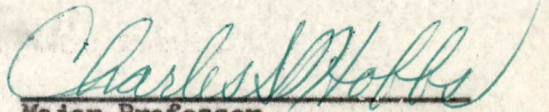


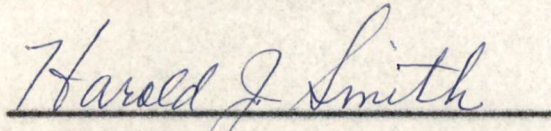
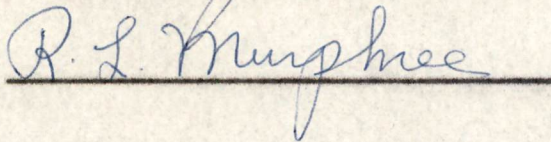
May 26, 1958

To the Graduate Council:

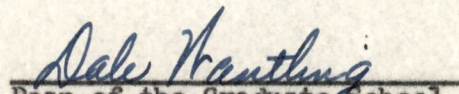
I am submitting herewith a thesis written by Ira Dyer, Jr. entitled "The Evaluation of Different Pasture Species in Various Combinations and at Varying Rates of Nitrogen Fertilization as Reflected in Beef Cattle Gains and Forage Yields." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.


Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:


Dean of the Graduate School

THE EVALUATION OF DIFFERENT PASTURE SPECIES IN
VARIOUS COMBINATIONS AND AT VARYING RATES
OF NITROGEN FERTILIZATION AS REFLECTED IN BEEF
CATTLE GAINS AND FORAGE YIELDS

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

by
Ira Dyer, Jr.

June 1958

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CHAPTER I

INTRODUCTION

Pastures often supply a major portion of the total feed used for the production of slaughter yearlings in the Southeast. The importance of productive and nutritious pastures to the beef cattle industry in the Southeast is self-evident. For this reason economical and profitable production of this type of beef will be greatly dependent on the pastures used. Therefore, it is very important for the beef producer to know which pasture combinations will result in the greatest returns from his enterprise.

In Tennessee there is a critical need for the evaluation of the more common pasture species such as orchardgrass, tall fescue and Ladino clover for beef production under varying soil and climatic conditions. The production of these species with different rates of nitrogen fertilization as reflected in beef cattle gains is also needed.

If profitable pastures are to be produced in Tennessee, information is needed regarding the cost of these pastures, soil types best suited for pastures, the optimum levels of fertilization, the optimum rate of grazing, and the effects of varying amounts of moisture and temperature. Closely associated with these factors is the amount of forage produced and the time of the year when the forage is produced.

Wide soil and climatic variations within the state resulted in pasture projects being conducted at three locations of University of Tennessee Agricultural Experiment Stations; namely, Highland Rim

Experiment Station, Springfield; Middle Tennessee Experiment Station, Spring Hill, and the Main Experiment Station, Knoxville, Tennessee. The various combinations of pasture species used were slightly different at the different stations and the nitrogen applications followed different patterns. This thesis will report the findings obtained at the Main Experiment Station, Knoxville, Tennessee. The Knoxville phase of the project was begun in the fall of 1954 with the following objectives:

1. To evaluate orchardgrass and tall fescue pastures alone and in combinations with Ladino clover as reflected in beef gains and animal grazing days.
2. To evaluate orchardgrass and tall fescue pastures under varying rates of nitrogen fertilization as reflected in beef gains and animal grazing days.

CHAPTER II

REVIEW OF LITERATURE

Pasture tests have been conducted for many years and in many states, but very few have been conducted in which beef animals were used to evaluate the grass species involved. Since the literature relating to pasture research is too voluminous for a complete review, the references cited will be limited to papers bearing directly on the phases of the subject dealt with in this study.

Brown (1933) found that applications of nitrogen increased the yield of pasture plants 197 per cent over unnitrated plants. Clover stands were observed to decrease with added nitrogen, but the percentage of protein increased 50 per cent when superphosphate and nitrogen were used. Eheart and Elliott (1941) reported highly significant increases in the percentage of grasses and decreases in the percentage of clover when nitrate of soda, ammonium sulfate or urea was used. Proportional decreases in the percentage of clover and increases in the percentage of grasses were obtained with increments of applied nitrogen. Elliott found the addition of nitrogen fertilizers was not beneficial where there was a good percentage of legumes. Where the legume population failed to occur in abundance for one or more years, nitrogen in the form of some quickly available carrier applied in the early spring before growth started was found to be very beneficial. Increases in dry matter production of the grasses was dependent on rainfall, but it was no more dependent on rainfall when 50, 100 or

150 lbs. of nitrogen per acre was used than when no nitrogen was applied (Eheart and Elliott 1941).

