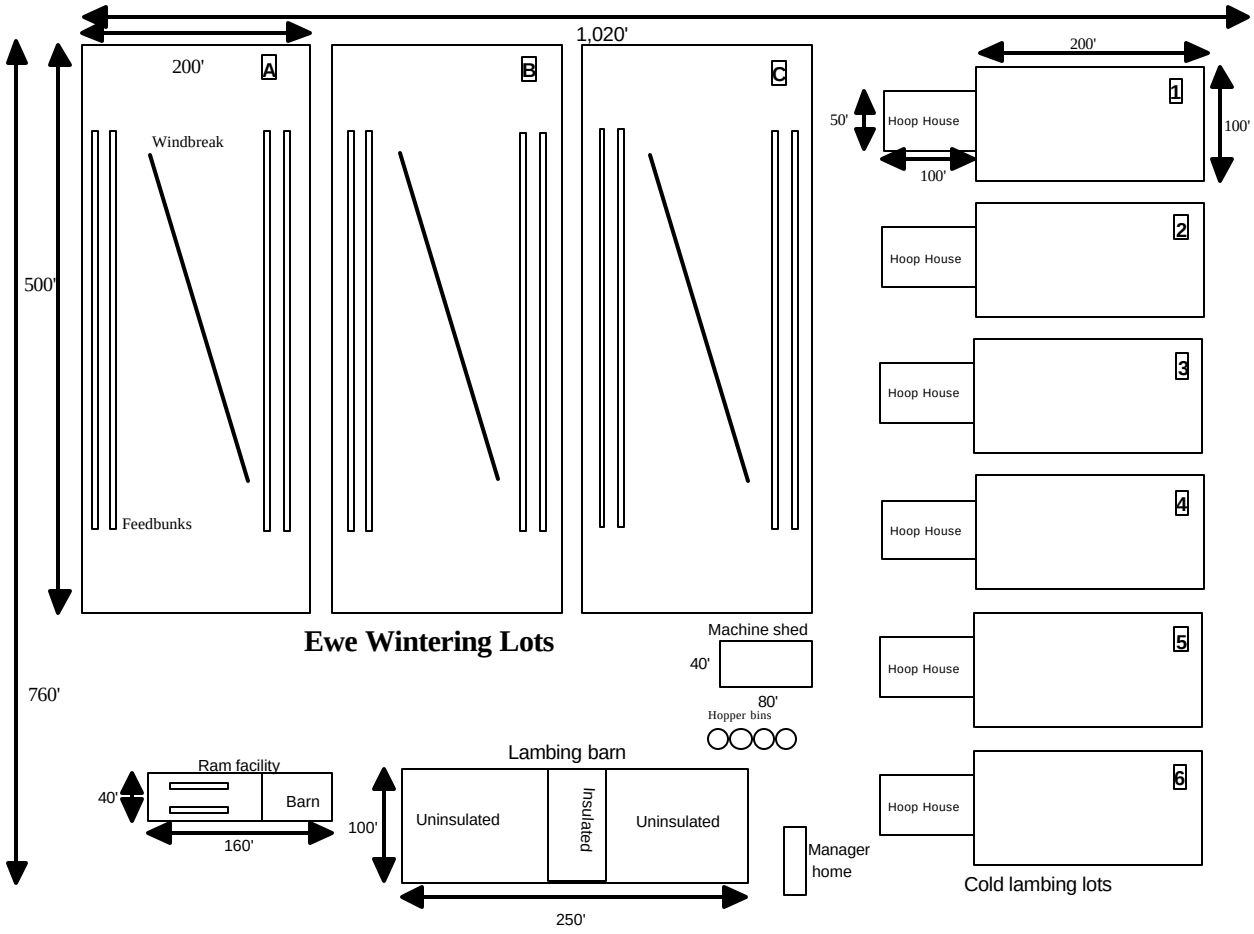

Figure 1. Schematic Drawing of Proposed Winter Lambing Alternative

The ram battery requires a 40 by 60 foot pole building and a dry lot with double-sided feeders to house the approximately 100 rams used by the cooperative. The estimated cost of this facility is just over $15,000.

The manager is expected to live on-site at the cooperative's facility. This insures security for the site and provides an on-site staff person during inclement weather. A double-wide trailer house was budgeted at $50,000, which includes the house, water and sewer service, propane system, and skirting.

Water development for the entire site including all livestock water fountains, water to the house and machine shop, and the pipeline to service them is estimated at nearly $27,000. Electrical development, including trenching wire to all service panels and livestock waterers is estimated at nearly $5,000. Total cost for mercury lights for the facility was estimated at $6,500.

Lagoon needs were estimated at $15,000. This allows for 7,700 cubic yards of storage (Appendix C). Total land need is estimated at 160 acres. This was budgeted at $50,000 including some site preparation (160 acres @ $200/acre and $18,000 for site/road work). Site work includes materials to build a five wire fence around the perimeter of the property. This fence would be constructed by cooperative employees as time permits.

Miscellaneous feeders and tools are estimated at $20,550. This includes $15,000 for feeders (also used for creep feeders) that will be used with feeder lambs, $800 for mineral feeders, $2,000 for hand and shop tools, and $2,750 for a sheep handling system and portable corrals.

The machinery needs for this option include two new 85 horsepower tractors. These tractors are equipped with front-wheel assist and cabs and have loaders with grapple forks. Budgeted amount is $59,000. Two pull type 350 cubic foot feed wagons are also included, one new and one used. Total feed wagon costs were estimated at $37,500. Two new pickups are budgeted; a 3/4 ton four wheel drive, and a ½ ton two wheel drive. Cost for the pickups is estimated at $40,000. There are two 4-wheel drive ATVs in the budget; estimated cost is $11,000. A used fifth wheel stock trailer is budgeted at $9,500. A grinder mixer with a hay table is budgeted at $13,500. Finally, a 60 foot auger, a snow blower, a heavy rear blade, a post hole auger, and a rotary mower are included in the budget for a total of $8,800.

Buildings and facilities are depreciated using straight line depreciation with no salvage value over 20 years. Machinery is depreciated over 10 years. Annual depreciation for the winter scenario is $45,000, which results from depreciating $203,000 of machinery and $496,000 of buildings and facilities.

Facilities and Equipment For Spring Lambing Option

The spring lambing option substantially reduces the capital investment required by the cooperative, due to reduced need for shelter at lambing time and for pairs. In the winter lambing scenario there was a need for shelter 11,100 animals in March. In the spring option during the month of March there are no lambs, and the ewes can be sheltered behind a simple windbreak. In addition,

the equipment needs are much smaller since the risk of not being able to feed in a timely manner is much lower with dry ewes.

Dry ewe facilities are three large lots allowing 57 square feet per ewe (Figure 2). The lots are 200 by 500 feet. Each lot will have 1,400 feet of double sided feed bunk, or 19 inches per ewe (described later in this section) and 300 feet of slotted windbreak fence 6 feet high (facilities and equipment are discussed in greater detail in Appendix B). The lots will include four (4) large scale waterers with a seven foot drinking area. There will be a mercury vapor yard light at each waterer. Each lot will have four 16 foot gates. Fencing will be 39 inch mesh, one row of barb wire on top, with four inch wood posts spaced at ten foot intervals. Total cost for the lots is estimated at slightly over $51,000 including labor, but not water and electrical development.

The production flow of animals in the spring scenario is much simpler than the winter plan. Ewes will winter in three lots and will lamb in May in the lots. Two hoop house shelters and lots will be available for shelter for the youngest lambs if weather threatens. Ewes and lambs will only remain at the facility until they are bonded and the lambs have been docked and castrated. They will be shipped as pairs directly to pasture.

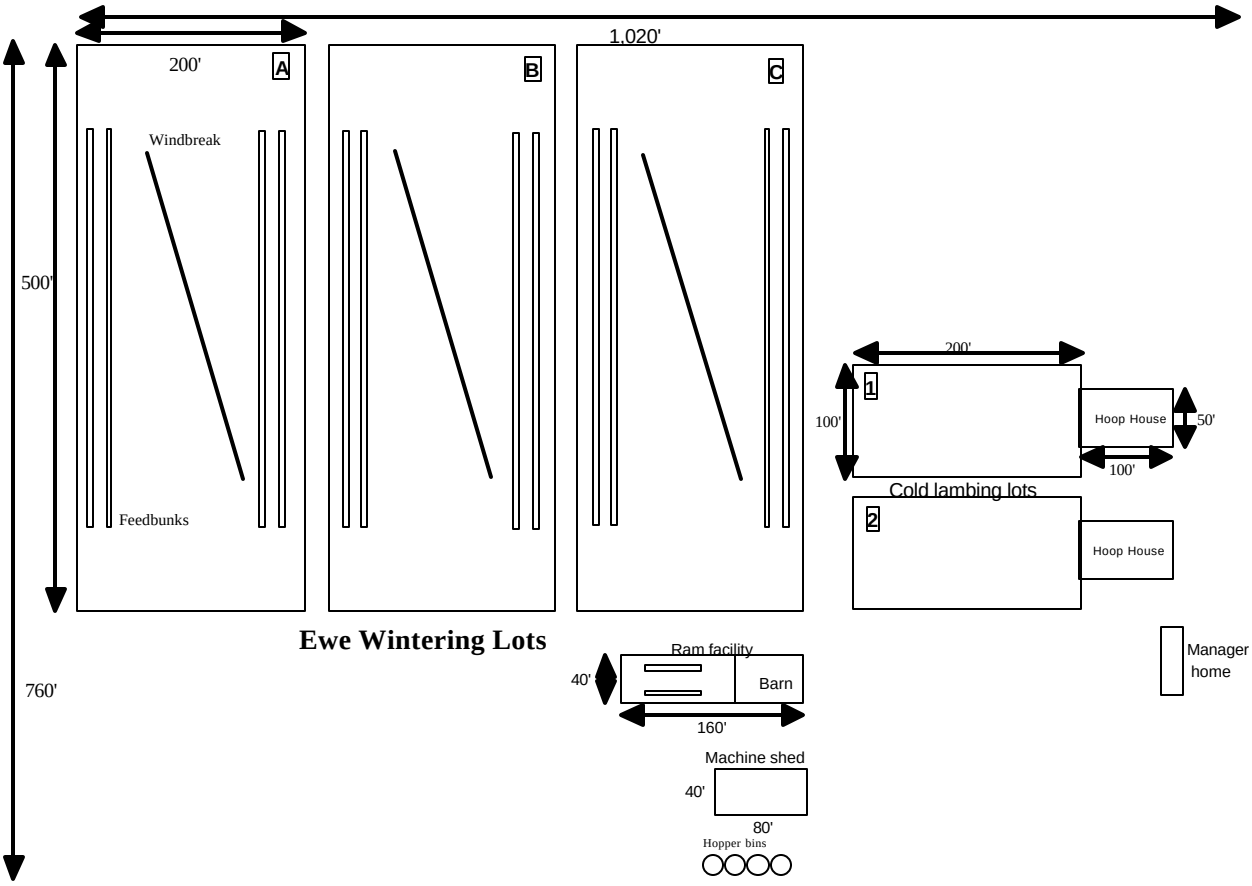

Figure 2. Schematic Drawing of Proposed Spring Lambing Alternative

Ewes will lamb on drylots in May. This eliminates the need for the expensive lambing barn that is part of the winter plan. In the spring scenario there will be two hoop house type barns to provide shelter as needed for newborn lambs.

