CREEP RATIONS FOR PRODUCING SPRING LAMBS

by

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B. V. Sc., Madras University, India, 1945

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1968

Approved by:

Major Professor

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TABLE OF CONTENTS

INTRODUCTION

Sheep production is an old and an important agricultural enterprise. The sheep industry produces mainly wool and meat which differ widely in nature, distribution, value and use.

In the early history of the United States, sheep were raised almost exclusively for wool. In more recent years, lamb production for meat has become the major source of income for sheepmen. The emphasis in sheep raising has shifted from fine wool sheep to the production of meat type, crossbred lambs. McAdams and Coppersmith (1963) reported that in Kansas the income from slaughter sheep and lambs from 1910 to 1919 averaged 58 per cent of the total income from sheep, which increased to 71 per cent of the total income by 1955.

Lamb consumption by Americans is low, compared to beef, pork and poultry. The average yearly per capita consumption is between 4 and 5 pounds. All lamb produced in the United States is consumed, and in recent years, imports of fresh, frozen, and live lamb have increased considerably.

In India, sheep are raised mostly for mutton from mature sheep. Milk, manure, and skins, are the other important by-products of the sheep and goat industry in India.

The production of spring lambs is a special type of enterprise, which for its success, demands breeding the right kind of animal, and providing a succulent, highly nutritive, cheap feed. The object is to produce, a fast rate of growth, from birth to slaughter, and simultaneously produce tender, juicy meat. Kansas has a favorable climate, abundant pastures in normal seasons, and suitable terminal markets for profitable lamb production.

Creep feeding of lambs received the attention of research workers,

commercial lamb producers, and breeders for at least half-century. Feeding of concentrates to which lambs have free access, but their mothers are excluded, provides the most satisfactory arrangement for feeding grain.

The purpose of creep feeding young lambs, is to produce lambs of heavy weight; to produce a high percentage of lambs for market; to force the lambs to an early finish; to finish the lambs before the feeds dry up; to overcome the unfavorable seasonal changes and rainfall to produce grazing grasses; to get lambs acquainted with troughs and feed; and to reduce shrinkage at the time of marketing.

The purpose of this investigation was to determine the value of various creep feeding rations and management practices, in fattening young suckling lambs for the spring market.

REVIEW OF LITERATURE

Nutritive Requirements

Nursing Ewes and Young Lambs

Research workers have demonstrated the importance of adequate nutrition, in relation to milk production of ewes, and the growth of their lambs.

The National Research Council (1957) recommended the following amounts of nutrients, for nursing ewes and lambs. Ewes, during the first 8 to 10 weeks of lactation, weighing 120 pounds, should be fed 8.3 per cent protein, 4.6 per cent digestible protein, 58 per cent total digestible nutrients and 1.2 therms digestible energy. During the last 12 to 14 weeks of lactation, the same ewes, should be fed, 7.7 per cent protein, 4.3 per cent digestible protein, 52 per cent total digestible nutrients and 1.1 therms of digestible

energy. Lambs, weighing 60 pounds, should be fed with rations containing, 11.5 per cent protein, 6.3 per cent digestible protein, 60 per cent total digestible nutrients, and 1.2 therms of digestible energy. Nutritive requirements for lambs weighing less than 60 pounds are not reported.

Morrison (1959) recommended, the following feeding standards, for nursing ewes and lambs. Ewes, weighing 120 pounds, nursing lambs, should be fed rations consisting of 0.23 to 0.26 pounds digestible protein, 2.7 to 3.1 pounds total digestible nutrients, and 2.3 to 2.6 therms net energy. Lambs, weighing 60 pounds should be fed 0.17 to 0.20 pounds digestible protein, 1.5 to 1.8 pounds total digestible nutrients and 1.3 to 1.6 therms net energy.

Wallace (1948) reported that birth weight of the lamb and milk yield of the ewe, was greatly affected by level of nutrition of the ewe during the last 6 weeks of pregnancy.

Pope et al. (1957) reviewed the nutrient requirements of sheep, and observed that the quality of protein is not a critical factor in sheep nutrition and quantity fed is more important than source. Slen and Whiting (1952); Doane et al. (1962) observed that feeding ewes rations containing 10 to 15 per cent protein resulted in increased rate of gain in suckling lambs. Kammlade and Kammlade (1955); Hinds (1964); Hinds et al. (1965); and Ranhotra and Jordan (1966), found that young lambs gained faster than controls, when fed creep rations containing 12 to 17 per cent protein.

Drake and Fontenot (1966) reported that 10 per cent roughage level in creep rations, produced greater daily gain and feed efficiency, than 25 or 40 per cent roughage level, in young lambs. Morrison (1967) found 12.5 per cent as optimum level for roughage, in rations for lambs, to produce increased rate of gain. Ranhotra and Jordan (1966) reported that 25 per

cent roughage level produced more efficient gains, than 45 per cent roughage level, in rations fed to young lambs.

Lactation Curve of Ewes

Morrison (1959) observed that daily milk yield was highest in the first 4 weeks and then falls more slowly, towards the end of lactation period. Maynard and Loosli (1962) observed, that in nursing ewes, milk production increased up to 4 to 6 weeks, maintained peak level up to 8 weeks, and then decreased slowly in the later periods of lactation.

Thomson and Thomson (1953) reported that 2 year old Cheviot ewes, on high plane nutrition, produced 20 gallons of milk in 13 weeks lactation, compared to 11 gallons in ewes with half the high plane of nutrition. Hadjipieris et al. (1966) reported that ewes reached mean peak level yields of milk of 3470 and 2680 grams per day respectively, at 2 to 3 weeks after parturition.

Guyer and Dyer (1953) reported that ewes fed concentrates 2 months before parturition and raising single lambs produced 14 per cent more milk; and those raising twins, produced 8 per cent more milk. Gardner (1964) found that ewes suckling twin lambs were more efficient in converting feed energy into milk energy than ewes suckling single lambs. Peart (1967) reported that ewes nursing twins produced 3 kg. of milk per day, during first lactation week, compared to 2 kg. of milk per day produced by ewes nursing single lambs, during the first lactation week.

Growth Pattern of Lambs

Bonsma (1939) observed that milk consumption and rate of gain in young

lambs were correlated, and genetically controlled and subject to environmental factors. Wallace (1948) reported that level of milk intake and supplementary feeding, greatly affected the subsequent growth of the lamb. Burris and Baugus (1955) found milk production of nursing ewes and early growth of lambs to be highly correlated.

Kammlade and Kammlade (1955) observed that lambs attained about 75 per cent of their mature weight by the time they were a year old. They further recorded, that about 50 per cent of the year's growth was made during the first 3 months, 25 per cent in the second 3 months, and 25 per cent in the last 6 months.