Brown and Munsell (1941) stated that there appears to be no justification for using nitrogenous fertilizers on pastures having 30 per cent or greater of the areas occupied by Ladino clover. They also stated that it is quite probable that the life of the Ladino will be shortened by stimulating the accompanying grasses to greater competition. Orchardgrass proved to be the most satisfactory grass in Ladino mixtures that were used primarily for pasture. Woodhouse (1950) reported that 250 lbs. of ammonium nitrate was contained in the herbage from one acre during one season. This was enough for the clover itself and usually ample for the grasses. Extra nitrogen increased the growth of the grass for a while, giving the appearance of increased yield, but the decreased clover growth resulted in a net gain too small to make the treatment pay. Jackobs (1952) found that a mixture that was predominately legume showed only slight response to nitrogen applications, but a marked response was noted when phosphate was applied. When the mixture was predominately grass there was a marked response to nitrogen.

Sprague and Garber (1950) in their study on the production and persistence of Ladino clover grown in association with orchardgrass and with bromegrass, under several times and heights of cutting, with and without nitrogen fertilization found that 60 lbs. per acre of nitrogen applied in April increased the yield somewhat on plots cut whenever the herbage reached a height of 8 inches. Significant

increases in yield were obtained primarily where the first crop of grass was removed late and when clover stands were poor. Nitrogen fertilizer stimulated the grass to such an extent that under the later cuttings, the Ladino was almost entirely crowded out.

Brown and Munsell (1943) found that when timothy and orchardgrass were seeded alone the application of 84 lbs. of nitrogen per season did not produce pasturage equal in quality or quantity as compared to seeding Ladino clover with the grasses. The only advantage of the pure grasses plus nitrogen was that this system produced larger yields in the first two weeks of May than the combination of grasses and legumes. Holmes (1951) found that the most efficient recovery of nitrogen was obtained by a single massive application of nitrogen given in the early spring. When the soil temperature was between 42 and 47 degrees Fahrenheit, the growth of grass was dependent on the availability of soluble nitrogen. During the months of March and April the plants were able to utilize the sun's energy for maximum growth if these nitrates were available.

Leasure (1949) compared the forage yields of orchardgrass - Ladino clover and tall fescue - Ladino clover. The results showed that fescue - Ladino produced 4,430 lbs. per acre and that orchardgrass - Ladino produced 4,330 lbs. per acre. Spencer (1949) conducted forage yield tests to compare different times of applying 200 lbs. of ammonium nitrate per acre to orchardgrass and tall fescue. Untreated plots of orchardgrass yielded 2,236 lbs. of dry matter per acre. When 200 lbs. of ammonium nitrate was applied in October, the yields were

2,715 lbs. of dry matter per acre. Application in January resulted in yields of 2,881 lbs. per acre. February applications gave yields of 2,921 lbs. of dry matter per acre and application in April resulted in yields of 3,119 lbs. per acre. Untreated plots of fescue yielded 3,055 lbs. of dry matter per acre. When 200 lbs. of ammonium nitrate per acre was applied in October, the yields were 4,217 lbs. of dry matter per acre. Application in January resulted in yields of 4,330 lbs. per acre. February application produced yields of 5,073 lbs. and April applications produced 5,050 lbs. per acre.

Taylor et al. (1956) applied nitrogen at the rate of 35, 70, and 140 lbs. of nitrogen per acre during the growing season. Eleven grazing trials conducted with beef cattle during a three year period indicated that orchardgrass and timothy were more palatable than fescue. The plots receiving the highest nitrogen level were the most palatable, and the total dry matter yield was in favor of the fescue. Woodhouse and Chamblor (1953) observed that large increases in forage yields were obtained from applications of 400 lbs. of elemental nitrogen. They found that to use fescue effectively as a winter grazing plant, it was necessary to produce and accumulate most of the forage before November 1. Fescue produced very little growth during November, December, January, and February, even though the plant remained green. The highest yields of fall forage was produced by applying nitrogen on August 1. Further findings showed that the increase in yield of forage per pound of nitrogen applied was essentially the same up to at least 100 lbs. of nitrogen per application. To obtain maximum yields from