Within a few days of birth, ewes and lambs are bonded together, and will be moved to the pastures. There are two cold housing units projected for this scenario. Each includes a 50 by 100 foot hoop house type building and a dry lot. These drylots and housing units will provide 23 square feet and 6 square feet per ewe, respectively. The hoop house is built on a 4 foot pony wall and is open on one end. The lots will be constructed using the same materials as the dry ewe lots. Each pairs lot will have 4 gates and 2 waterers with mercury lights. Estimated cost per lot, not including water and electrical development, is about $14,000. The total for both lots is estimated at about $28,000.

The spring lambing scenario has annual non-pasture feed requirements of approximately 1,800 tons of roughage and 965 tons of grain (40,200 bushels of barley). The feed storage area includes four hopper bottom bins with augers holding a total of approximately 16,000 bushels of grain. Roughage is stored uncovered on the ground at delivery and after it is processed (ground). The spring lambing scenario assumes that annual feed needs are contracted with delivery times staggered throughout the feeding period, reducing the amount of grain storage needed and reducing the fire risk with large amounts of hay storage. Estimated cost of the feed storage area is $32,000.

Machine storage and repair will occupy a 40 by 80 foot pole building with 14 foot sidewalls. The building will include a 10 by 20 foot employee locker room and restroom. Estimated cost of this structure is $25,000.

The ram battery requires a 40 by 60 foot pole building and a dry lot with double-sided feeders to house the approximately 100 rams used by the cooperative. The estimated cost for this facility is just over $15,000.

The manager is expected to live on-site at the cooperative's facility. This insures security for the site and provides a staff person on-site during inclement weather. A double-wide trailer house was budgeted at $50,000. This includes the house, water and sewer service, propane system, and skirting.

Water development for the entire site including all livestock water fountains, water to the house and machine shop, and the pipeline to service them is estimated at slightly over $20,000. Electrical development including trenching wire to all service panels and livestock waterers is estimated at nearly $5,000. Total cost for mercury lights for the facility are estimated at $4,500.

Cost of lagoon facilities was estimated at $12,170. This allows for 6,250 cubic yards of run-off storage (Appendix C). Total land need is estimated at 160 acres. This was budgeted at $50,000 including some site preparation (160 acres @ $200/acre and $18,000 for road/site work). Site work includes materials to build a five wire fence around the perimeter of the property. The fence is to be constructed by cooperative employees as time permits.

Miscellaneous feeders and tools are estimated at $5,550. This includes $800 for mineral feeders, $2,000 for hand and shop tools, and $2,750 for a sheep handling system and portable corrals. Creep feeders were not needed since the lambs would not be weaned and started on feed until they are large enough to use existing feeders.

Labor needs for spring lambing are less than the winter option. The two full time employees are retained, but the seasonal lambing labor is reduced to 1,080 hours. This provides 1.5 man hours of additional labor around the clock during lambing season or an additional 5 people for the 30-day lambing season. The seasonal labor was budgeted at the same rate as the winter lambing scenario. Seasonal, part-time labor availability may be an issue for the spring lambing scenario given the timing of the peak labor needs and potential competition for labor with other agricultural producers. The permanent employees will have the same responsibilities and salaries as in the winter lambing scenario. In addition, they will be expected to monitor the pairs on pasture closely for signs of predation and general health.

The machinery needs for the spring lambing scenario have been reduced. This is because during the winter feed period there will be only dry ewes on the facility. This reduces the total feed output needed per day since there is less risk to the flock from slight delays of feeding due to a mechanical breakdown. The spring lambing scenario includes one new 85 horsepower tractor and one used chore tractor valued at $12,500. The new tractor is equipped with front-wheel assist and a cab and has a loader with grapple fork. The chore tractor will be a used two-wheel drive tractor capable of pulling the feed wagon and operating the mower and blade. Total budgeted amount for tractors is $42,000. One new pull type 350 cubic foot feed wagon is included in the budget for the spring lambing. A spare is not included since dry ewes could be fed long hay with the tractor loader if the feed wagon was broken. Estimated cost of the feed wagon is $25,000. Two new pickups are budgeted; a 3/4 ton four wheel drive and a ½ ton two wheel drive. Pickup costs were estimated at $40,000. Two 4-wheel drive ATVs are budgeted at a cost of $11,000. A used fifth wheel stock trailer is budgeted at $9,500. Finally, a 60 foot auger, a tractor mounted-snow blower, a heavy rear blade, a tractor mounted-post hole auger, and a rotary mower are included in the budget for a total of $8,800.

Depreciation for the spring lambing cooperative is lower than winter lambing systems. The depreciation schedule is the same as in the winter option; equipment is depreciated on a 10 year straight line schedule, and buildings and facilities are depreciated over 20 years. The reduction in depreciation expense occurs from the much smaller equipment and building inventory in the spring lambing option. Annual depreciation is $25,000, which results from $145,700 of machinery and $242,825 of buildings and facilities.

Cooperative Member Investment

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.

To obtain greater benefit from grazing sheep on leafy spurge, it is more desirable to have relatively larger infestations within the total area to be grazed (Bangsund et al. 1999). For example, the financial benefit for using sheep to control a 50 acre infestation of leafy spurge within a 350 acre pasture would be less, per acre of leafy spurge, than using sheep to control a 250 acre patch of leafy spurge within the same pasture.

Prospective members of the proposed cooperative should consider the risk-return of their investment. The objective of this analysis was to investigate the profitability and cashflow of a large coop-owned ewe flock. Initial conditions were based upon 50 percent equity, which must be provided by the cooperative members. Further, the cooperative members must provide between 4-6 months grazing for one ewe, depending on the alternative, for each share of stock they own. According to recommended stocking rates in a season-long grazing system between 0.75 and 1.5 ewes per acre of leafy spurge can be supported without decreasing the carrying capacity of cattle depending on the length of grazing season and the overall carrying capacity of the range (Table 6) (Bangsund et al. 1999). After four years of consecutive grazing by sheep, grass consumption by cattle within leafy spurge infestations will increase from zero grass utilization to more than 80 percent of existing grass production (Figure 3) (Bangsund et al. 1999). The estimated reduction in leafy spurge infestation density caused by grazing sheep will be more than 50 percent after five years of season-long grazing (Figure 4).

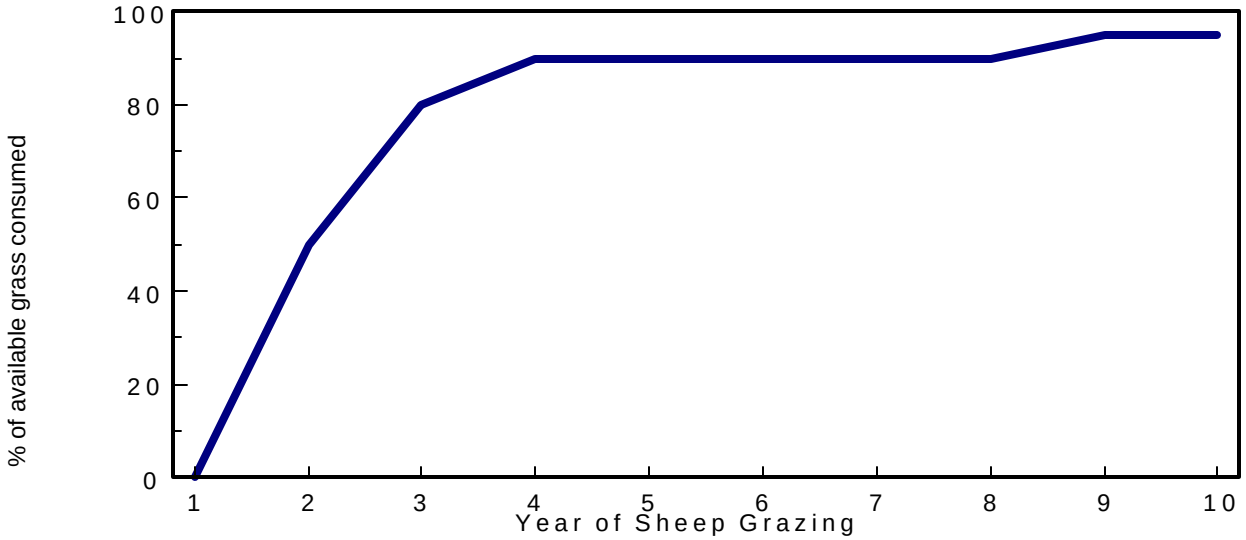

Figure 3. Grass Utilization of Available Forage by Cattle within a Leafy Spurge Infestation Seasonally Grazed by Sheep

Source: Bangsund et al. 1999.

Table 6. Recommended Sheep Stocking Rates for Leafy Spurge Control

Months Grazed	Mature sheep per acre	
	Western North Dakota	Eastern North Dakota
1	4	8
2	2	4
3	1.5	3
4	1	2
5	.875	1.8
6	.75	1.5
7	.625	1.3
8	.5	1

Source: Bangsund et al. 1999.