Fraser (1951) reported that single lambs, weighing 12 pounds at birth, gained one pound per day and reached 80 pounds in 68 days, whereas, twin lambs from the same flock, weighing 9 pounds at birth, gained 0.7 pounds per day and reached 80 pounds in 101 days. Guyer and Dyer (1953) observed that single lambs were 8 per cent heavier at birth, than twins, and gained 9 per cent faster than twins, to 16 weeks of age. Bogart et al. (1957) reported that crossbred single lambs were 1.92 to 2.40 pounds heavier at birth than twin lambs.

De Baca et al. (1956) reported the advantage of male lambs, in rapid growth and heavier weaning weight, resulted from the larger birth weight of males. McClaugherty et al. (1959) reported that ram lambs gained significantly faster than wether lambs. Menzies and Banbury (1964) found ram lambs gained faster than wether lambs, but ewe lambs gained equally as fast as wether lambs. Juma and Faraj (1966) reported that sex of lamb and type of birth had a significant effect on birth weight of Awassi lambs.

Rations for Creep Feeding

Dry Lot Rations for Young Lambs

Craig (1895) reported that corn meal was better than oats or bran, for feeding young lambs, before and after weaning, in respect of rate of gain, cost of gain and feed efficiency. Holden (1932) observed, that corn produced faster gains, with less feed, than barley in young lambs. Willman (1935) reported that lambs fed cracked corn, made slightly more economical gains, but less average daily gain, than lambs fed a grain mixture of corn, oats, bran, linseed meal and hay. King (1936) observed that lambs fed grains as creep fed, made larger cheaper gains, than those receiving no grain.

Reed (1927) reported that a grain mixture of 6 parts corn and 1 part linseed meal, produced a good rate of gain in lambs. Weber (1930) reported that high protein grain mixture containing 12 parts ground shelled corn, 2 parts bran, 3 parts linseed meal and alfalfa hay, produced 0.4 pounds more gain per head per day in lambs, before weaning, and 0.8 pounds more gain per head per day in lambs, after weaning, than similar lambs fed grain mixture, relatively low in protein.

Miller (1940) found grain mixture of equal parts of corn, oats and bran, or 2 parts corn, 2 parts oats and 1 part linseed meal, as a good starter for young lambs.

Morrison (1959) recommended 20 pounds coarsely ground or crushed oats, 20 pounds coarsely ground or cracked corn, 10 pounds wheat bran, 10 pounds linseed meal or soybean meal, as an excellent creep feed for young lambs.

Mathews and Madson (1960) found that 50 per cent rolled barley, 30 per

cent chopped oats, 10 per cent dried molasses pulp, 10 per cent cottonseed meal; or 70 per cent rolled barley, 30 per cent dried molasses pulp; or only steamed barley, with free access to alfalfa hay, and bone meal and salt mixture in all three rations, produced increased rate of gains in young suckling lambs.

Gray et al. (1962) reported that a ration of 89 per cent cracked yellow corn, 10 per cent soybean meal, 1 per cent aureomycin crumbles, produced faster lamb gains than a ration of shelled corn.

Woolfolk et al. (1964) reported that lambs fed 61.5 per cent cracked yellow corn, 30 per cent soybean meal, 5 per cent alfalfa meal, 1.5 per cent bone meal, 1 per cent trace mineralized salt, and 1 per cent aureomycin produced higher rate of gain in single and twin lambs, than creep feed containing 89 per cent shelled corn, 10 per cent soybean meal, and 1 per cent aureomycin. They found that twin lambs responded more consistently to creep feed, than single lambs.

Creep Rations for Lambs on Pasture

Harper (1930) reported that nursing ewes and their lambs fed on pasture only produced larger and cheaper gains than lambs fed grains with pasture grazing. Baird and Sell (1959) found that creep feeding of lambs, when adequate forage supply was available, did not improve growth rate or slaughter grade of lambs.

Briggs (1937); Dyer and Weaver (1941); Menzies and Banbury (1961); Reese and Woolfolk (1963); Large and Spedding (1964); Kortan (1965); Lewis (1964) observed that young lambs, running with their mothers, fed creep ration of grain mixture, with grazing on pasture, gained faster and made

cheaper gains, than the lambs that were not fed creep feed.

Woolfolk et al. (1962) reported that young lambs fed 78.5 per cent cracked yellow corn, 20 per cent soybean oil meal, 5 per cent aureomycin crumbles, grazed on pasture, gained 38 per cent faster, and were marketed 35 days earlier, than control lambs. Woolfolk et al. (1963) observed that creep fed lambs, with pasture grazing, gained 52 per cent faster and were 8 pounds heavier than control lambs. Carter and Copenhaver (1966) fed 49.1 per cent ground yellow corn, 10 per cent soybean meal, 35 per cent dehydrated alfalfa, 5 per cent molasses, 0.9 per cent Vitamin D, to young lambs, with pasture grazing, and observed 50 per cent faster gains than lambs not creep fed.

Menzies and Banbury (1964) reported that young lambs fed a ration of sorghum grain and alfalfa hay on rye pasture made faster and cheaper gains than lambs fed a similar ration in the dry lot.

Methods of Feeding and Preparation

Morrison (1959) observed no benefit from grinding or crushing most of the grains fed to sheep, except for young lambs, self fed up to 5 to 8 weeks of age or for old sheep. He found that grinding coarsely or crushing of grains was better, than ground to a fine meal and pelleting the entire ration, when the roughage was of poor quality, was more advantageous, than when good roughage was fed to lambs. Hungate (1966) observed that grinding increases greater consumption, and, under ad-lib feeding, pellets of ground feeds gave greater gains, due to greater consumption.

Ross et al. (1960) reported that suckling lambs fed a pelleted grain mixture, consumed 2.28 times more feed than whole grain, and gained 20 per cent faster and yielded higher grading carcasses than controls fed grain.

Ross and Rosenkrans (1962a) reported that lambs on pelleted rations made 15.8 per cent faster gains, and consumed 22.1 per cent more pelleted rations, than those lambs fed shelled corn. Jordan and Gates (1961), and Garrigus (1967) observed increased feed intake, greater gains and feed efficiency in lambs fed pelleted rations.

Bierer and Vickers (1958) reported that pelleting alfalfa, resulted in a significant loss, about 32 per cent of Vitamin A, and had no effect on Vitamin E content of feed. Jensen et al. (1958) found high incidence of ruminal parakeratosis in lambs fed a pelleted ration.

Karr et al. (1964) reported that steaming of cracked corn significantly improved lamb gains 12 per cent, and reduced feed required per pound of gain by 0.5 pound in lambs. Shelton (1965) found lamb performance improved, by steam rolling sorghum grain, and pellets were preferred over finely ground grains, by lambs.