pure grass sods, it was necessary to apply from 100 to 400 lbs. of elemental nitrogen annually. Woodhouse and Chambler (1953) reported that on established stands of orchardgrass and fescue and Ladino clover mixtures, the increase in forage production due to adding nitrogen was not enough to justify the cost of the nitrogen applied. Furthermore, they found that applications of nitrogen on a sod of Ladino-grass mixtures that had been over grazed frequently hastened the loss of the clover. Blaser and Brady (1950) reported that with the addition of 50 lbs. of nitrogen to the grass-Ladino mixtures, resulted in 353 lbs. more forage per acre, but the addition of 100 lbs. of nitrogen increased the forage yield only 480 lbs. per acre.

Jones et al. (1947) reporting on one year's work showed that yields from orchardgrass were increased from 1,099 lbs. per acre with no nitrogen to 5,099 lbs. per acre when plots were treated with 488 lbs. of calnitro or 100 lbs. of nitrogen per acre applied in the spring. As the amount of nitrogen was increased, the protein content was increased as well as the yields.

Kentucky workers (Ky. Agr. Exp. Sta. Annual Report. 1944) harvested Kentucky 31 fescue and orchardgrass twice during the year from plots sown in the fall of 1942 and found that Kentucky 31 fescue yielded 1,020 lbs. of hay per acre compared to 905 lbs. per acre for orchardgrass. These workers (Ky. Agr. Exp. Sta. Annual Report. 1949) found that tall fescue yields varied from 3,692 lbs. to 4,521 lbs. of hay when cut in May, while orchardgrass yields ranged from 2,202 lbs. to 2,511 lbs.

Another test by Kentucky workers (Ky. Agr. Exp. Sta. Annual Report. 1949) showed that 100 lbs. of ammonium nitrate per acre applied after each of three clippings to three year old orchardgrass sods raised the yields from 2,236 to 2,734 lbs. of dry matter per acre to 3,821 - 4,956 lbs. of dry matter per acre. The yields of tall fescue on three year old sods were increased from a range of 1,544 to 1,815 lbs. and from 2,422 to 3,260 lbs. of dry matter per acre when 100 lbs. of ammonium nitrate per acre was applied after each of two clippings.

Burger (1954) found that Ladino clover - orchardgrass, and tall fescue - Ladino clover were much better in producing beef and dry matter than mixtures of Kentucky bluegrass, timothy, white clover and orchardgrass - lespedeza. The greater production of the tall growing mixtures reflected the ability of these mixtures to produce feed during every month of the growing season. Hervey and Cook (1953) reported that steers grazed on first year fescue for 90 days gained 123 lbs. (1.4 lbs. per head daily). On fescue - alfalfa pasture of the same age, animals pastured for 62 days gained 60 lbs. (1 lb. per head daily). During the second year the steers grazing the fescue gained 1.1 lbs. per head per day and those grazing the alfalfa-fescue pasture produced gains of 1.6 lbs. per head per day. On the basis of 4 years work he concluded that fescue holds little promise for the improvement of agriculture in the southern Blacklands. Sell and Baird (1953) found that steers grazed on fescue during the winter made lower daily gains and produced less total gain than steers grazed on crimson

clover on a summer grass sod, even though it had more grazing days per acre. Although fescue gave the longest grazing season and was the most dependable cold hardy winter pasture, the low rate of gain, lack of finish and selling price of the steers made fescue the poorest pasture studied.

Jackobs (1952) compared orchardgrass, smooth brome, Kentucky bluegrass, fescue, perennial ryegrass and tall oatgrass planted alone and in combination with alfalfa and Ladino clover. Orchardgrass and fescue were the most consistent producers throughout the four year period of the experiment. Orchardgrass and fescue became established readily and were nearly as productive the first year as the short lived grasses. Orchardgrass growing alone or with Ladino clover produced about the same amount of forage as comparable plantings with fescue. Although fescue and orchardgrass were about equally productive, it appeared that fescue had a greater depressive effect on the clover.