Logistics associated with effective management of the cooperative members' flock dictate that 50 mature ewes per cooperative member is the minimum limit. These ewes are assumed to be grouped within one pasture. Accordingly, the minimum leafy spurge infestation size is 50 acres at recommended stocking rates (Bangsund et al. 1999).[2]

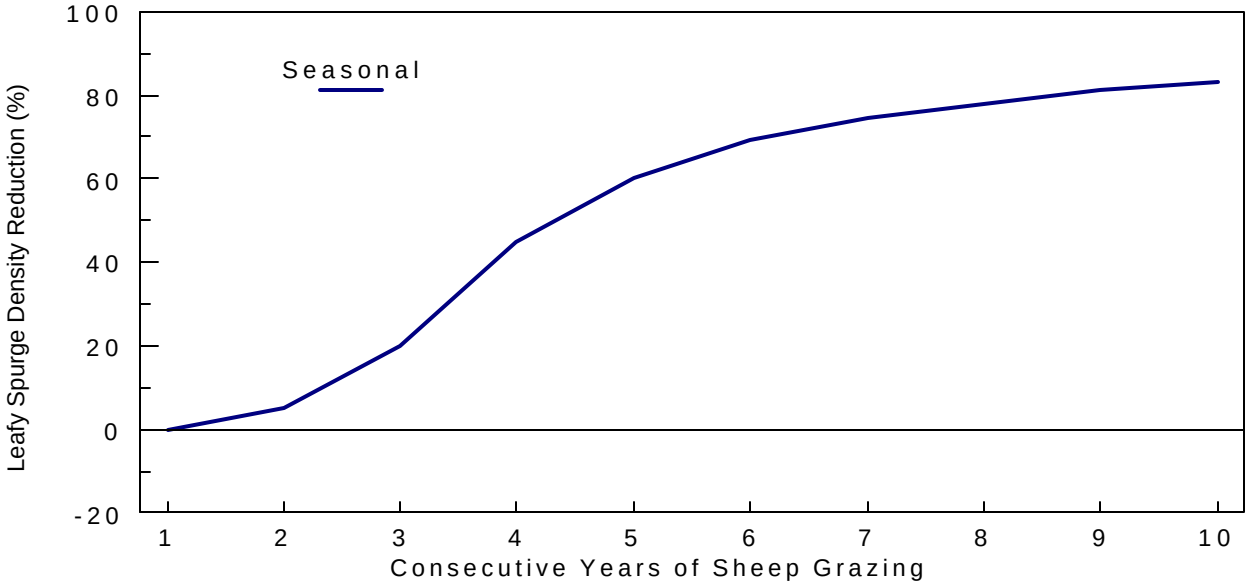

Figure 4. Leafy Spurge Density Reduction from Initial Density with Seasonal Sheep Grazing over 10 years

Source: Bangsund et al. 1999.

[2] Assumed decreasing sheep stocking rate over time as the leafy spurge density is decreased (Bangsund et al. 1999). The assumption in this analysis is that sheep stocking rates will remain static, even as leafy spurge density is decreased.

Capital Investment

A comparison of the assets required 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 7). 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) (Appendix A). The additional buildings are predominantly the insulated lambing barn and cold lambing lots. The additional equipment for the winter lambing scenario includes creep feeders, additional feed wagon, and a grinder mixer. The increase in current assets is the additional operating capital required for the winter lambing scenario. Equity requirements for a producer-owned agricultural cooperative of this nature have been suggested to be 50 percent (Baltezore 1999).

Table 7. 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 Requirement	50%	50%	
Total Equity	$752,627	$539,273	
Member equity/ewe	$150.53	$107.85	

Fencing Costs

The advantage of using sheep to control leafy spurge is maximized when the sheep are confined within pastures which are predominantly leafy spurge (Bangsund et al. 1999). Two fencing alternatives were considered with each management alternative: building a new fence and modifying an existing fence. Costs and materials for construction of a new fence or modifying an existing fence were based upon 1998 retail prices (Bangsund et al. 1999). Labor costs were not included. The additional fencing costs assumed a square, relatively flat pasture. Water development costs were not included as pastures were assumed to have existing water facilities which would not require significant modification to accommodate sheep.

Fencing requirements for the various scenarios are different because of the different size/age composition of the flocks grazed. Lambs are weaned prior to the grazing season (see Table 3) 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 8).

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 8. Annual Fence Costs per Ewe by Total Size of Pasture 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	$1,594	$1.59	na	na	na	na	na
	Modify	$286	$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

Proposed Cooperative Structure

There are several alternative cooperative business structures which may be implemented for this proposed cooperative. The structure ultimately depends on the composition of the prospective members and the members' ability to generate the necessary equity to start the cooperative. The business plan is the next step in the process of forming a cooperative. The decision of how to organize the cooperative to most effectively meet the needs of its members is completed as part of the business plan (Patrie 1998; Olson 1999).

A cooperative is a form of corporation where the ownership is shared by those who do business (patronage) with the cooperative versus a corporation whereby ownership is based upon the number of shares owned by the shareholder. A cooperative has a board of directors who represent the shareholders and are elected from within the cooperative membership. The board is responsible for hiring a manager who is responsible for the daily management of the cooperative. Within the cooperative, each shareholder is entitled to one vote regardless of the number of shares the person has accumulated.[3] Cooperatives qualify for single tax treatment. Net income paid to members is a deductible expense for the cooperative's tax treatment, thus avoiding the concern of "double taxation," but the cooperative must pay at least 20% of its net income as cash to the members so they have enough cash to pay the income taxes on the full amount (Saxowsky and Knoepfle 1999). If the tax regulations are not followed, the cooperative is taxed as a corporation.

A "new-generation" cooperative (Patrie 1998) is a phrase which has been coined and represents a form of organizing the type of cooperative analyzed in this report. New generation cooperatives have the following attributes (Patrie 1998):

1) Equity investment by the prospective members is required prior to establishing delivery rights.
2) There is an agreement between the cooperative and the producer which links the delivery of products to the number of equity units purchased. Total delivery rights should approximately equal the capacity for the cooperative.
3) Shares are transferable between eligible producers at prices that are agreeable between the buyer and seller. These equity shares will appreciate or depreciate in value based on the potential earnings they represent. All sales or transfers of shares must be approved by the board of directors.
4) Relatively high levels of cash patronage refunds are issued annually to the shareholder/producers. Because a high level of equity is achieved in advance of business startup, a majority of the net returns can be returned to the producers in cash.

[3] This is generally the case, but not always.

RESULTS

Expected annual net income for the baseline winter lambing scenario was a negative $61,000 (Table 9). Net income in this case approximates profitability of the proposed cooperative. 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.

Table 9. Expected Returns from Sheep Cooperative for 5,000 Ewe Winter Lambing and Spring Lambing Scenarios

Income	Winter Lambing	Spring Lambing
Net income (after Depr.) [1]	($60,728)	$123,722
Net income/ewe	($12.15)	$24.74
Percent earnings/loss returned	100%	100%
Hypothetical Cooperative Member		
Acre pasture	100	100
Acres of Leafy Spurge	50	50
Ewes/shares needed	50	50
Capital required to purchase shares	$7,526	$5,403
Investment in additional 'new' fence [2]	$2,197	$2,551
Investment in additional 'modified' fence [2]	$405	$607
Earnings returned	($607)	$1,237
Return on investment (new fence) [3]	(6.2%)	15.6%
Return on investment (modified fence) [3]	(7.7%)	20.6%

[1] Does not include a charge for equity capital provided by members. A more detailed breakdown of spring and winter lambing budgets and alternative scenarios as provided by FINPACK (1999) may be found in Appendix D.
[2] Assuming a 100-acre pasture.
[3] Investment assumed to include equity capital and fencing material, no charge for labor to construct fence.

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 10). 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 11). 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 be at 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 10. Impact of Changes in Lamb Selling Price and Percentage of Lambs Sold Per Ewe on Winter and Spring Lambing Scenarios

	Winter Lambing	Spring Lambing
Low lamb selling price ($/cwt) [1]	49.00	49.00
High lamb selling price ($/cwt) [2]	90.00	90.00
Lowest feasible lamb selling price ($/cwt)	84.10	59.51
Lowest feasible lambs sold/ewe	1.33	0.94

[1] Lowest North Dakota lamb selling price in the past 10 years occurred in 1991 (North Dakota Agricultural Statistics Service, various years).

[2] Highest North Dakota lamb selling price in the past 10 years occurred in 1997 (North Dakota Agricultural Statistics Service, various years).

Table 11. Sensitivity Analysis for Winter Lambing and Spring Lambing Scenarios

	Winter Lambing [1]				Spring Lambing [2]			
Income	Low Lamb Selling Price	High Lamb Selling Price	Lowest Feasible Lambs Sold Per Ewe	Lowest Feasible Price	Low Lamb Selling Price	High Lamb Selling Price	Lowest Feasible Lambs Sold Per Ewe	Lowest Feasible price
Net income (after Depr.) [3]	($263,228)	$44,272	$1,022	$22	($78,786)	$228,714	$214	$39
Net income/ewe	($52.65)	$8.85	$0.20	$0.00	($15.76)	$45.74	$0.04	$0.01
Percent earnings/loss returned	100%	100%	100%	100%	100%	100%	100%	100%
Hypothetical Cooperative Member								
Pasture size	100	100	100	100	100	100	100	100
Acres of leafy spurge	50	50	50	50	50	50	50	50
Ewes/shares needed	50	50	50	50	50	50	50	50
Capital required to purchase shares	$7,526	$7,526	$7,526	$7,526	$5,403	$5,403	$5,403	$5,403
Investment in additional 'new' fence [4]	$2,197	$2,197	$2,197	$2,197	$2,551	$2,551	$2,551	$2,551
Investment in additional 'modified' fence [4]	$405	$405	$405	$405	$607	$607	$607	$607
Member equity returned	($2,632)	$443	$10	$0	($788)	$2,287	$2	$0
Return on investment (new fence) [5]	(27.1%)	4.6%	0.1%	0.0%	(9.9%)	28.8%	0.0%	0.0%
Return on investment (modified fence) [5]	(33.2%)	5.6%	0.1%	0.0%	(13.1%)	38.1%	0.0%	0.0%

[1] The 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 for the winter lambing scenario.