Antibiotics for Young Lambs

Hatfield and Garrigus (1952) reported that spring lambs, fed 10 mg. aureomycin per pound of feed, gained faster and cheaper and produced better carcass grades, than control lambs. Jordan and Bell (1954) found that aurofac supplementation caused no digestive disturbances, produced higher average daily gains, improved feed efficiency, and reduced the incidence of urinary calculi in suckling lambs. Jukes (1955) observed that chlortetracycline, at 10 mg. per pound of feed, gave favorable results in lamb feeding rations. Pope et al. (1957) recommended 5 to 10 mg. antibiotics per pound of feed in creep rations for suckling lambs, and found greatest response in stress conditions, with reduction in the incidence of enterotoxemia.

Hatfield et al. (1954) reported that antibiotic fed lambs, consumed 19 per cent less feed per unit gain, than control lambs. Hale et al. (1959) found 13 per cent increase in rate of gain and 6 per cent increase in feed efficiency, by adding antibiotics to creep rations of lambs.

Kinsman and Riddel (1952) reported that rate of gain in suckling lambs was not affected by supplementing creep rations with 15 mg. of antibiotics per pound of ration. Beeson et al. (1954) reported that antibiotic pellets, implanted at 2 and 44 days of age respectively, had no significant effect on growth rate of young lambs. Mathews and Madson (1960) found 10 to 20 mg. aureomycin per pound of creep ration had no effect on rate of gain or feed consumption in suckling lambs.

Early Weaning of Lambs

Weber and Loeffel (1932) found that creep fed lambs, weaned at 3 months of age, made satisfactory progress and gain when continued on full feed for 28 days. They also observed a direct relationship between the amount of grain fed to ewes and gains made by lambs before they were weaned.

Kammlade and Kammlade (1955) observed that lambs were seldom weaned before they reach 3½ months of age and many are not weaned until 5 or 6 months old. DeBaca et al. (1956) reported that weaning crossbred lambs provides fast rate of growth especially in the case of male lambs which are heavy at birth. Baird and Sell (1959) reported that lambs can be successfully weaned at 45 to 60 pounds live weight, provided there is an adequate supply of high quality winter temporary pasture. Creep consumption was not stimulated by early weaning nor was lamb performance improved by creep feeding the early weaned lambs grazed on small grain pasture.

Brothers and Whiteman (1961) reported that lambs, less than 70 days old, were too young to wean without influencing their subsequent gains regardless of their weights. Ross and Rosenkrans (1962b) of University of Missouri concluded that lambs weaned at 61 days of age and self fed a pelleted ration without pasture, gained faster and graded high at market weight than suckling lambs creep fed with pasture grazing.

Menzies et al. (1963) observed that lambs weaned at 68 days of age gained slightly slower and consumed more feed than lambs fed a similar creep ration of whole sorghum grain, alfalfa hay, and which were not weaned. They reported that lamb gains cost $1.87 more per cwt. for early weaned lambs; but considering the reduced ewe feed cost, the total feed cost per cwt. gain was $0.50 less for early weaned lambs. Menzies and Banbury (1964) reported that lambs fed standard creep ration, whole sorghum grain and alfalfa hay, and weaned at 8-10 weeks of age, gained slightly less than control lambs. They also observed that weaned lambs consumed more hay, than nursing lambs.

Neale and King (1964) reported that weaning young lambs at 4½ months of age, was superior to weaning at 2, 3, or 4 months of age, resulting in high weaning weight and low death losses in lambs under range conditions. Woolfolk et al. (1964) found that lambs weaned at 56 days of age, gained slowly, but had high dressing percentage and carcass grades. Franklin et al. (1964) concluded that Merino lambs could be weaned successfully, under drought conditions, at ages ranging from 8-16 weeks.

Litton (1964) reported that early weaning makes it easier to control parasites, and found that lambs weaned at 30 days of age, in four lots, averaged 0.69, 0.69, 0.59, and 0.62 pounds gain per day, and the feed per pound of gain was 3.47, 3.81, 2.96 and 3.34 pounds, respectively.

Wickersham (1965) indicated that lambs weaned at 56 days of age, reached market weight at the same age, as lambs weaned at 100 days of age. Ruttle (1966) reported that lambs weaned at 2, 3, 4 and 5 months of age, produced a pound of gain on 6.46, 7.42, 9.14 and 10.44 pounds of feed, respectively; and concluded that early weaning increased feed efficiency, reduced feed costs and produced more lean tissue and less waste fat in lambs.

Miscellaneous Factors Affecting Performance of Young Lambs

Woolfolk et al. (1964) found significantly greater gains in lambs fed 5 per cent sodium bicarbonate in the ration of lambs, and observed no advantage in feeding fish meal in place of linseed meal, in creep rations for young lambs.

Bushman et al. (1965) reported that feeding 1.5 per cent calcium chloride or ammonium chloride, resulted in significant reduction in urinary calculi, and had not affected feed consumption, rate of gain or carcass composition.

Riley and Rhodes (1965) found no advantage from the use of Vitamin E injections to young lambs.

McClaugherty et al. (1959) reported that docking did not effect significantly the growth rate or slaughter grade of lambs, but increased dressing percentage in lambs.

Ray (1966) reported that the quality of carcass from intact male lambs, whose testicles were forced up into body cavity by placing an elastic ring on scrotum below testicles; compared favorably with carcasses from lambs that were castrated.

Garrigus (1966) observed that young lambs reared by self feeding had

uniform finishing than lambs hand fed.

Lewis (1966) found feeding lambs on elevated slotted floors saved labor, bedding and kept lambs clean, but did not make much difference in rate of gain in lambs.

MATERIALS AND METHODS

The data used in this study and analysis were the records for 1964-65 and 1965-66, which were collected by Mr. Evans E. Banbury, Superintendent, Colby Branch Agricultural Experiment Station, Kansas State University. The experiments were conducted with the cooperation of Dr. Carl S. Menzies, Animal Husbandry Department, Kansas State University.

The experiments involved a flock of about 450 commercial fine wool ewes and their lambs, maintained at Colby Branch Experiment Station. During the years 1964-65 and 1965-66, young suckling lambs and their dams, were used for feeding trials. These ewes were purchased in Southwest Texas, as yearlings, and replaced after producing six lamb crops. The flock used in these experiments consisted of ewes having produced their first, fourth, and sixth lamb crops in 1964-65 and their first, second, and fifth lamb crops in 1965-66. The breeding season extended from June 1 to September 1. Purebred Hampshire rams were used.