Duncan et al. (1949) reported that steers grazed on orchardgrass-Ladino clover pasture gained 204 lbs. per steer during a 225 day period and steers on Kentucky 31 fescue - Ladino clover gained 212 lbs. Duncan et al. (1950) found that yearling steers grazed on orchardgrass - Ladino hop clover gained 504 lbs., dressed 59.4 per cent and were fatter than the steers on fescue-Ladino-hop clover that gained 485 lbs. and dressed 58.8 per cent. Kentucky workers (Ky. Agr. Exp. Sta. Annual Report. 1949) found that the digestion coefficients for Kentucky 31 fescue were 10.7 per cent for protein and 70 per cent for organic matter, while the coefficients for orchardgrass were 13.0 per cent for protein and 73 per

cent for organic matter. Greater palatability of orchardgrass was shown by the fact that total consumption per head per day was 11.7 lbs. for the animals ingesting the orchardgrass as compared to 9.0 lbs. daily for the animals receiving fescue.

Blaser et al. (1956) reported on a grazing experiment designed to obtain data on carrying capacity, herbage quality or liveweight gains per animal, and liveweight gains per acre when using beef animals. The pasture treatments included orchardgrass and tall fescue each fertilized with nitrogen, and the same grass species grown with Ladino clover, lespedeza - orchardgrass, white clover and bluegrass - white clover pastures. Data collected during 6 growing seasons showed that the herbage quality of the four grass legume mixtures were similiar; however, animals grazing the tall fescue - clover mixture made somewhat lower gains than those grazing other pastures. Animals grazing fertilized grasses with nitrogen made lower daily gains than animals grazing the same grasses grown with Ladino clover and not fertilized with nitrogen. Steers grazing tall fescue - Ladino clover mixtures and tall fescue fertilized with nitrogen made lower gains per head than did steers grazing mixtures of orchardgrass - Ladino clover and orchardgrass fertilized with nitrogen. Tall fescue pastures fertilized with nitrogen produced the highest carrying capacity. The carrying capacity of lespedeza-orchardgrass-white clover and bluegrass - white clover pastures were about equal.

CHAPTER III

EXPERIMENTAL PROCEDURE

General Plan

This investigation was conducted over a two year period to evaluate orchardgrass, fescue and Ladino clover pastures in various combinations and under different levels of nitrogen fertilization. Weanling steer calves were used both years to measure the quality and quantity of forage produced. Grazing and feed lot data were collected for each year. The data were analyzed by years and then combined and summarized together.

General Experimental Procedure

Pastures

Thirty-six acres of land located in two tracts at the University Blount County Farm were used in this study. The two tracts were adjacent to one another with one tract containing 27 acres and the other 9 acres.

The land area involved in this study was selected because the topography and soil type were found to be more uniform than for any other area that was available for the study. The two tracts were divided into 12 three acre lots as uniform in topography and soil type as possible. Soil samples were taken over the entire area and fertilizer and lime were applied according to the recommendations made

from the analysis of the soil samples. At seeding time the entire area was fertilized with 200 lbs. of triple - superphosphate, 100 lbs. of ammonium nitrate, and 1.5 tons of lime per acre.

After several unsuccessful attempts, the seedings were established in the fall of 1954 and the spring of 1955. The seedings included the following 6 treatments, with each treatment replicated in the test.

Lot No.	Pasture Treatments
1AB	Orchardgrass plus nitrogen
2AB	Orchardgrass - Ladino clover plus nitrogen
3AB	Orchardgrass - Ladino clover
4 AB	Fescue plus nitrogen
5 AB	Fescue - Ladino clover plus nitrogen
6 AB	Fescue - Ladino clover

During the summer of 1955 the seedings were not grazed, but were clipped with a rotary type mower to remove the weeds and tall growth. In October of 1955 the lots were individually fenced following the points that were previously set in surveying out the three acre lots. The fence was constructed with steel posts and four strands of barbed wire with wooden posts used for corners and braces. In order to provide water for the cattle, troughs with automatic floats were placed so that one trough served two lots. Shelter was provided in all lots by the use of portable houses approximately 12 feet by 10 feet. In these shelters hay racks were provided along with salt and mineral boxes.

One of the important objectives in this study was to determine the effects of varying rates of nitrogen applications on grasses and grass - legume mixtures. Another objective of the study was to determine the time to apply nitrogen fertilizer to obtain the greatest returns in the form of forage produced. In order to evaluate the above points it was decided to apply nitrogen in the form of ammonium nitrate (33 per cent nitrogen) 3 times per year. The first application during the season was applied the first of March since the growing season usually starts about that time each year. The second and third applications were made the first of June and September, respectively.