[2] The 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 for the spring lambing scenario.

[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 0.2 to 0.7 AUMs per acre (Table 12). 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 0.2 to 0.7 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.

Net returns 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 13). 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 (see Table 12). 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 9), then the annual net returns are increased by more than $600 for the 50 acre infestation.

Table 12. Comparison of Losses Over 10 Years, Uncontrolled 50-Acre Leafy Spurge Infestation and a Recommended Herbicide Application, by Carrying Capacity

Uncontrolled Infestation [1]

	AUMs Lost		Value of Lost Grazing	
AUMs/Acre	total	annual avg	total	annual avg
0.2	101.6	10.2	$1,524	$152
0.3	152.4	15.2	$2,286	$229
0.4	203.4	20.3	$3,051	$305
0.5	253.9	25.4	$3,809	$381
0.6	304.7	30.5	$4,571	$457
0.7	355.5	35.6	$5,333	$533

Herbicide Application [2]

	AUMs Lost		AUMs Gained		Herbicide Cost		Annual net/
AUMs/Acre	total	annual avg	total	annual avg	total	annual avg	50 acres
0.2	101.6	10.2	61.1	6.1	$5,653	$565	($474)
0.3	152.4	15.2	91.7	9.2	$5,653	$565	($428)
0.4	203.4	20.3	122.2	12.2	$5,653	$565	($382)
0.5	253.9	25.4	152.8	15.3	$5,653	$565	**($336)**
0.6	304.7	30.5	183.3	18.3	$5,653	$565	**($290)**
0.7	355.5	35.6	213.9	21.4	$5,653	$565	**($244)**

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.

Table 13. Comparison Over 10 Years of 50 Spring Lambing Ewes Grazing a 100-Acre Leafy Spurge Infested Pasture with Alternative Cooperative Patronage Levels [1]

Sheep Grazing (zero patronage)

	AUMs Lost		AUMs Gained		Costs of Grazing				Annual net
AUMs/Acre	total	annual avg	total	annual avg	investment	fencing	annual avg. cost	Patronage	returns/flock [2]
0.2	101.6	10.2	61.4	6.1	$5,393	$607	$600	$0	($508)
0.3	152.4	15.2	92.2	9.2	$5,393	$607	$600	$0	($462)
0.4	203.4	20.3	122.9	12.3	$5,393	$607	$600	$0	($416)
0.5	253.9	25.4	153.6	15.4	$5,393	$607	$600	$0	($370)
0.6	304.7	30.5	184.3	18.4	$5,393	$607	$600	$0	($324)
0.7	355.5	35.6	215.0	21.5	$5,393	$607	$600	$0	($277)

Sheep Grazing (Patronage equals investment)

	AUMs Lost		AUMs Gained		Costs of Grazing				Annual net
AUMs/Acre	total	annual avg	total	annual avg	investment	fencing	annual avg. cost	Patronage [3]	returns/flock [2]
0.2	101.6	10.2	61.4	6.1	$5,393	$607	$600	$600	**$92**
0.3	152.4	15.2	92.2	9.2	$5,393	$607	$600	$600	**$138**
0.4	203.4	20.3	122.9	12.3	$5,393	$607	$600	$600	**$184**
0.5	253.9	25.4	153.6	15.4	$5,393	$607	$600	$600	**$230**
0.6	304.7	30.5	184.3	18.4	$5,393	$607	$600	$600	**$277**
0.7	355.5	35.6	215.0	21.5	$5,393	$607	$600	$600	**$323**

Sheep Grazing (expected patronage)

	AUMs Lost		AUMs Gained		Costs of Grazing				Annual net
AUMs/Acre	total	annual avg	total	annual avg	investment	fencing	annual avg. cost	Patronage [4]	returns/flock [2]
0.2	101.6	10.2	61.4	6.1	$5,393	$607	$600	$1,237	**$729**
0.3	152.4	15.2	92.2	9.2	$5,393	$607	$600	$1,237	**$775**
0.4	203.4	20.3	122.9	12.3	$5,393	$607	$600	$1,237	**$821**
0.5	253.9	25.4	153.6	15.4	$5,393	$607	$600	$1,237	**$867**
0.6	304.7	30.5	184.3	18.4	$5,393	$607	$600	$1,237	**$914**
0.7	355.5	35.6	215.0	21.5	$5,393	$607	$600	$1,237	**$960**

[1] Based on $15/AUM over a 10-year time frame, modified fencing for 100-acre pasture, 50-acre leafy spurge infestation, spring lambing scenario. Infestation spreading at 2.0 radial feet/year, starting with a 30 percent canopy cover or 100 percent loss of cattle grazing within infestation.

[2] Equals annual avg. AUMs gained (@$15/AUM) minus annual avg. cost of grazing, plus patronage.

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

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

Note: Returns would be less with new fencing.

CONCLUSION

This report presents the feasibility for a 5,000 ewe sheep 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.

REFERENCES

Baltezore, James F. 1999. Personal Communication. Saint Paul Bank for Cooperatives, Fargo.

Bangsund, Dean A., Jay A. Leitch, and F. Larry Leistritz. 1996. Economic Analysis of Herbicide Control of Leafy Spurge (*Euphorbia esula L.*) in Rangeland. Agricultural Economics Report No. 342. Department of Agricultural Economics, North Dakota State University, Fargo.

Bangsund, Dean A., F. Larry Leistritz, and Jay A. Leitch. 1997. Predicted Future Economic Impacts of Biological Control of Leafy Spurge in the Upper Midwest. Agricultural Economics Report No. 382. Department of Agricultural Economics, North Dakota State University, Fargo.

Bangsund, Dean A., Dan Nudell, Randall S. Sell, and F. Larry Leistritz. 1999. Economic Analysis of Controlling Leafy Spurge with Sheep. Agricultural Economics Report No. 431. Department of Agricultural Economics, North Dakota State University, Fargo.

Birchall, Scott. 1999. Personal Communication. Livestock Waste Management Specialist. Carrington Research Extension Center, North Dakota State University Extension Center, Carrington.

FINPACK. 1999. FINPACK 99 Release 1.10. Center for Farm Financial Management, Department of Applied Economics, University of Minnesota, St. Paul.

Hansen, Richard W., Robert D. Richard, Paul E. Parker, and Lloyd E. Wendel. 1997. "Distribution of Biological Control Agents of Leafy Spurge (*Euphorbia esula L.*) in the United States: 1988-1996." *Biological Control* 10:129-142.

Harris, Peter, Paul H. Dunn, Dieter Schroeder, and Ronald Vonmoos. 1985. "Biological Control of Leafy Spurge in North America." In *Leafy Spurge*, A. K. Watson, ed., pp 79-92. Champaign, IL: Weed Science Society of America.

North Dakota Agricultural Statistics Service. Various Years. *North Dakota Agricultural Statistics*. North Dakota Agricultural Statistics Service, North Dakota State University Extension Service, North Dakota State University, Fargo.

Olson, Frayne E. Personal Communication. Assistant Director, Quentin Burdick Center for Cooperatives, North Dakota State University, Fargo.

Patrie, William. 1998. Creating 'Co-op Fever:' A Rural Developer's Guide to Forming Cooperatives. United States Department of Agriculture. Rural Business-Cooperative Service. Services Report No. 54. Washington DC.

Saxowsky, David M. and Terry W. Knoepfle. 1999. Website: http://www.ndsu.nodak.edu/instruct/swandal/AGEC242/242sec9.htm

Sedivec, Kevin, Thomas Hanson, and Cindie Heiser. 1995. Controlling Leafy Spurge Using Goats and Sheep. Extension Publication R-1093. North Dakota State University Extension Service, North Dakota State University, Fargo.

Sell, Randall S., Dean A. Bangsund, and F. Larry Leistritz. 1999. Perceptions of Leafy Spurge by Ranch Operators and Local Decision Makers: An Update. Agricultural Economics Statistical Series Report No. 56. Department of Agricultural Economics, North Dakota State University, Fargo.

Sell, Randall S., Dean A. Bangsund, F. Larry Leistritz, and Dan Nudell. 1998a. Perceptions of Leafy Spurge by Public Land Managers, Local Decision Makers, and Ranch Operators. Agricultural Economics Report No. 406. Department of Agricultural Economics, North Dakota State University, Fargo.

Sell, Randall S., Dean A. Bangsund, F. Larry Leistritz, and Dan Nudell. 1998b. Ranch Operators' Perceptions of Leafy Spurge. Agricultural Economics Report No. 400. Department of Agricultural Economics, North Dakota State University, Fargo.

APPENDIXES

APPENDIX A
Beginning Balance Sheets and Asset Inventories for Spring and Winter Lambing Scenarios

Appendix Table A1. Beginning Balance Sheets and Asset Inventories for Spring and Winter Lambing Scenarios

Spring Lambing			**Winter Lambing**		
Cash & checking balance		125,000	Cash & checking balance		250,000
Total Current Assets		125,000	Total Current Assets		250,000
INTERMEDIATE FARM ASSETS			INTERMEDIATE FARM ASSETS		
Breeding Lvst (Schd I)	No.	Market Value	Breeding Lvst (Schd I)	No.	Market Value
yearling ewes	5,000	500,000	yearling ewes	5,000	500,000
rams	100	15,000	rams	100	15,000
Farm machinery (Schd J)		145,700	Farm machinery (Schd J)		203,700
Total Intermediate Assets		660,700	Total Intermediate Assets		718,700
LONG TERM FARM ASSETS			LONG TERM FARM ASSETS		
Land (Schd L)	Acres	Market Value	Land (Schd L)	Acres	Market Value
facility inc site	160	50,000	facility inc site	160	50,000
Bldgs & improve. (Schd M)		242,845	Bldgs & improve. (Schd M)		486,553
Other long term assets		-	Other long term assets		-
Total Long Term Assets		292,845	Total Long Term Assets		536,553
TOTAL FARM ASSETS		1,078,545	TOTAL FARM ASSETS		1,505,253

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Appendix Table A1. Continued