All lambs were sold as milk-fat lambs during the spring and summer. As lambs reached approximately 100 pounds liveweight, they were sold in groups at Denver, Colorado and Omaha, Nebraska livestock markets. The average feed lot weight at market date was 103 and 105 pounds, and average sale weight at market was 98 and 99 pounds respectively, in 1964-65 and 1965-66.

To study the effects of various creep feeding rations on suckling lambs

for a spring market, ewes and lambs were divided into 8 groups each year. Allotments were based on age of the lamb and type of birth (single or multiple). Lambs were docked and castrated, during a 7-10 day adjustment period, before being placed in test groups.

During 1964-65, ewes received a standard nursing ration of one pound sorghum grain, 1.25 pounds alfalfa hay and full feed sorghum silage (about 10 pounds per ewe daily). The ewes in first, second and third groups, grazed on rye pasture, until their lambs were weaned at 8-10 weeks of age, and were then fed a maintenance ration of 1 pound alfalfa hay and 6 pounds sorghum silage. The lambs in other groups were weaned when 4-5 months of age.

During the same year, 515 suckling lambs were self fed the following creep rations:

The first group of young lambs was fed a creep ration, 10 per cent soybean meal, 35 per cent ground sorghum grain, 55 per cent ground alfalfa hay. These lambs were weaned when 8-10 weeks of age.

The second group of lambs received a mixture of 45 per cent ground sorghum grain, 55 per cent ground alfalfa hay, and grazed on rye pasture with their dams. Lambs were weaned at 8-10 weeks of age.

The third group of lambs was fed a mixture of 45 per cent ground sorghum grain, 55 per cent ground alfalfa hay, and were weaned at 8-10 weeks of age.

The fourth group was fed 45 per cent ground sorghum grain and 55 per cent ground alfalfa hay.

The fifth group was self fed whole sorghum grain and alfalfa hay.

The sixth group was self fed, whole sorghum grain and alfalfa hay,

which included approximately one-quarter ounce of ammonium chloride per lamb per day.

The seventh group of suckling lambs had a changing ration based on the age of lamb.

Table 1. Composition of changing ration fed group 7.

Period[1] Ration	1 to 60 days	60 to 90 days	90 to 120 days	120 days to market
% soybean meal	20	15	10	10
% ground sorghum grain	70	60	50	35
% ground alfalfa hay	10	25	40	55

[1]Calculated on days from birth of first lamb.

The eighth group was fed a mixture of 65 per cent sorghum grain and 35 per cent ground alfalfa hay.

During the feeding experiments in 1965-66, ewes were fed a uniform standard nursing ration, consisting of one pound whole sorghum grain, 1.25 pounds alfalfa hay, and all the sorghum silage consumed by ewes. The second group of ewes, grazed on rye pasture, until the lambs were weaned at 8-10 weeks old, and were fed a maintenance ration of 1 pound alfalfa hay and 6 pounds sorghum silage, after the lambs were weaned. The lambs in other groups were weaned at 4 to 5 months of age.

In the same year, 481 young lambs were fed the following creep rations:

The first group of lambs received a mixture of 55 per cent alfalfa hay, 40 per cent ground sorghum grain and 5 per cent molasses.

The second group was grazed on rye pasture only, and the lambs were weaned when 8-10 weeks of age.

The third group of lambs was given 55 per cent ground alfalfa hay, 40 per cent ground sorghum grain, and 5 per cent soybean meal.

The fourth group had a creep ration consisting of 55 per cent ground alfalfa hay, 35 per cent ground sorghum grain and 10 per cent soybean meal.

The fifth group of lambs were fed free choice alfalfa hay and ground sorghum grain.

The sixth group was fed, free choice, alfalfa hay and ground sorghum grain, containing 1½ per cent ammonium chloride, until the oldest lamb was 80 days of age, and then reduced to 1 per cent ammonium chloride.

The seventh group was given 55 per cent ground alfalfa hay and 45 per cent ground sorghum grain mixture.

The eighth group was fed 45 per cent ground wheat and 55 per cent ground alfalfa hay.

The effect of type of birth and creep rations of lambs to the average daily gains and carcass weights of lambs in 1964-65 and 1965-66, were analyzed by the Least Squares Analysis of Variance using I. B. M. Data Processing Machine. Analysis of Variance was adjusted by the regression factors calculated for the age of ewes and birth weight of the young lambs.

RESULTS AND DISCUSSION

The analysis of variance indicates that type of birth of lambs is highly significant ($P < 0.01$) to the average daily gains and carcass weights of lambs in 1964-65 and 1965-66.

The creep rations of lambs were highly significant ($P < 0.01$) to the average daily gains and approach significance ($P < 0.10$) to carcass weights of lambs in 1964-65. Creep rations of lambs were highly significant

($P < 0.01$) to both average daily gains and carcass weights in 1965-66.

The type of birth and carcass weight of lambs in their interaction, are nonsignificant ($P < 0.05$) to average daily gains and highly significant ($P < 0.01$) to carcass weights of lambs in 1964-65. The type of birth and carcass weights of lambs, in their interaction, were nonsignificant ($P < 0.05$) to average daily gains and carcass weights in 1965-66.

The regression factors, age of the ewe and birth weight of lambs, were highly significant ($P < 0.01$) to the average daily gains and carcass weights of lambs in 1964-65; and highly significant ($P < 0.01$) to average daily gains and nonsignificant ($P < 0.05$) to carcass weights of lambs in 1965-66.

Research workers in the past mainly experimented with corn as the main grain in creep rations of lambs. In the present study, feeding experiments were conducted to study the effects of changes in the levels of sorghum grain; addition of ammonium chloride on the incidence of urinary calculi; grazing on rye pasture; and feeding whole grain versus ground grain to lambs. Early weaning of lambs when 8-10 weeks of age was studied by feeding grain and hay; and also grazing on rye pasture.

Lamb performance and feed costs by treatments for 1964-65 are reported in Table 2.

Lambs weaned when 8-10 weeks of age and fed 45 per cent sorghum grain and 55 per cent alfalfa hay gained 0.60 pounds per day which compares to 0.61 pounds per day made by lambs fed a similar ration but not weaned. Early weaned lambs did not gain significantly ($P < 0.05$) faster than lambs not early weaned and produced carcasses that graded only slightly lower. Early weaned lambs consumed more feed but the resulting reduced ewe feed costs resulted in a saving of $0.79 per cwt. of gain in favor of early

Table 2. Lamb performance and feed cost by treatments, 1964-65.