The orchardgrass and fescue (Lots 1AB and 4AB) received 150 lbs. of ammonium nitrate per acre, respectively, at each of the three applications. The lots composed of orchardgrass - Ladino clover and fescue - Ladino clover (Lots 2AB and 5AB) received 75 lbs. of ammonium nitrate per acre at each of the three applications. Lots 3AB and 6AB did not receive nitrogen. Each year a total of 450 lbs. of ammonium nitrate per acre was applied to the grass pastures (Lots 1AB and 4AB) equally divided between the three applications. The lots composed of grasses and Ladino clover receiving nitrogen (Lots 2AB and 5AB) received annually 225 lbs. of ammonium nitrate per acre.

In addition to the nitrogen fertilizer that was applied each season, potash and phosphate were applied according to the requirements, as shown by the soil samples analysis. These samples were taken each year during the summer in order to allow time for analysis and ample time for applying the fertilizer needed before late fall. During the

fall of 1957 Lots 1A, 3A, 3B, 5B, and 6B received 75 lbs. of triple superphosphate (48 per cent P.) per acre. A few of the pastures (Lots 1B, 2B, and 4B) received 100 lbs. of triple superphosphate per acre applied in the fall.

During the summer of 1956 and 1957 all pastures were clipped once each year. The decision to clip was based on the condition of the pasture as well as the amount of the grasses that had headed out. Clipping was done in most cases when approximately 75 per cent of the grass had headed out with care being taken not to clip lower than 6 inches in height.

Throughout the entire grazing season of each year, all lots were carefully scored and evaluated every two weeks. The scoring was done by Professor H. R. Duncan and the writer, except when Professor Duncan was unable to assist. The evaluations of the pastures required rather close observation as well as considerable experience; therefore, it was believed advisable to have the judgement of two individuals rather than one as often as possible. The bi-monthly scorings involved the following: the height of the grasses and clover, the percentage of clover, grasses and weeds, the stage of growth, (young, pre-bloom, bloom, seed or dormant) condition of the pasture, color, carrying capacity, thickness of sod, footing and the grade of the pastures (excellent, very good, good, fair, poor and very poor). This information was used as a basis of adding extra animals to the various lots or removing extra animals that had been previously placed in the lots.

In the original plan it was decided to remove the steers from the pastures around the last of August or the first of September and place the next group of steers on the pastures approximately the first of November. This would allow the pastures approximately 60 days to recover from the summer grazing period, and produce some excess growth for the winter period. Slight deviations from this schedule was followed because it was not possible to obtain the cattle in time to get them on pasture by November.

Cattle

Weanling Angus and Hereford steers weighing approximately 500 lbs. were used in this study. Twenty-four head of steers were required each year for the study. In order to have uniform steers with respect to weight and quality, it was necessary to purchase a part of the steers that were used. The steers used in the 1956 test came from two sources, and included 12 purchased in the Morristown feeder calf sale and 12 purchased from Strong Stock Farm near Knoxville. In 1957, 12 steers came from Strong Stock Farm and 12 from the experimental herds at Franklin, Tennessee.

Besides the 24 head of steers used as test steers, extra animals were used intermittantly throughout the grazing season to remove the excess pasturage. Since these extra animals did not have to be uniform as to sex, size, and breed, animals already on hand at the University of Tennessee Blount County Farm were used primarily for this purpose. Twelve head of steers were purchased the second year for extra grazing

animals, and they were used along with animals on hand to provide sufficient numbers. During the peak grazing season as many as 50 extra animals plus the 24 test steers were used at one time.

In allotting the steers to the various pasture treatments and lots, two-day initial weights, feeder and condition grades, origin and other factors that might affect the probable outcome were taken into consideration. After the steers were allotted to the various treatments, they were branded with hot irons according to the lot numbers. For example Lot 1A - steers 11 and 12; Lot 1B - steers 13 and 14; Lot 2A - steers 21 and 22; Lot 2B - 23 and 24, etc. Each lot was assigned 2 test steers that remained in the respective lot throughout the entire test period.