Spring Lambing			**Winter Lambing**		
Current Farm Liabilities			Current Farm Liabilities		
Farm accrued interest			Farm accrued interest		
Accounts payable and accrued expenses			Accounts payable and accrued expenses		
Current Loans (Schd R)			Current Loans (Schd R)		
Opr. loan - Bank of Cooperative		62,500	Opr. loan - Bank		125,000
Total Current Liabilities		62,500	Total Current Liabilities		125,000
Interm. Farm Liabilities (Schd S)		Balance	Interm. Farm Liabilities (Schd S)		Balance
Bank for Cooperative		257,000	Bank for Cooperative		257,500
Bank for Cooperative		72,350	Bank for Cooperative		101,850
Bank for Cooperative		121,422	Bank for Cooperative		243,277
Total Inter. Liabilities		450,772	Total Inter.. Liabilities		602,627
Long Term Farm Liabilities (Schd T)			Long Term Farm Liabilities (Schd T)		
Lg Term			Lg Term		
Balance			Balance		
Bank for Cooperative	9.75	25,000	Bank for Cooperative	9.75	25,000
Total Long Term Liabilities		25,000	Total Long Term Liabilities		25,000
Total Farm Liabilities		538,272	Total Farm Liabilities		727,627

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Appendix Table A1. Continued

Spring Lambing				**Winter Lambing**			
Breeding Livestock				Breeding Livestock			
yearling ewes	5,000	$100/ewe	500,000	yearling ewes	5,000	$100/ewe	500,000
rams	100	$150/ram	15,000	rams	100	$150/ram	15,000
Total breeding livestock			515,000	Total breeding livestock			515,000

Schedule J: Machinery and Equipment	Market Value	Schedule J: Machinery and Equipment	Market Value
85 hp mfwd/loader	29,500	85 hp mfwd/loader	29,500
chore tractor	12,500	85 hp mfwd/loader	29,500
feed wagon	25,000	feed wagon	25,000
60 foot auger	3,850	feed wagon/used	12,500
7 by 26 foot trailer/used	9,500	60 foot auger	3,850
3/4 ton pickup 4 x4	25,000	7 by 26 trailer/used	9,500
½ ton pickup 4 x2	15,000	3/4 ton pickup 4x4	25,000
4 wheel atv	5,500	½ ton pickup 2x4	15,000
4 wheel atv	5,500	4 wheel atv	5,500
snow blower	3,000	4 wheel atv	5,500
rear blade	2,700	snow blower	3,000
mower	1,200	rear blade	2,700
post hole auger	1,900	mower	1,200
hand and shop tools	2,000	post hole auger	1,900
mineral feeders	800	grinder mixer	13,500
handling fac/port corral	2,750	creep feeders	15,000
		hand and shop tools	2,000
		mineral feeders	800
		handling fac/port corral	2,750
Total machinery and equipment	145,700	Total machinery and equipment	203,700

Farm Land		Market Value	Farm Land		Market Value
Facility inc site prep	160 Acres	50,000	Facility inc site prep	160 Acres	50,000
Total land		50,000	Total land		50,000

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Appendix Table A1. Continued

Spring Lambing		**Winter Lambing**	
Schedule M: Buildings and Improvements		Schedule M: Buildings and Improvements	
	Market Value		Market Value
3 winter ewe lots	51,241	3 winter ewe lots	51,241
2 cold housing barns	28,540	6 cold housing barns	85,621
feed facility	31,964	warm lambing barn	175,077
machine storage	25,000	feed facility	31,964
ram facility	15,300	machine storage	25,000
water development	20,160	ram facility	15,300
house	49,000	water development	26,880
lagoon	12,170	house	49,000
lights	4,500	lagoon and earth work	15,000
electrical supply	4,950	lights	6,500
		electrical supply	4,970
Total buildings and improvements	242,825	Total buildings and improvements	486,553

Appendix B
Common Facility Specifications and Expense Estimates

Appendix B. Common Facility Specifications and Expense Estimates

Feedbunk–Made on site from highway guard rail and well sucker rod. Each bunk is 13 feet long and has 26-30 linear feet of access. Cost of materials and labor is estimated at $106 each, based on regional prices for materials and two hours labor at $10 per hour.

Transportation Assumptions - For winter scenario assumed that only dry ewes are transported to pasture. Assuming 400 head per semi load or 13 loads out to pasture and 13 loads back to the facility. Assumed each trip averaged 35 loaded miles and $2.50 per mile. There was no additional charge assumed for multiple drop off and pick up points. Lambs were assumed sold FOB the facility and transportation costs were absorbed by the buyers. The same cash cost was assumed for the spring lambing scenario, however in spring cooperative employees would haul the pairs in smaller groups using the cooperative's trailer. The logistical challenges and labor requirements associated with taking the ewes/pairs to summer pasture may necessitate another alternative whereby the cooperative members are responsible for taking the ewes/pairs from the cooperative facility to the summer pastures.

Lot fences are made of 39 inch woven wire and topped with 1 row of barb wire. Posts are 4 inch treated wood posts spaced at 10 foot intervals and corners are 8 inch double braced. All gates are 16 foot, 2 inch pipe gates.
Lot fence is estimated at $0.85 per running foot.
Gates are estimated at $100 each for 16 foot 2 inch pipe gates.
Corners are estimated at $80 each.

Lights are mercury vapor mounted on a high line pole, cost is $200 each erected. An additional $50 per pole was estimated for the electrical hookup.

Electrical supply was estimated at 6,000 feet of 100 amp wire and 1,000 feet of 200 amp wire. Wire was assumed to use the same trench as water lines. An additional 500 feet of trenching in addition to trenching for water lines was budgeted.

Waterers are 7 foot Behlen feedlot units priced at $460 each. Thirty units were used in the facility. Seven thousand feet of water pipeline was assumed. In addition, each waterer had $100 budgeted for a concrete pad.

Creep Feeders are round metal sheep feeders from PJ Construction of Dickinson. They include a 50 gallon barrel for feed storage. They are sized to be appropriate for baby lambs to market lamb size. Cost including the barrel is estimated at $75 each.

Hand Tools are budgeted at $2000. This includes an air compressor, welder, small electrical tools (drill, grinder, saw, etc.) and a selection of hand mechanic and carpenter tools.

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Handling Facilities include a Sydell working chute setup and a portable corral system. This is budgeted at $2750.

Mineral Feeders are Sioux brand mineral feeders priced at $80 each.

Machinery was priced in fall of 1999 at K&K Equipment, Western Dakota Equipment, RZ Motors and Country General, all in Hettinger, ND. Additional prices were obtained from actual purchases made by the Hettinger Research and Extension Center. All prices are for new equipment except where noted. In the case of used equipment ½ of the price of new was assumed.

Electricity Expense

Electricity expense is estimated at $500 per month in the winter scenario ($6,000/year) and $250 per month in spring scenario($3,000/year). This is an estimate based on manager's house use, building lights, and yard lights and water heaters. Winter scenario has 26 yard lights with an average yearly cost of $84 each or $2,184. The spring scenario uses 18 yard lights. It is assumed that they are not used 40 percent of the time, since all sheep but rams are off-facility for grazing season, and that annual cost is $50 each or $900 per year. The manager's house was allocated $100 per month for electricity. This leaves $900 in the spring scenario and $2,600 in the winter scenario to power water fountains and heat and light other buildings. The winter scenario uses considerably more electricity because of the larger number of water fountains that need to be heated, the increased use of lights during an extended winter lambing season, and an increased need for lights and heat in the employee locker room.

Appendix C
Waste Management Issues for Southwestern Sheep Co-op Feasibility Study (Birchall 1999)

Appendix C. Waste Management Issues for Southwestern Sheep Co-op Feasibility Study (Birchall 1999)

Data.

5,000 ewes in feedlot for 6 months (assumed body weight of 175 lb).
100 rams in feedlot for 6 months (assumed body weight of 240 lb).
6,000 lambs in feedlot; 7 months (average body weight 55 lb) for winter lambing.
4 months (average body weight 75 lb) for spring lambing.

Catchment area: 509,000 square feet (includes pen area plus 20%) winter.
Less for spring lambing (413,000 sq. ft).

Typical as-collected manure volume and concentrations:

Volume	2.8 lb/day for 100 lb live weight.
Moisture content	62%
TKN	19.6 lb/ton
P_2O_5	13.2 lb/ton

Storage requirement.

Animal feeding operations with outside pens must have a storage pond with capacity to hold the runoff from a 1 in 25 year, 24 hour storm (2.5"), precipitation minus evaporation over a minimum of 6 months and any sludge build-up.

For the larger winter lambing option and a 12 month storage period, the storage requirement is approximately 7,700 cubic yards.

Using past NRCS cost share payments and assuming a 1:1 storage ratio, the excavation and compaction of such a structure would cost between $13,000 and $15,000. (Excavation; $1.15 per cubic yard for the first 500 cubic yards, then $0.95 per cubic yard. Roller Compaction; $1.40 and $1.20 per cubic yard, respectively.)

Note that this estimate does not include the cost of pen preparation or diversion embankments around the pen area. In wetter years, some form of irrigation system will be required for effluent distribution.

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Land area required for manure re-use.
From the feedlot use estimates, the total amount of manure collected would be 3,780 tons (spring) or 3,240 tons (winter).

Cropping rotation with the 5-year average yields (North Dakota Agricultural Statistics Service, various years) and nutrient uptake:

		Nitrogen	Phosphorus
Wheat	30 bu/a plus straw	52 lb N/a	29 lb P_2O_5/a
Barley	41 bu/a plus straw	48 lb N/a	19 lb P_2O_5/a
Alfalfa (per year for 2 years)	1.8 ton/a	81 lb N/a	18 lb P_2O_5/a
Average nutrient uptake:		66 lb N/a	21 lb P_2O_5/a

Assume that the manure is not incorporated after spreading, approximately 35% of the nitrogen will be lost.

Area required for nitrogen utilization: 730 acres/year.
Area required for phosphorus utilization: 2,370 acres.

As repeated applications at the rate necessary to meet nitrogen uptake will build up excessively high soil phosphorus levels, manure applications should be rotated over the larger area.

For the winter lambing option, the areas are 620 acres and 2,030 acres, respectively.