Group No.	1	2	3	4	5	6	7	8
Treatment	Ground mixture: 10% S.B.M. 35% sorg. gr. 55% alfalfa hay (Weaned 8-10 weeks)	Rye pasture ground mixture: 45% sorg. gr. 55% alfalfa hay (Weaned 8-10 weeks)	Ground mixture: 45% sorg. gr. 55% alfalfa hay (Weaned 8-10 weeks)	Ground mixture: 45% sorg. gr. 55% alfalfa hay	Whole sorg. gr. alfalfa hay	Whole sorg. gr. alfalfa hay (NH_4Cl)[1]	Ground mixture: changing ration[2]	Ground mixture: 65% sorg. gr. 35% alfalfa hay
No. lambs	65	63	64	67	61	66	68	61
Average market weight, lb.[3]	109.2	105.7	106.3	105.3	101.3	101.2	106.6	106.7
Average total gain, lb.[4]	98.4	95.0	95.8	94.5	90.6	90.1	95.9	95.8
Average daily gain, lb.	.65	.60	.60	.61	.53	.53	.62	.60
Average market age, days	154	159	161	159	177	177	159	163
Average daily feed, lb.	2.51	1.82	2.49	2.02	1.71	1.73	2.03	1.85
Average pounds feed/cwt. gain	393.0	304.5	418.6	339.9	334.1	339.8	336.5	314.8
Lamb feed cost/cwt. gain	$8.65	$5.88	$8.09	$6.56	$6.35	$6.82	$7.67	$6.39
Ewe feed cost to 4-5-65 per cwt. gain	$5.84	$3.09	$6.01	$8.32	$8.67	$8.80	$8.13	$8.27
Total feed cost/cwt. gain	$14.49	$8.97	$14.10	$14.88	$15.02	$15.62	$15.80	$14.66
Carcass grade USDA[5]	12.9	13.1	12.5	13.2	13.8	13.6	13.7	13.5

[1]Ammonium chloride was fed beginning 12-10-64 at 1/8 oz. per lamb per day for each lamb over 20 days of age; increased to 1/4 oz. on 1-6-65, when youngest lamb became 20 days old.

[2]Changing ration details given in Table 1.

[3]Weight at station prior to shipment.

[4]Market weight minus birth weight.

[5]Prime = 14; choice = 11.

Table 3. Least squares estimates of average daily gains and carcass weights of lambs fed in 1964-65.

Group No.	Average daily gain[1]		Average carcass weight[1]	
	No. of lambs	Rate of gain[2]	No. of lambs	Carcass weight[2]
1	65	$.64^{a}$	55	54.2^{a}
2	63	$.60^{b}$	48	53.5^{ab}
3	64	$.60^{bc}$	45	53.6^{abc}
4	67	$.60^{bcd}$	52	54.3^{abcd}
5	61	$.53^{e}$	29	55.8^{e}
6	66	$.52^{e}$	31	54.9^{adef}
7	68	$.62^{abcd}$	49	53.7^{abcdfg}
8	61	$.58^{bcd}$	43	54.4^{abcdfg}

[1]Average daily gains and carcass weights of lambs were adjusted to age of ewes and birth weight of lambs.

[2]Rate of gain and carcass weight in the same column not bearing the same subscript letter are significantly ($P < 0.05$) different.

weaned lambs.

Lambs weaned when 8-10 weeks of age and grazed on rye pasture and fed a creep ration of 45 per cent sorghum grain and 55 per cent alfalfa hay, gained 0.60 pounds per day. Lambs weaned at the same age and fed the same ration in the dry lot did not gain significantly ($P < 0.05$) faster. Lambs on rye pasture consumed less creep feed and made more efficient and cheaper gains. Rye pasture stimulated milk production in ewes and the lambs in this lot weighed 7.5 pounds more at weaning age than lambs fed similar ration in the dry lot. Menzies and Banbury (1961) and Woolfolk et al. (1963) reported that creep fed lambs on rye pasture made cheaper and faster gains.

Replacing 10 per cent sorghum grain with soybean meal for early weaned lambs improved the rate of gain by 0.05 pounds per lamb per day ($P < 0.05$) over lambs fed 45 per cent sorghum grain and 55 per cent hay. Carcass grades were not materially affected. Ten per cent soybean meal greatly improved feed efficiency and increased feed costs per cwt. gain by only $0.39.

Whole sorghum grain and alfalfa hay fed in separate feed troughs, with or without ammonium chloride, produced a significantly ($P < 0.05$) slower rate of gain of 0.53 pounds per day in lambs, compared to lambs on other creep rations. However lambs from these two lots produced higher grading and heavier carcasses. Addition of ammonium chloride did not affect feed consumption or lamb performance and eliminated the incidence of urinary calculi in lambs. Bushman et al. (1965) also observed that ammonium chloride and calcium chloride were beneficial in preventing urinary calculi in lambs.

Increasing the sorghum grain level from 45 to 65 per cent did not

significantly affect rate of gain nor materially change carcass grade. It did improve feed efficiency slightly and reduced feed costs at the feed prices used.

Lambs started on a creep ration containing 20 per cent soybean meal, 70 per cent sorghum grain, 10 per cent alfalfa hay and periodically reducing the protein and concentrate levels with their advancing age (as they became ruminant animals) did not gain significantly ($P < 0.05$) faster than lambs fed 45 per cent sorghum grain and hay (Table 1). The high protein-high concentrate increased feed costs per cwt. lamb gain by $0.92 compared to the 45 per cent grain and 55 per cent alfalfa hay ration.

Single wether lambs gained faster than single ewe lambs and single lambs significantly ($P < 0.05$) gained faster than twin lambs (Table 4). Fraser (1951), Guyer and Dyer (1953) and Juma and Faraj (1966) reported that single lambs gained faster than twin lambs.

Early weaned lambs on rye pasture with creep ration produced 55.3 pounds weight at weaning age, compared to 47.8 pounds in early weaned lambs fed similar ration in the dry lot. Lambs fed standard ration of 45 per cent sorghum grain and alfalfa hay in the dry lot produced same weaning weight as lambs weaned early and fed same ration in the dry lot, but feed costs were higher in not weaned lambs (Table 5). DeBaca *et al.* (1956) and Woolfolk *et al.* (1964) reported that early weaning produced greater gains in lambs.

Early weaned lambs fed 10 per cent soybean meal ration gained faster than lambs fed other creep rations and weaned at an early age, but feed costs were slightly higher.

Lamb performance and feed costs by treatments for 1965-66 are reported in Table 6.

Table 4. Average daily gain and market age of lambs by sex and type of birth for treatments, 1964-65.

