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James K. Lewis
South Dakota State University

W. R. Trevillyan

South Dakota State University
Brookings, South Dakota
Department of Animal Science
Agricultural Experiment Station

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James K. Lewis and W. R. Trevillyan[1]

Lamb mortality is a source of great economic loss to range sheep producers. Safford and Hoversland (1960) studied lamb mortality in range ewes on a relatively high plane of nutrition in Montana and found that 23½% of the lambs died between birth and weaning. Seventy-three percent of those died in the first 5 days. Nearly 3/4 of the deaths were due to pneumonia, starvation, no visible symptoms, still births and dysentery. Death loss is higher among small lambs, which are especially susceptible toclimatic stress. Australian workers have reported that the lamb is born with a high capacity for high initial heat production, but with limited reserves of energy. Consequently, the lamb needs food shortly after birth (McDonald, 1961). Anything that prevents early suckling is likely to be a cause of death. For example, delayed milk production, lamb weakness, lack of desire to suck, failure of ewe to mother the lamb, injured teats and spoiled udder have all been causes of lamb death at Antelope Range.

Plane of nutrition of the ewe before lambing and during early lactation is an important factor influencing lamb mortality. Previous studies at Antelope Range showed the importance of winter supplementation in lambing percentage and lamb survival and the importance of summer grazing rate on lambing percentage and weaning weight (Gartner, Lewis and Trevillyan, 1965). The intensity of grazing studies have been continued. From 1964 through 1966 a self-fed pelleted ration was compared with hand-fed prairie hay from lambing until being placed on summer pasture. Results of the year 1964 have been reported (Lewis, Gartner and Trevillyan, 1965).

The Study Area

The Antelope Range Field Station is located approximately 15 miles east of Buffalo in Harding County in the northwest corner of South Dakota. This area lies within the lowest rainfall belt in the state. Annual precipitation from 1954 through 1966 at the experiment station averaged 13.78 inches, while the growing season precipitation (April 1 to September 30) averaged 11.35 inches. Annual and growing season precipitation for the study period were 15.89 and 13.76, 18.28 and 15.81, 14.08 and 11.09 for 1964. 1965 and 1966, respectively.

The vegetation is the northern mixed prairie type. The dominant cool-season grasses are western wheatgrass (Agropyron smithii) and needle-and-thread (Stipa comata): the dominant warm-season grass is blue grama

[1]Superintendent, Antelope Range Field Station

(Bouteloua gracilis). Other common grasses are green needle grass (Stipa viridula), prairie sandreed (Calamovilfa longifolia), prairie junegrass (Koeleria cristata), little bluestem (Andropogon scoparius), and bluegrasses (Poa spp.). Sedges, especially threadleaf sedge (Carex filifolia) and needleleaf sedge (Carex elocharis), are fairly abundant. Silver sagebrush (Artemisia cana), is conspicuous as are many native forbs.

Soils in this dry part of the Chestnut soil zone have not been leached to any great depth. Consequently, lime and other carbonates have accumulated fairly high in the soil profile. Most of the soils on the field station have fine sand incorporated in their surface horizons. The majority of these soils would be classed as a silty range soil group.[1] Other important range-soil groups found on the station are sandy, thin silty, thin sandy, panspots and overflow.

Experimental Procedure

Three hundred permanently allotted range ewes were summer-grazed under continuous season-long grazing at a light (<35%), medium (45-55%) or heavy (>60%) use rate from early May to late October. One hundred ewes were grazed at the medium rate under a four-pasture rest rotation grazing system. Put-and-take ewes were used to adjust the stocking rate to secure the desired degree of use. Ewes were winter-grazed as a band on deferred range and fed 2/3 lb. of 40% protein supplement containing added phosphorus and vitamin A every other day until approximately 6 weeks before lambing and then were given the same amount of supplement daily until lambing. This supplement contained less phosphorus and aureomycin was added in 1966. Iodized salt was provided. Prairie hay was fed at the rate of about 3 3/4 lbs. per head daily when snow cover prevented grazing. In 1965 and 1966 a partial or whole feed of hay was given during cold, blistery weather particularly with the approach of lambing. Ewes were fed 3 days a total of 120 lbs. of hay per head in 1963-64, in 78 days a total of 146 lbs. in 1964-65 and in 50 days a total of 188 lbs. of hay per head in 1965-66. Ewes were sheared approximately 3 weeks to one month before the beginning of lambing. Ewes were bred to Hampshire rams to begin lambing about April 1 in 1964 and 1965 and about April 15 in 1966. Ewes were treated with thiobenzole for internal parasites about November 1 eac year. Ewes were shed-lambed, kept in lambing jugs 1 to 2 days and in doubling up pens 1 to 2 weeks before turning out on spring range.