Other comments.
- Aim for pen drainage to be away from feeding areas to prevent mud build-up near feed bunks.
- Pen slopes should be between 2% and 6% to promote adequate drainage.
- A sediment drain (with a slope of less than 1%) will help settle solids out before the storage pond.
- Windbreak walls on top of a mound help with pen cleaning and provide additional shelter.
- If the lambs were being raised for breeding, try to locate the lambing areas up-slope of the wintering pens to reduce disease transmission.

Appendix D
FINPACK Budgets for Spring and Winter Lambing Scenarios

Appendix Table D1. FINPACK Budgets for Spring and Winter Lambing Scenarios

	Sheep, Market Lamb Prod
Budget Unit	Per Ewe
Description	Spring Lambing
Mkt Lambs	
Quantity (head)	1.2
Weight (lb.)	125
Price (cwt.)	76.00
Product income	114.00
Cull income	
Cull Ewes	7.83
Cull Rams	0.01
Miscellaneous income	
Wool	6.00
Gross income	127.84
Purchased feed	
Mineral	0.53
Hay	18.54
Grain	15.40
Breeding fees	-
Veterinary	3.00
Livestock supplies	
Supplies	2.00
Straw	0.50
Marketing	-
Total direct expense	39.97
Return over budget expense	87.87

	Sheep, Market Lamb Prod
Budget Unit	Per Ewe
Description	Winter Lambing
Mkt Lambs	
Quantity (head)	1.2
Weight (lb.)	125
Price (cwt.)	76.00
Product income	114.00
Cull income	
Cull Ewes	7.85
Cull Rams	0.26
Miscellaneous income	
Wool	6.00
Gross income	128.11
Purchased feed	
mineral	0.53
hay	27.29
grain	29.68
Breeding fees	-
Veterinary	3.00
Livestock supplies	
Supplies	2.00
Straw	0.50
Marketing	-
Total direct expense	63.00
Return over budget expense	65.11

Appendix Table D2. FINPACK Long Range Plan for Spring Lambing Scenarios

FINPACK 99: FINLRB Long Range Plan — Spring Lambing Scenario
Center for Farm Financial Management — Address: spring lambing
(C)1999 University of Minnesota

			Base Plan Expected	Alt. 1 Low Price	Alt. 2 Best Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible price
PLAN DESCRIPTION							
Total crop acres			-	-	-	-	-
Total labor hours			-	-	-	-	-
Change in farm assets			-	-	-	-	-
Change in farm liabilities			-	-	-	-	-
Livestock Plan	Unit	Sales/Unit					
Market Lambs, Spring	Ewe	1.20 head	5,000	-	-	-	-
Market Lambs, Worst price	Ewe	1.20 head	-	5,000	-	-	-
Market Lambs, best price	Ewe	1.20 head	-	-	5,000	-	-
Market Lambs, Necessary	Ewe	0.94 head	-	-	-	5,000	-
Market Lambs, Lowest Feas.	Ewe	1.20 head	-	-	-	-	5,000
PROFITABILITY							
			Base Plan Expected	Alt. 1 Low Price	Alt. 2 Best Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible price
INCOME STATEMENT (Typical Year)							
Mkt Lambs		$ 76.00/cwt.	570,000	-	-	-	-
Mkt Lambs		$ 49.00/cwt.	-	367,500	-	-	-
Mkt Lambs		$ 90.00/cwt.	-	-	675,000	-	-
Mkt Lambs		$ 76.00/cwt.	-	-	-	446,500	-
Mkt Lambs		$ 59.51/cwt.	-	-	-	-	446,325
Cull breeding livestock							
Cull Ewes			39,150	-	-	-	-
Cull Rams			65	-	-	-	-
Other Cull breeding livestock			-	39,200	39,200	39,200	39,200
Total cull breeding livestock			39,215	39,200	39,200	39,200	39,200
Misc. livestock income							
Wool			30,000	-	-	-	-
Other Misc. livestock inc			-	30,000	30,000	30,000	30,000
Total misc. livestock income			30,000	30,000	30,000	30,000	30,000
(A) Gross farm income			639,215	436,700	744,200	515,700	515,525
Purchased feed							
Mineral		$ 0.07/lb	2,650	-	-	-	-
Hay		$ 51.50/ton	92,700	-	-	-	-
Grain		$ 79.80/ton	77,000	-	-	-	-
mineral		$ 0.07/lb	-	2,650	-	-	-
hay		$ 51.50/ton	-	92,700	-	-	-
grain		$ 79.80/ton	-	77,000	-	-	-
Other Purchased feed			-	-	172,350	172,350	172,350
Total purchased feed			172,350	172,350	172,350	172,350	172,350
Veterinary			15,000	15,000	15,000	15,000	15,000
Livestock supplies							
Supplies		$ 2.00/ewe	10,000	-	-	-	-
Straw		$ 25.00/ton	2,500	-	-	-	-
Other Livestock supplies			-	12,500	12,500	12,500	12,500
Total livestock supplies			12,500	12,500	12,500	12,500	12,500
Interest [1]							
Bank of Coop			25,058	25,058	25,058	25,058	25,058
Bank of Coop			7,054	7,054	7,054	7,054	7,054
Bank of Coop			11,839	11,839	11,839	11,839	11,839
Bank of Coop			-	-	-	-	-

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Appendix Table D2 Continued

FINPACK 99: FINLRB Long Range Plan Center for Farm Financial Management (C)1999 University of Minnesota		Spring Lambing Scenario Address: spring lambing				
Bank of Coop		2,355	2,355	2,355	2,355	2,355
Operating interest		6,094	6,094	6,094	6,094	6,094
Total interest		52,399	52,399	52,399	52,399	52,399
Fuel & oil		3,959	3,959	3,959	3,959	3,959
Repairs		1,672	1,672	1,672	1,672	1,672
Custom hire						
Hay Grind($100per20 tons)		10,000	-	-	-	-
Manure Haul		6,237	-	-	-	-
Trucking(pasture&market)		1,625	-	-	-	-
Shearing @2.25/ewe		11,475	-	-	-	-
Other Custom hire		-	29,337	29,337	29,337	29,337
Total custom hire		29,337	29,337	29,337	29,337	29,337
Hired labor						
Manager		40,000	-	-	-	-
Assistant Manager		22,500	-	-	-	-
Seasonal Help/Lambing		9,072	-	-	-	-
1008 Hours @ $9/hr		-	-	-	-	-
Other Hired labor		-	71,572	71,572	71,572	71,572
Total hired labor		71,572	71,572	71,572	71,572	71,572
Real estate taxes		5,002	5,002	5,002	5,002	5,002
Farm insurance		4,000	4,000	4,000	4,000	4,000
Utilities		3,000	3,000	3,000	3,000	3,000
Marketing		1,000	1,000	1,000	1,000	1,000
Dues & professional fees		100	100	100	100	100
Miscellaneous						
Water (SW Water Pipeline)		10,264	-	-	-	-
Misc.		1,500	-	-	-	-
Other Miscellaneous		-	11,764	11,764	11,764	11,764
Total miscellaneous		11,764	11,764	11,764	11,764	11,764
(B) Total cash farm expense		383,655	383,655	383,655	383,655	383,655
(C) Net cash farm income		255,560	53,045	360,545	132,045	131,870
Depreciation		25,231	25,231	25,231	25,231	25,231
(D) Net farm income [2]		230,329	27,814	335,314	106,814	106,639

		Base Plan Expected	Alt. 1 Low Price	Alt. 2 Best Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible price
PROFITABILITY MEASURES (Market)						
Net farm income	(D)	230,329	27,814	335,314	106,814	106,639
Labor & management earnings	(D-E)	197,912	-4,603	302,897	74,397	74,222
Rate of return on farm assets	(H/I)	26.2 %	7.4 %	35.9 %	14.8 %	14.7 %
Rate of return on farm equity	(J/K)	42.6 %	5.1 %	62.1 %	19.8 %	19.7 %
Rate of return on added investment	(L/M)		- %	- %	- %	- %
Operating profit margin	(H/N)	60.6 %	30.3 %	67.8 %	46.4 %	46.3 %
Asset turnover	(N/I)	43.3 %	24.5 %	53.0 %	31.8 %	31.8 %
(E) Interest on farm net worth	(K* 6%)	32,416	32,416	32,416	32,416	32,416
(F) Farm interest paid		52,399	52,399	52,399	52,399	52,399
(G) Value operators labor & mgt		-	-	-	-	-
(H) Return on farm assets	(D+F-G)	282,728	80,213	387,713	159,213	159,038
(I) Total farm assets		1,078,545	1,078,545	1,078,545	1,078,545	1,078,545
(J) Return on farm equity	(D-G)	230,329	27,814	335,314	106,814	106,639
(K) Total farm net worth		540,273	540,273	540,273	540,273	540,273
(L) Added return to added investment			-202,515	104,985	-123,515	-123,690
(M) Added capital invested			-	-	-	-
(N) Value of farm production		466,865	264,350	571,850	343,350	343,175

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Appendix Table D2 Continued

FINPACK 99: FINLRB Long Range Plan — Spring Lambing Scenario
Center for Farm Financial Management — Address:
(C)1999 University of Minnesota — spring lambing