Group No.	Single wether			Single ewes			Twins			Group average		
	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)
1	21	.71	141	16	.65	152	28	.60	164	65	.65	154
2	19	.66	149	18	.62	154	26	.56	169	63	.60	159
3	15	.69	140	21	.58	164	28	.57	170	64	.60	161
4	21	.69	140	16	.61	156	30	.55	174	67	.61	159
5	16	.63	153	17	.52	175	28	.48	191	61	.53	177
6	20	.62	156	18	.53	179	28	.47	192	66	.53	177
7	23	.72	140	15	.63	155	30	.54	174	68	.62	159
8	17	.66	152	18	.60	160	26	.55	172	61	.60	163

Table 5. Weights of lambs weaned and selected non-weaned lambs at 8-10 weeks of age, 1964-65 and 1965-66.

Year	1964-65					1965-66
Group No.	1	2	3	4	7	2
Treatment	Ground mixture: 10% SBM 35% sorg. grain, 55% alfal. hay (weaned 8-10 weeks)	Rye pasture ground mixture: 45% sorg. gr. 55% alf. hay (weaned 8-10 weeks)	Ground mixture: 45% sorg. gr. 55% alf. hay (weaned 8-10 weeks)	Ground mixture: 45% sorg. gr. 55% alf. hay	Ground mixture: Changing ration[2]	Rye pasture (weaned 8-10 weeks
No. lambs	65	63	64	66	67	64
Average weaning age, days[1]	66	66	66	66	66	68.1
Average weaning weight, lb.[1]	52.0	55.3	47.8	48.0	52.6	49.4
Single wethers	59.5	61.5	57.9	56.3	59.5	56.8
Single ewes	54.7	58.9	49.3	52.6	56.2	52.1
Twins	44.9	48.2	41.4	39.7	45.5	39.2

[1]Lambs in groups 1, 2, and 3 were weaned, while those in 4 and 7 were weighed at a corresponding age, but were not weaned until later.

[2]See Table 1 for composition of ration.

Table 6. Lamb performance and feed costs by by treatments, 1965-66.

Group No.	1	2	3	4	5	6	7	8
Treatment	Ground mixture: 40% sor. gr. 55% alfalfa hay, 5% molasses	Rye pasture[1] (weaned 8-10 weeks)	Ground mixture: 40% sorg. gr. 5% SBM 55% alf. hay	Ground mixture: 35% sorg. gr. 10% SBM 55% alf. hay	Free choice: alf. hay, ground sor. grain	Free choice alf. hay, ground sor. grain (NH_4Cl)	Ground mixture: 45% sor. gr. 55% alf. hay	Ground mixture: 45% wheat 55% alf. hay
No. lambs	65	64	60	59	54	61	60	58
Average market weight, lb.[3]	103.8	102.2	103.8	104.9	98.3	101.1	103.8	102.4
Average total gain, lb.	93.47	92.12	93.32	94.47	88.30	90.80	93.35	92.18
Average daily gain, lb.	.56	.47	.60	.61	.49	.50	.56	.55
Average market age, days	169	197	156	158	187	187	170	171
Average daily feed, lb.	2.15	.25[1]	2.10	2.09	1.90	1.94[4]	2.14	2.0
Average pounds feed/cwt. gain	399.9	53.6	360.6	347.4	392.7	393.9	385.4	366.4
Lamb feed cost/cwt. gain[5]	$7.84	$1.10[6]	$7.43	$7.64	$7.38	$7.72	$7.44	$7.88
Ewe feed cost to 4-5-65 per cwt. gain[5]	$8.41	$3.45[6]	$8.59	$8.40	$9.06	$8.62	$8.47	$8.69
Total feed cost/cwt. gain	$16.25	$4.55	$16.02	$16.04	$16.44	$16.34	$15.91	$16.57
U.S.D.A. carcass grade[7]	12.2	11.1	12.0	11.9	12.2	12.3	12.2	12.0

[1]Starting June 1, lambs were fed a mixture of 55% ground alfalfa hay, 40% ground sorghum grain and 5% soybean meal, in addition to rye pasture. Feed consumed averaged over entire period.

[2]1½% ammonium chloride (NH_4Cl) until oldest lamb was 80 days, then reduced to 1% ammonium chloride.

[3]Weight prior to shipping.

[4]Includes ammonium chloride.

[5]Includes cost of feed for ewes nursing lambs and ewes having lambs weaned up to April 3, 1966, when all lambs were weaned.

[6]Value of rye pasture not included.

[7]Prime = 14, choice = 11.

Table 7. Least square estimates of average daily gains and carcass weights of lambs fed in 1965-66.

Group No.	Average daily gain[1]		Average carcass weight[1]	
	No. of lambs	Rate of gain[2]	No. of lambs	Carcass weight[2]
1	65	$.55^{a}$	55	52.2^{a}
2	64	$.48^{b}$	63	48.0
3	60	$.60^{c}$	39	52.3^{ab}
4	59	$.60^{c}$	38	51.9^{abc}
5	54	$.49^{bd}$	41	51.9^{abcd}
6	61	$.50^{bd}$	51	52.0^{abcde}
7	60	$.56^{ae}$	46	52.2^{abcde}
8	58	$.55^{ae}$	46	50.7^{cd}

[1]Average daily gains and carcass weights of lambs were adjusted to age of ewes and with weight of lambs.

[2]Rate of gain and carcass weight in the same column not bearing the same subscript letter are significantly ($P < 0.05$) different.

Young lambs fed a creep ration containing 5 per cent molasses, 40 per cent sorghum grain and 55 per cent alfalfa hay did not gain significantly faster ($P < 0.05$) nor produce higher grading carcasses than lambs fed 45 per cent sorghum grain and 55 per cent alfalfa hay (group 7). Replacing 5 per cent grain with molasses increased feed costs per cwt. gain in lambs by $0.34.

Replacing 5 per cent grain with soybean meal, significantly ($P < 0.05$) increased rate of gain by 0.04 pounds per day over lambs fed 45 per cent sorghum grain in group 7. Five per cent soybean meal ration improved feed efficiency and only slightly increased feed costs per cwt. of lamb gain.

Increasing soybean meal level to 10 per cent failed to further improve rate of gain over that observed for 5 per cent soybean meal, but it did improve feed efficiency enough to pay for itself.

Replacing sorghum grain with wheat in a ground mixed creep ration did not significantly ($P < 0.05$) affect lamb gain. Wheat produced slightly more efficient but expensive gains than sorghum grain.

Lambs weaned when 8-10 weeks of age and grazed on rye pasture with no creep ration gained 0.47 pounds per day which was significantly ($P < 0.05$) slower than lambs on other creep rations. However, costs of feed per cwt. lamb gain was considerably cheaper than for grain fed lambs. The rye pasture lambs produced carcasses that graded lower and weighed significantly ($P < 0.05$) less than lambs on other rations.