Half of the ewes in each grazing treatment were fed prairie hay from the time they lambed until the new grass was abundant enough that they quit coming for hay. The other half of the ewes were self-fed a pellet containing approximately 2/3 prairie hay and 1/3 barley with 5/6 molasses. In 1964, 2½% bentonite was used to aid in pelleting and in 1965-66 a small amount of alfalfa hay was added to bring the total protein content of the pellet to 10%. In line with the findings of Minyard (1965), aureomycin was

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[1] Dyksterhuis, E. J. 1964. My rangelands. What kinds? How good? S. Dak. Agr. Ext. Ser. F.S. 224.

added to pellets at the rate of 10 mg./lb. in 1965 and 1966. Pellet feeding was continued until the ewes were placed on summer pasture about May 1.

Results and Discussion

The results for each year and the average of the 3 years are shown in the table. The values given are totals for the 4 summer treatments in each year. The lamb weights are averages of the 4 summer treatments.

Lamb losses were abnormally high in both 1964 and 1965. In 1964 the winter was open and the ewes were in very good condition at shearing (February 28), although 1 or 2 ewes developed blindness just prior to shearing. After shearing the amount of supplement was doubled. In mid-March 1 or 2 ewes showed incordination and were brought in for special handling. A bad storm with extremely cold weather and about 3 inches of snow hit on March 20 and prairie hay was fed for 3 days. Following the storm 10 ewes were lost with symptoms resembling pregnancy disease. Treatment with molasses drench and intraperitoneal glucose injection was ineffective. Lambing began April 1 and for 8 days the drop band was fed prairie hay free-choice along with 1 lb. of alfalfa, 1 lb. of corn and 2/3 lb. of the winter supplement. Corn feeding was reduced, then stopped on April 10. However, hay and supplement was fed until the ewe lambed and was placed on the experimental lambing ration. More ewes were dry at lambing, more ewes required help, more ewes failed to milk adequately and more lambs were bummed than had been experienced in previous years.

Weather after lambing was good in 1964, grass came early and lambs seemed to do well. However, dog ticks (Dermicentra andersonii) were noticed during the last week of April. By the last of April the ticks were present in epidemic numbers--covering the sagebrush, saddle horses and cattle, as well as the sheep. Many lambs died and many that were sick recovered slowly. Typical symptoms were lameness in 1 or more legs, general inactivity and weakness. Some lambs died while they were still in good condition, others became quite emaciated. Post mortem examinations showed an arthritis with an increase in joint fluid. The bacteria cultured from this fluid were mostly staphylococci with a few colonies of Corynebacterium pyogenes which is frequently found in joint infections and abscesses. One lamb was found to have multiple abscesses throughout the skeletal muscles and biscera from which staphylococci were cultured. These organisms may have entered through the tick bites. There was no evidence of viral arthritis, white muscle disease or internal parasites. Lambs that were given penicillin injections responded slowly if at all. Although lamb losses were quite high, especially among twins, the self-fed pellet reduced losses sharply among both twin (53% vs. 28%) and single (15% vs. 6%) lambs.

In 1965, the ewes were in very good condition and the lambs got off to a very good start. However, spring storms occurred at about weekly intervals during April. Approximately 12 inches of snow and a total precipitation of

TABLE 1 Effect of Lambing Ration on Survival and Weaning Weight of Range Lambs
Antelope Range 1964-66