	LIQUIDITY						
	CASH FLOW (Typical Year)						
	Net cash farm income	(C)	255,560	53,045	360,545	132,045	131,870
	Nonfarm income	(+)	-	-	-	-	-
	Net cash available	(=)	255,560	53,045	360,545	132,045	131,870
	Family living	(-)	-	-	-	-	-
	Corporate income taxes	(-)	50	50	50	50	50
(R)	Cash available for principal payments	(=)	255,510	52,995	360,495	131,995	131,820
	Farm interest paid	(+)	52,399	52,399	52,399	52,399	52,399
	Cash avail. for principal and interest	(=)	307,909	105,394	412,894	184,394	184,219
	Bank of Coop		80,638	80,638	80,638	80,638	80,638
	Bank of Coop		16,491	16,491	16,491	16,491	16,491
	Bank of Coop		18,480	18,480	18,480	18,480	18,480
	Bank of Coop		2,840	2,840	2,840	2,840	2,840
	Operating loan interest		6,094	6,094	6,094	6,094	6,094
(S)	Total scheduled principal and interest	(-)	124,543	124,543	124,543	124,543	124,543
	Cash available after loan payments	(=)	183,366	-19,149	288,351	59,851	59,676
	Annual capital replacement		106,600	106,600	106,600	106,600	106,600
	Principal paid on intermediate debts		71,659	71,659	71,659	71,659	71,659
(T)	Cash required for replacement	(-)	34,941	34,941	34,941	34,941	34,941
(U)	Cash surplus or deficit	(=)	148,425	-54,090	253,410	24,910	24,735
	Cash available for principal payments	(R)	255,510	52,995	360,495	131,995	131,820
	Annual farm long term principal pymts	(-)	485	485	485	485	485
(V)	Cash available for farm intermed. debt	(=)	255,025	52,510	360,010	131,510	131,335
(W)	Farm intermediate debt to be served		450,772	450,772	450,772	450,772	450,772
	Years to turnover farm intermed. debt	(W/V)	1.8	8.6	1.3	3.4	3.4
	Surplus as a percent of payments	(U/(S+T))	93.1 %	-33.9 %	158.9 %	15.6 %	15.5 %
	Cash farm expense as % of income	(B/A)	60.0 %	87.9 %	51.6 %	74.4 %	74.4 %
	Farm interest as % of value of prod.	(F/N)	11.2 %	19.8 %	9.2 %	15.3 %	15.3 %
	Farm debt payments as % of value of prod.		26.7 %	47.1 %	21.8 %	36.3 %	36.3 %
	SOLVENCY						
	BALANCE SHEET (Market)						
	Current farm assets		125,000	125,000	125,000	125,000	125,000
	Intermediate farm assets	(+)	660,700	660,700	660,700	660,700	660,700
	Long term farm assets	(+)	292,845	292,845	292,845	292,845	292,845
	Nonfarm assets	(+)	-	-	-	-	-
(X)	Total assets	(=)	1,078,545	1,078,545	1,078,545	1,078,545	1,078,545
	Current farm liabilities		62,500	62,500	62,500	62,500	62,500
	Intermediate farm liabilities	(+)	450,772	450,772	450,772	450,772	450,772
	Long term farm liabilities	(+)	25,000	25,000	25,000	25,000	25,000
	Nonfarm liabilities	(+)	-	-	-	-	-
(Y)	Total liabilities	(=)	538,272	538,272	538,272	538,272	538,272
	Net worth	(X-Y)	540,273	540,273	540,273	540,273	540,273

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Appendix Table D2 Continued

FINPACK 99: FINLRB Long Range Plan
Center for Farm Financial Management
(C)1999 University of Minnesota

Spring Lambing Scenario
Address:
spring lambing

SOLVENCY MEASURES						
Current percent in debt		50.0 %	50.0 %	50.0 %	50.0 %	50.0 %
Current & intermediate pct in debt		65.3 %	65.3 %	65.3 %	65.3 %	65.3 %
Long term percent in debt		8.5 %	8.5 %	8.5 %	8.5 %	8.5 %
Nonfarm percent in debt		- %	- %	- %	- %	- %
Total percent in debt	(Y/X)	49.9 %	49.9 %	49.9 %	49.9 %	49.9 %
NET WORTH CHANGE (Typical Year)						
Net farm income		230,329	27,814	335,314	106,814	106,639
Nonfarm income	(+)	-	-	-	-	-
Family living	(-)	-	-	-	-	-
Corporate income taxes	(-)	50	50	50	50	50
Net worth change per year	(=)	230,279	27,764	335,264	106,764	106,589

FINANCIAL STANDARDS MEASURES	Base Plan Expected	Alt. 1 Low Price	Alt. 2 Best Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible price
Liquidity					
Current ratio	2.00	2.00	2.00	2.00	2.00
Working capital	62,500	62,500	62,500	62,500	62,500
Solvency					
Farm debt to asset ratio	49.9 %	49.9 %	49.9 %	49.9 %	49.9 %
Farm equity to asset ratio	50.1 %	50.1 %	50.1 %	50.1 %	50.1 %
Farm debt to equity ratio	99.6 %	99.6 %	99.6 %	99.6 %	99.6 %
Profitability					
Rate of return on farm assets	26.2 %	7.4 %	35.9 %	14.8 %	14.7 %
Rate of return on farm equity	42.6 %	5.1 %	62.1 %	19.8 %	19.7 %
Operating profit margin	60.6 %	30.3 %	67.8 %	46.4 %	46.3 %
Net farm income	230,329	27,814	335,314	106,814	106,639
Repayment Capacity					
Term debt coverage ratio	254.8 %	83.8 %	343.4 %	150.5 %	150.4 %
Capital replacement margin	183,366	-19,149	288,351	59,851	59,676
Efficiency					
Asset turnover	43.3 %	24.5 %	53.0 %	31.8 %	31.8 %
Operating expense ratio	51.8 %	75.9 %	44.5 %	64.2 %	64.3 %
Depreciation expense ratio	3.9 %	5.8 %	3.4 %	4.9 %	4.9 %
Interest expense ratio	8.2 %	12.0 %	7.0 %	10.2 %	10.2 %
Net farm income ratio	36.0 %	6.4 %	45.1 %	20.7 %	20.7 %
INCOME TAX					
Federal income tax	-	-	-	-	-
State income tax	50	50	50	50	50
Total income taxes	50	50	50	50	50

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Appendix Table D2 Continued

CROP AND LIVESTOCK PRODUCTION						
Mkt Lambs	head sold	6,000	-	-	-	-
Mkt Lambs	head sold	-	6,000	-	-	-
Mkt Lambs	head sold	-	-	6,000	-	-
Mkt Lambs	head sold	-	-	-	4,700	-
Mkt Lambs	head sold	-	-	-	-	6,000
PLANNED INPUT QUANTITIES						
Mineral	lb	37,500	-	-	-	-
Hay	ton	1,800	-	-	-	-
Grain	ton	965	-	-	-	-
mineral	lb	-	37,500	-	-	-
hay	ton	-	1,800	-	-	-
grain	ton	-	965	-	-	-
Supplies	1	5,000	-	-	-	-
Straw	ton	100	-	-	-	-

[1] Bank of Cooperatives is used as an example only, no inference is implied or assumed as to potential financing of the cooperative.

[2] Net farm income as calculated by FINPACK does not include the expense of purchasing replacement ewes and rams. Therefore, net farm income for all scenarios would be reduced by $106,600 (1,000 replacement ewes purchased annually for $100/head and 33 rams at $200/head).

Appendix Table D3. FINPACK Long Range Plan for Winter Lambing Scenarios

FINPACK 99: FINLRB Long Range Plan
Center for Farm Financial Management
(C)1999 University of Minnesota

Traditional Winter Lambing
High Input Scenario
winter lambing

			Base Plan Expected	Alt. 1 Low Price	Alt. 2 High Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible Price
PLAN DESCRIPTION							
Total crop acres			-	-	-	-	-
Total labor hours			-	-	-	-	-
Change in farm assets			-	-	-	-	-
Change in farm liabilities			-	-	-	-	-
Livestock Plan	Unit	Sales/Unit					
Market Lambs, Winter	Ewe	1.20 head	5,000	-	-	-	-
Market Lambs, Low Price	Ewe	1.20 head	-	5,000	-	-	-
Market Lambs, high price	Ewe	1.20 head	-	-	5,000	-	-
Market Lambs, Nec. Lamb %	Ewe	1.33 head	-	-	-	5,000	-
Market Lambs, Lowest	Ewe	1.20 head	-	-	-	-	5,000
PROFITABILITY							
			Base Plan Expected	Alt. 1 Low Price	Alt. 2 High Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible Price
INCOME STATEMENT (Typical Year)							
Mkt Lambs	$ 76.00/cwt.		570,000	-	-	-	-
Mkt Lambs	$ 49.00/cwt.		-	367,500	-	-	-
Mkt Lambs	$ 90.00/cwt.		-	-	675,000	-	-
Mkt Lambs	$ 76.00/cwt.		-	-	-	631,750	-
Mkt Lambs	$ 84.10/cwt.		-	-	-	-	630,750
Cull breeding livestock							
Cull Ewes			39,270	-	-	-	-
Cull Rams			1,300	-	-	-	-
Other Cull breeding lives			-	40,550	40,550	40,550	40,550
Total cull breeding livestock			40,570	40,550	40,550	40,550	40,550
Misc. livestock income							
Wool			30,000	-	-	-	-
Other Misc. livestock income			-	30,000	30,000	30,000	30,000
Total misc. livestock income			30,000	30,000	30,000	30,000	30,000
(A) Gross farm income			640,570	438,050	745,550	702,300	701,300
Purchased feed							
mineral	$ 0.07/lb		2,650	-	-	-	-
hay	$ 51.50/ton		136,450	-	-	-	-
grain	$ 79.58/ton		148,400	-	-	-	-
Other Purchased feed			-	287,500	287,500	287,500	287,500
Total purchased feed			287,500	287,500	287,500	287,500	287,500
Veterinary			15,000	15,000	15,000	15,000	15,000
Livestock supplies							
Supplies	$ 2.00/ewe		10,000	-	-	-	-
Straw	$ 25.00/ton		2,500	-	-	-	-
Other Livestock supplies			-	12,500	12,500	12,500	12,500
Total livestock supplies			12,500	12,500	12,500	12,500	12,500
Interest [1]							
Bank of Coop			25,106	25,106	25,106	25,106	25,106
Bank of Coop			9,930	9,930	9,930	9,930	9,930
Bank of Coop			23,720	23,720	23,720	23,720	23,720
Bank of Coop			2,355	2,355	2,355	2,355	2,355
Operating interest			12,188	12,188	12,188	12,188	12,188
Total interest			73,299	73,299	73,299	73,299	73,299
Fuel & oil			3,959	3,959	3,959	3,959	3,959
Repairs			1,672	1,672	1,672	1,672	1,672

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Appendix Table D3. Continued