Lambs fed free choice ground sorghum grain and alfalfa hay in separate feed troughs significantly ($P < 0.05$) gained 0.07 pounds per day, less than lambs fed ground mixture of 45 per cent sorghum grain and alfalfa hay (group 7). The addition of ammonium chloride to the free choice ground

sorghum grain and alfalfa hay ration did not affect lamb performance, but effectively prevented the incidence of urinary calculi, which was also observed in 1964-65.

As observed in 1964-65, single wether lambs gained faster than single ewe lambs and singles gained significantly ($P < 0.05$) faster than twin lambs (Table 8).

In 1964-65, lambs fed whole sorghum grain and alfalfa hay ration and those fed the 65 per cent sorghum grain and 35 per cent alfalfa hay ground mixture developed 4 and 1 cases of urinary calculi, respectively. Lambs fed the whole sorghum grain and alfalfa hay ration with the addition of ammonium chloride did not develop urinary calculi (Table 9).

Two cases of enterotoxemia developed in lambs fed creep rations with rye pasture (group 2) and 65 per cent grain and 35 per cent alfalfa hay (group 8). The other causes of death noticed in lamb losses were pneumonia and prolapsed rectum.

In 1965-66, lambs fed free choice ground sorghum grain and alfalfa hay developed 3 cases of urinary calculi. Addition of ammonium chloride to the same ration (group 6) effectively prevented the formation of urinary calculi (Table 10).

Two cases of enterotoxemia developed in lambs fed free choice ground sorghum grain and alfalfa hay and both lambs died of the disease. The other causes of death were pneumonia and prolapse of rectum.

The following conclusions are made on the creep rations fed to young lambs:

Early weaning of lambs when 8-10 weeks of age did not affect lamb performance but reduced feed costs per cwt. of lamb gain.

Addition of 5 per cent soybean meal increased rate of gain but

Table 8. Average daily gain and market age of lambs by sex and type of birth for treatments, 1965-66.

Group No.	Sinble wethers			Single ewes			Twins			Group average		
	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)	No. of lambs	Average daily gain	Average market age (days)
1	17	.59	163	20	.59	157	28	.52	182	65	.56	169
2	22	.51	179	15	.47	197	27	.44	210	64	.47	197
3	19	.66	144	17	.60	155	24	.56	167	60	.60	156
4	20	.66	147	15	.62	152	24	.55	171	59	.61	158
5	20	.56	169	12	.50	182	22	.42	208	54	.49	187
6	17	.52	176	18	.52	178	26	.46	200	61	.50	187
7	19	.62	153	16	.56	166	25	.51	185	60	.56	170
8	19	.61	155	15	.55	170	24	.51	184	58	.55	171

Table 9. Incidence of disease in lambs by treatments in 1964-65.

Group No.	Urinary calculi		Enterotoxemia		Other causes	
	Affected	Died	Affected	Died	Removed	Died
1	--	--	--	--	2[1]	--
2	--	--	1	1	1[2]	--
3	--	--	--	--	1[3]	--
4	--	--	--	--	--	--
5	4	1	--	--	2[4]	--
6	--	--	--	--	--	1[6]
7	--	--	--	--	--	--
8	1	--	1	1	3[5]	--

[1]Twin removed -1, stunted lamb -1.

[2]Twin removed.

[3]Prolapse of rectum

[4]Twin removed -1; paralysis of rear legs -1.

[5]Prolapse of rectum -2, twin removed -1.

[6]Pneumonia.

Table 10. Incidence of disease in lambs by treatments in 1965-66.

Group No.	Urinary calculi		Enterotoxemia		Other causes	
	Affected	Died	Affected	Died	Removed	Died
1	—	—	—	—	—	—
2	—	—	—	—	1[1]	1[2]
3	—	—	—	—	1[3]	—
4	—	—	—	—	1[4]	2[5]
5	3	—	1	1	—	—
6	—	—	1	1	—	—
7	—	—	—	—	1[6]	1[7]
8	—	—	—	—	3[8]	1[9]

[1]Twin removed.

[2]Lung infection.

[3]Atrisia Ani.

[4]Prolapse.

[5]Inadequate nutrition -1, twin died -1.

[6]Wean lamb.

[7]Pneumonia.

[8]Broken leg -1, weak lamb -1, twin removed -1.

[9]Run over by tractor.

increasing soybean meal level to 10 per cent did not further improve gains but did slightly improve feed efficiency.

Wheat was equal to sorghum grain in a ground mixed creep ration for lambs.

Molasses did not increase feed consumption nor improve rate or efficiency of gain but increased feed costs.

Rye pasture grazing with no creep ration produced lowest but cheapest rate of gain in lambs.

Addition of ammonium chloride effectively eliminated the incidence of urinary calculi in lambs.

SUMMARY

To study the effects of various creep rations on suckling lambs for a spring market, ewes and lambs were divided into 8 groups in 1964-65 and 1965-66. Ewes were fed sorghum grain, alfalfa hay and sorghum silage. Lambs were creep fed rations containing soybean meal, sorghum grain, wheat, molasses, alfalfa hay and rye pasture grazing.

The analysis of variance indicates that the type of birth and creep rations of lambs were highly significant ($P < 0.01$) to the average daily gains and carcass weights of lambs in 1964-65 and 1965-66. The age of the ewes and birth weight of lambs were adjusted to the analysis of variance and were found highly significant ($P < 0.01$) to the average carcass weight and average daily gains of lambs in 1964-65 and 1965-66.

In 1964-65, lambs weaned when 8-10 weeks of age and fed sorghum grain and alfalfa hay did not gain significantly ($P < 0.05$) faster than lambs not weaned. Weaned lambs consumed more feed. Early weaning reduced ewe feed

costs and resulted in a saving of $0.79 per cwt. of lamb gain.

Lambs weaned early and grazed on rye pasture with creep feed did not gain significantly ($P < 0.05$) faster. Lambs on rye pasture consumed less feed and made cheaper gains.

Replacing 10 per cent sorghum grain with soybean meal in the ration of early weaned lambs significantly ($P < 0.05$) improved rate of gain and carcass weights of lambs.

Whole sorghum grain and alfalfa hay produced significantly ($P < 0.05$) slow rate of gain. Addition of ammonium chloride to this ration effectively prevented the incidence of urinary calculi in lambs.

Increasing sorghum grain level to 65 per cent, did not significantly ($P < 0.05$) increase rate of gain or carcass weights of lambs. It did improve feed efficiency and slightly lowered feed costs.

Changing ration (Table 1) did not produce significantly ($P < 0.05$) faster gains or heavier carcass weights in lambs and increased feed costs per cwt. of lambs gain.

Replacing 5 per cent sorghum grain with molasses did not significantly ($P < 0.05$) increase rate of gain or carcass weights of lambs. It increased feed costs per cwt. gain.