Lambing Ration	1964			1965			1966			All Years	
	Prairie Hay	Self-fed Pellets	Both Lots	Prairie Hay	Self-fed Pellets	Both Lots	Prairie Hay	Self-fed Pellets	Both Lots	Prairie Hay	Self-fed Pellets
Ewes with lambs alive after lambing	183	178	361	181	180	361	163	172	335	527	530
No. twins alive after lambing	64	102	166	120	122	242	98	82	180	282	306
Twins died before summer past, %	53	28	38	56	29	42	13	5	9	41	21
No. singles alive after lambing	146	125	271	118	110	228	110	124	234	374	359
Singles died before summer past, %	15	6	11	14	12	13	4	2	3	11	7
Twins born single alive after lambing	5	1	6	3	2	5	2	2	4	10	5
Twins born single died before summer past, %	20	0	17	67	0	40	0	0	0	29	0
All lambs alive after lambing	215	229[1]	444	241	239[1]	480	210	210[1]	420	666	678[1]
All lambs died before weaning, %	32	21	26	38	25	31	11	6	9	27	17
Weaning wt. twins, lb.	57	60	58	54[2]	62	58	69	70	70	60	64
Weaning wt. singles, lb.	70	76	73	73	78	75	83	84	84	75	79
Lambs weaned/ewe with lambs alive after lambing, lb	55	72	63	65	83	74	87	90	88	69	82
Feed consumed lb/ewe:											
Prairie hay	19	--		97	--		27	--		48	--
Protein supplement	2	--		2	--		6	--		3	--
Self-fed Pellet	--	153		--	137		--	77		--	122
Cost of feed $	.29	3.82		1.07	3.42		.39	1.92		0.63	2.62
Additional feed cost $		3.53			2.35			1.53			1.99
Value of lamb, $	11.55	15.12		13.65	17.43		18.27	18.90		14.49	17.22
Additional value of lamb $		3.57			3.78			0.63			2.73
Net returns from pelleted ration		.04			1.43			-0.90			0.74

[1] Includes triplets

[2] No twins were weaned in the rest-rotation prairie hay lot in 1965.

2.65 inches were received in April. Again, the lamb death losses on spring range was quite high. However, twin losses were reduced from 56% to 29% by the self-fed supplement. Nineteen sixty-five was one of those somewhat rare years when needleandthread awns are troubleseome to lambs. Weaning weights appeared to be reduced in some pastures by needle damage.

In 1966, a severe blizzard occurred on March 3 and dropped about 13 inches of snow in 2 days. A number of ewes were lost in drifts. However, the ewes were very strong and thrifty and those that were found and dug out within 5 days were still alive and healthy. Lambing did not begin until April 12 and lambs had very little climatic stress after being turned out on Spring range. Lamb losses were fairly low, but were still reduced approximately in half for both singles and twins by the self-fed ration. Weaning weights were near normal in 1966.

In general, the self-fed lambing ration reduced lamb losses in all summer grazing treatments. However, the reduction was greatest in heavy grazing and in rest rotation

The pelleted ration was quite palatable. Consumption varied from about 3 to 6½ lbs. in pasture and was as high as 8 to 9 lbs. per head daily in the lambing pens. On pasture, ewes continued to eat supplement even when new grass was fairly abundant, whereas the ewes would quit eating hay before the new grass was sufficiently abundant. The pelleted ration undoubtedly reduced utilization on the spring range.

Over-all 3 years the self-fed lambing ration reduced death loss of twins from 41 to 21%, of singles from 11 to 7% and of all lambs from 27 to 17%. Both single and twin lambs from ewes receiving the self-fed ration averaged 4 lbs. heavier than the controls. Ewes that were fed the pelleted ration weaned 13 more pounds of lamb than the controls.

With prairie hay at $20/ton, 40% protein supplement at $100/ton, the pelleted ration at $50/ton and feeder lambs at $21/hundred, the increased lamb production from the self-fed ration was worth 74¢ per ewe more then the additional cost of the pelleted ration for the 3 year average. However, the extra production was worth only 4¢ more than the additional feed cost in 1964, $1.43 more in 1965 and 90¢ less than the added feed cost in 1966. The extra value of the higher plane of nutrition following lambing can probably be obtained at lower cost by hand feeding.

Conclusions

A high plane of nutrition immediately after lambing is necessary for good lamb survival and early growth, especially during climatic stress, but also during stress produced by disease. Compared with prairie hay

feeding in lambing pens and on spring pasture, self-feeding a pelleted ration of 2/3 prairie hay and 1/3 barley containing 10% total protein reduced lamb losses by about 1/2, increased weaning weights by about 4 lbs. and was economical in 2 of the 3 years studied. Similar reductions in lamb losses could probably be obtained by hand feeding at somewhat lower cost.

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