		Base Plan Expected	Alt. 1 Low Price	Alt. 2 High Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible Price
INCOME STATEMENT (continued)						
Custom hire						
Hay Grind ($100per20 ton)		11,000	-	-	-	-
Manure Hauling		4,698	-	-	-	-
Trucking (pasture/market)		1,625	-	-	-	-
Shearing @ $2.25/ewe		11,475	-	-	-	-
Other Custom hire		-	28,798	28,798	28,798	28,798
Total custom hire		28,798	28,798	28,798	28,798	28,798
Hired labor						
Manager		40,000	-	-	-	-
Assistant Manager		22,500	-	-	-	-
Seasonal Help/Lambing		29,160	-	-	-	-
(3240 hours @ 9/hr)		-	-	-	-	-
Other Hired labor		-	91,660	91,660	91,660	91,660
Total hired labor		91,660	91,660	91,660	91,660	91,660
Real estate taxes		9,175	9,175	9,175	9,175	9,175
Farm insurance		7,151	7,151	7,151	7,151	7,151
Utilities		6,000	6,000	6,000	6,000	6,000
Marketing		1,000	1,000	1,000	1,000	1,000
Dues & professional fees		100	100	100	100	100
Miscellaneous						
Water (SW Water Pipeline)		10,264	-	-	-	-
Misc		1,500	-	-	-	-
Other Miscellaneous		-	11,764	11,764	11,764	11,764
Total miscellaneous		11,764	11,764	11,764	11,764	11,764
(B) Total cash farm expense		549,578	549,578	549,578	549,578	549,578
(C) Net cash farm income		90,992	-111,528	195,972	152,722	151,722
Depreciation		45,100	45,100	45,100	45,100	45,100
(D) Net farm income [2]		45,892	-156,628	150,872	107,622	106,622
PROFITABILITY MEASURES (Market)						Price
Net farm income	(D)	45,892	-156,628	150,872	107,622	106,622
Labor & management earnings	(D-E)	735	-201,785	105,715	62,465	61,465
Rate of return on farm assets	(H/I)	7.9 %	-5.5 %	14.9 %	12.0 %	12.0 %
Rate of return on farm equity	(J/K)	6.1 %	-20.8 %	20.0 %	14.3 %	14.2 %
Rate of return on added investment	(L/M)		- %	- %	- %	- %
Operating profit margin	(H/N)	33.8 %	-55.3 %	48.9 %	43.6 %	43.5 %
Asset turnover	(N/I)	23.5 %	10.0 %	30.4 %	27.6 %	27.5 %
(E) Interest on farm net worth	(K* 6%)	45,158	45,158	45,158	45,158	45,158
(F) Farm interest paid		73,299	73,299	73,299	73,299	73,299
(G) Value operators labor & mgt		-	-	-	-	-
(H) Return on farm assets	(D+F-G)	119,191	-83,329	224,171	180,921	179,921
(I) Total farm assets		1,505,253	1,505,253	1,505,253	1,505,253	1,505,253
(J) Return on farm equity	(D-G)	45,892	-156,628	150,872	107,622	106,622
(K) Total farm net worth		752,626	752,626	752,626	752,626	752,626
(L) Added return to added investment			-202,520	104,980	61,730	60,730
(M) Added capital invested			-	-	-	-
(N) Value of farm production		353,070	150,550	458,050	414,800	413,800

– continued –

Appendix Table D3. Continued

			Base Plan Expected	Alt. 1 Low Price	Alt. 2 High Pric	Alt. 3 Nec. Lamb percent	Alt. 4 Lowest Feasible Price
	LIQUIDITY MEASURES						
	CASH FLOW (Typical Year)						
	Net cash farm income	(C)	90,992	-111,528	195,972	152,722	151,722
	Nonfarm income	(+)	-	-	-	-	-
	Net cash available	(=)	90,992	-111,528	195,972	152,722	151,722
	Family living	(-)	-	-	-	-	-
	Corporate income taxes	(-)	50	50	50	50	50
(R)	Cash available for principal payments	(=)	90,942	-111,578	195,922	152,672	151,672
	Farm interest paid	(+)	73,299	73,299	73,299	73,299	73,299
	Cash avail. for principal and interest	(=)	164,241	-38,279	269,221	225,971	224,971
	Bank of Coop		80,795	80,795	80,795	80,795	80,795
	Bank of Coop		23,214	23,214	23,214	23,214	23,214
	Bank of Coop		37,026	37,026	37,026	37,026	37,026
	Bank of Coop		2,840	2,840	2,840	2,840	2,840
	Operating loan interest		12,188	12,188	12,188	12,188	12,188
(S)	Total scheduled principal and interest	(-)	156,063	156,063	156,063	156,063	156,063
	Cash available after loan payments	(=)	8,178	-194,342	113,158	69,908	68,908
	Annual capital replacement		106,600	106,600	106,600	106,600	106,600
	Principal paid on intermediate debts		82,279	82,279	82,279	82,279	82,279
(T)	Cash required for replacement	(-)	24,321	24,321	24,321	24,321	24,321
(U)	Cash surplus or deficit	(=)	-16,143	-218,663	88,837	45,587	44,587
	Cash available for principal payments	(R)	90,942	-111,578	195,922	152,672	151,672
	Annual farm long term principal pymts	(-)	485	485	485	485	485
(V)	Cash available for farm intermed. debt	(=)	90,457	-112,063	195,437	152,187	151,187
(W)	Farm intermediate debt to be served		602,627	602,627	602,627	602,627	602,627
	Years to turnover farm intermed. debt	(W/V)	6.7	999.0	3.1	4.0	4.0
	Surplus as a percent of payments	(U/(S+T))	-8.9 %	-121.2 %	49.2 %	25.3 %	24.7 %
	Cash farm expense as % of income	(B/A)	85.8 %	125.5 %	73.7 %	78.3 %	78.4 %
	Farm interest as % of value of prod.	(F/N)	20.8 %	48.7 %	16.0 %	17.7 %	17.7 %
	Farm debt payments as % of value of prod.		44.2 %	103.7 %	34.1 %	37.6 %	37.7 %
	SOLVENCY						
	BALANCE SHEET (Market)						
	Current farm assets		250,000	250,000	250,000	250,000	250,000
	Intermediate farm assets	(+)	718,700	718,700	718,700	718,700	718,700
	Long term farm assets	(+)	536,553	536,553	536,553	536,553	536,553
	Nonfarm assets	(+)	-	-	-	-	-
(X)	Total assets	(=)	1,505,253	1,505,253	1,505,253	1,505,253	1,505,253
	Current farm liabilities		125,000	125,000	125,000	125,000	125,000
	Intermediate farm liabilities	(+)	602,627	602,627	602,627	602,627	602,627
	Long term farm liabilities	(+)	25,000	25,000	25,000	25,000	25,000
	Nonfarm liabilities	(+)	-	-	-	-	-
(Y)	Total liabilities	(=)	752,627	752,627	752,627	752,627	752,627
	Net worth	(X-Y)	752,626	752,626	752,626	752,626	752,626
	SOLVENCY MEASURES						
	Current percent in debt		50.0 %	50.0 %	50.0 %	50.0 %	50.0 %
	Current & intermediate pct in debt		75.1 %	75.1 %	75.1 %	75.1 %	75.1 %
	Long term percent in debt		4.7 %	4.7 %	4.7 %	4.7 %	4.7 %
	Nonfarm percent in debt		- %	- %	- %	- %	- %
	Total percent in debt	(Y/X)	50.0 %	50.0 %	50.0 %	50.0 %	50.0 %

– continued –

Appendix Table D3. Continued

NET WORTH CHANGE (Typical Year)						
Net farm income		45,892	-156,628	150,872	107,622	106,622
Nonfarm income	(+)	-	-	-	-	-
Family living	(-)	-	-	-	-	-
Corporate income taxes	(-)	50	50	50	50	50
Net worth change per year	(=)	45,842	-156,678	150,822	107,572	106,572
FINANCIAL STANDARDS MEASURES						
Liquidity						
Current ratio		2.00	2.00	2.00	2.00	2.00
Working capital		125,000	125,000	125,000	125,000	125,000
Solvency						
Farm debt to asset ratio		50.0 %	50.0 %	50.0 %	50.0 %	50.0 %
Farm equity to asset ratio		50.0 %	50.0 %	50.0 %	50.0 %	50.0 %
Farm debt to equity ratio		100.0 %	100.0 %	100.0 %	100.0 %	100.0 %
Profitability						
Rate of return on farm assets		7.9 %	-5.5 %	14.9 %	12.0 %	12.0 %
Rate of return on farm equity		6.1 %	-20.8 %	20.0 %	14.3 %	14.2 %
Operating profit margin		33.8 %	-55.3 %	48.9 %	43.6 %	43.5 %
Net farm income		45,892	-156,628	150,872	107,622	106,622
Repayment Capacity						
Term debt coverage ratio		105.7 %	-35.1 %	178.7 %	148.6 %	147.9 %
Capital replacement margin		8,178	-194,342	113,158	69,908	68,908
Efficiency						
Asset turnover		23.5 %	10.0 %	30.4 %	27.6 %	27.5 %
Operating expense ratio		74.4 %	108.7 %	63.9 %	67.8 %	67.9 %
Depreciation expense ratio		7.0 %	10.3 %	6.0 %	6.4 %	6.4 %
Interest expense ratio		11.4 %	16.7 %	9.8 %	10.4 %	10.5 %
Net farm income ratio		7.2 %	-35.8 %	20.2 %	15.3 %	15.2 %
INCOME TAX						
Federal income tax		-	-	-	-	-
State income tax		50	50	50	50	50
Total income taxes		50	50	50	50	50
CROP AND LIVESTOCK PRODUCTION						
Mkt Lambs	head sold	6,000	-	-	-	-
Mkt Lambs	head sold	-	6,000	-	-	-
Mkt Lambs	head sold	-	-	6,000	-	-
Mkt Lambs	head sold	-	-	-	6,650	-
Mkt Lambs	head sold	-	-	-	-	6,000
PLANNED INPUT QUANTITIES						
mineral	lb	37,500	-	-	-	-
hay	ton	2,650	-	-	-	-
grain	ton	1,865	-	-	-	-
Supplies	ewe	5,000	-	-	-	-
Straw	ton	100	-	-	-	-

[1] Bank of Cooperatives is used as an example only, no inference is implied or assumed as to potential financing of the cooperative.

[2] Net farm income as calculated by FINPACK does not include the expense of purchasing replacement ewes and rams. Therefore, net farm income for all scenarios would be reduced by $106,600 (1,000 replacement ewes purchased annually for $100/head and 33 rams at $200/head).