In 1965-66, replacing 5 per cent grain with soybean meal for non weaned lambs significantly ($P < 0.05$) increased rate of gain. It also increased feed efficiency but slightly increased feed costs.

Ten per cent soybean meal produced same rate of gain and failed to further improve rate of gain over that observed for 5 per cent soybean meal, but slightly improved feed efficiency.

Replacing sorghum grain with wheat did not significantly ($P < 0.05$)

affect rate of gain.

Lambs weaned early and grazed on rye pasture with no creep ration, significantly ($P < 0.05$) produced a lower rate of gain and low carcass weights. The costs of gain were cheap in this lot.

Lambs fed free choice ground sorghum grain and alfalfa hay gained significantly ($P < 0.05$) slower and produced high grading carcasses. Addition of ammonium chloride to this ration effectively eliminated the incidence of urinary calculi in lambs.

Single wether lambs gained faster than single ewe lambs and single lambs gained significantly ($P < 0.05$) faster than twin lambs.

ACKNOWLEDGMENTS

The author wishes to express his sincere thanks and gratitude to Dr. Carl S. Menzies, Major Professor, for the constant encouragement, advice and guidance in the preparation of this thesis and also to Mr. Evans E. Banbury, Superintendent, Colby Branch Agricultural Experiment Station, for his assistance.

Thanks are extended to Dr. Don L. Good, Head of the Department of Animal Husbandry, and to Dr. Robert R. Schalles for their help and cooperation.

Gratitude and sincere thanks are expressed to Dr. B. A. Koch and Dr. P. E. Sanford for their valuable suggestions and criticisms.

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APPENDIX

Table 1. Analysis of variance of average daily gains of lambs in 1964-65.

	D.F.	S.S.	M.S.	F. Ratio
Type of birth	1	0.2355	0.2355	31.6048**
Creep ration	7	0.8343	0.1191	15.9934**
Type of birth x creep ration	7	0.0534	0.0076	1.0244
Regression	2	0.6798	0.3399	45.6071**
Error	496	3.6968	0.0074	
Total	513	5.4998		

**Highly significant ($P < 0.01$).

Table 2. Analysis of variance of carcass weights of lambs in 1964-65.

	D.F.	S.S.	M.S.	F. Ratio
Type of birth	1	74.2482	74.2482	6.4385**
Creep ration	7	151.9776	21.7111	1.8827
Type of birth x creep ration	7	214.2632	30.6090	2.6543**
Regression	2	246.8624	123.4312	10.7035**
Error	335	3863.1535	11.5318	
Total	352	4550.5049		

**Highly significant ($P < 0.01$).

Table 3. Analysis of variance of average daily gains of lambs in 1965-66.

	D.F.	S.S.	M.S.	F. Ratio
Type of birth	1	0.0514	0.0514	10.0064**
Creep ration	7	0.9954	0.1422	27.6350**
Type of birth x creep ration	7	0.0326	0.0046	0.9061
Regression	2	0.3677	0.1838	35.7326**
Error	465	2.3931	0.0051	
Total	482	3.8402		

**Highly significant ($P < 0.01$).

Table 4. Analysis of variance of carcass weights of lambs in 1965-66.

	D.F.	S.S.	M.S.	F. Ratio
Type of birth	1	126.4356	126.4356	12.1192**
Creep ration	7	867.2758	123.8965	11.8759**
Type of birth x creep ration	7	107.5851	15.3693	1.4732
Regression	2	32.8162	16.4081	1.5727
Error	363	3787.0303	10.4325	
Total	380	4921.1430		

**Highly significant ($P < 0.01$).

CREEP RATIONS FOR PRODUCING SPRING LAMBS

by

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B. V. Sc., Madras University, India, 1945

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE UNIVERSITY
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1968

To study the value of various creep rations for producing lambs for a spring market, 450 ewes and their lambs were divided into 8 groups in 1964 and 1965 on the basis of age and type of birth of lambs.

Average daily gain data and carcass data were analyzed for type of birth and creep rations. Analysis of variance was adjusted to age of the ewe and birth weight of lambs. Analysis of variance indicates that the type of birth and creep rations of lambs were highly significant ($P < 0.01$) to the average daily gains and carcass weights of lambs in both years. Age of ewes and birth weights of lambs were highly significant ($P < 0.01$) to the average daily gains and carcass weights of lambs in both years.

In 1964 lambs weaned when 8-10 weeks of age performed equally as well as non-weaned lambs fed a similar ration. Early weaning reduced ewe feed costs and reduced in a saving of $0.79 per cwt. of lamb gain.

Lambs on rye pasture, weaned early, with creep ration of grain and alfalfa hay did not gain significantly ($P < 0.05$) faster than lambs fed similar ration in the dry lot. Lambs on rye pasture consumed less feed and made cheaper gains with greater feed efficiency.

Ten per cent soybean meal ration for early weaned lambs significantly ($P < 0.05$) improved rate of gain.

Whole sorghum grain and alfalfa hay ration resulted in significantly ($P < 0.05$) slower rate of gain but produced high grade carcasses in lambs. Addition of ammonium chloride eliminated the incidence of urinary calculi and did not affect feed consumption or lamb performance.

Sixty-five per cent sorghum grain in a ground mixed ration did not significantly ($P < 0.05$) increase lamb gains, but improved feed efficiency.

Young lambs started on a creep ration containing 20 per cent soybean

meal, 70 per cent sorghum grain, 10 per cent alfalfa hay and periodically reducing the protein and concentrate levels with their advancing age, did not gain significantly ($P < 0.05$) faster. The ration increased feed costs per cwt. of lamb gain by $0.92.

In 1965 5 per cent molasses did not significantly ($P < 0.05$) improve rate of gain or feed efficiency.

Five per cent soybean meal, significantly ($P < 0.05$) increased rate of gain, and increased feed efficiency.

Ten per cent soybean meal significantly ($P < 0.05$) increased rate of gain and did not significantly ($P < 0.05$) improve carcass weight or grade. Ten per cent soybean meal produced same rate of gain and failed to further improve rate of gain over that observed for 5 per cent soybean meal, but slightly improved feed efficiency.

Forty-five per cent wheat did not significantly ($P < 0.05$) increase rate of gain.

Early weaned lambs grazed on rye pasture with no creep ration gained significantly ($P < 0.05$) slower than lambs on other rations. Carcass weights and grades were significantly ($P < 0.05$) lower.

Lambs fed free choice ground grain and hay gained significantly ($P < 0.05$) slower but lamb carcasses graded equally as high as those from other lots. Addition of ammonium chloride eliminated incidence of urinary calculi and did not affect lamb performance as in 1964.

Single wether lambs gained faster than single ewe lambs and single lambs gained significantly ($P < 0.05$) faster than the twin lambs in both years.