After branding, the steers were moved to their respective lots. During the winter period which was considered to be from November to the last of March, the steers were fed hay. The hay was weighed and records were kept in order to determine the wintering costs. Throughout the summer grazing period, the steers received only the forage produced by the pastures, plus salt and mineral mix of salt and dicalcium phosphate. During both year's trials the wintering phase was of short duration because the cattle were not available for the test until February 10 in 1956 and January 4 in 1957.

During the entire pasture period all test steers were individually weighed every 28 days. These weights were used along with the number of grazing days produced by the various treatments to calculate the monthly average daily gains, beef gain per acre, and grazing days

per acre. If the steers needed spraying, this was usually done at the regular weigh days in order to avoid an extra working of the cattle. At the end of the grazing season (August 30 to September 15) the cattle were weighed on two consecutive days to obtain an average weight. Feeder and condition grades were assigned at this time, in the same manner as they were at the beginning of the pasture period, by at least two qualified graders from the University of Tennessee Animal Husbandry Department. The graders worked individually and the grades used in this report represent an average. The initial price was the amount actually paid for the steers or, in the case of calves raised, an appraised price by a packer or other qualified buyer was used.

After completing the pasture period, the test steers were placed in drylot for a finishing period on grain. This was done because it was believed that it would be profitable to feed these cattle into a higher grade rather than sell them straight off grass at a much lower price. The cattle were fed inside a barn with 4 animals per lot. The 6 lots represented the 6 pasture treatments that were studied using the same cattle. The cattle from each treatment were all grouped and fed together in order to determine if there was any difference in performance between treatments.

The steers in all treatments were full-fed a mixture of 8 parts ground shelled corn and 1 part cottonseed meal plus 5 to 7 lbs. of grass hay per head per day. The concentrate was fed at a rate that would permit the animals to clean up all feed after each feeding. Each steer at the beginning of the dry-lot finishing period was implanted

with 24 milligrams of stilbestrol. This was done in order to try to produce more efficient and profitable gains. Since all steers were implanted at the same rate, no difference between lots could be attributed to the stilbestrol. A continued effort was made to keep the animals on maximum feed consumption. During the dry-lot period the animals were weighed every 28 days just as they were during the pasture season. Records were kept of individual steer weights and of the hay and concentrate consumed per lot. This information was used to calculate the returns from the dry-lot period plus overall performance of the steers.

At the end of the dry-lot feeding period (84 days in 1956 and 122 days in 1957) the cattle were graded by personnel from the University Animal Husbandry Department before being sent to the East Tennessee Packing Company for slaughter. After slaughtering, the carcasses were tagged in order that they could be followed in the cooler at the packing plant, to obtain federal carcass grades and carcass weights. This information was used in calculating the returns and performance of the various pasture treatments.

All feed costs were based on the local price paid for the feed-stuffs as shown in Table XIV.

The cost of applied fertilizer was based on the local price as shown in Table XIV. In determining the financial results for the pastures, the only costs considered were the cost of the fertilizer, cost of applying fertilizer, cost of clipping and cost of hay fed during the winter period.

In analyzing the data, a weighted average was used within each year and an unweighted average was used in summarizing the data for the two years. Analysis of variance techniques according to Snedecor (1956) were used to determine the significance of differences among treatments for average daily gain on pasture and in dry-lot and beef gain and grazing days per acre.

CHAPTER IV

RESULTS AND DISCUSSION

The data for the first year (1956) of this experiment comparing the cattle on orchardgrass, fescue and Ladino clover pastures are summarized in Tables I, II, III, and IV. During the winter grazing period of 1956, there were no significant differences of test steers on various pastures among the average daily gains ($P > .05$). Very good daily gains were obtained in all lots during the wintering period. This was probably due to the fact that there was an abundance of forage present when the steers were placed in the lots.

The total pounds of beef produced per acre during the winter period was in favor of the fescue pastures with a high of 94 lbs. for fescue-Ladino clover (Lots 6AB) and a low of 45 lbs. for the straight orchardgrass pasture (Lots 1AB). The difference approached significance at the 5 per cent level. The fescue pastures (Lots 4AB, 5AB, and 6AB) produced significantly ($P < .01$) more grazing days per acre than the orchardgrass pastures (1AB, 2AB, and 3AB). The fescue produced 51, 51, and 49 grazing days per acre, respectively, compared to 37, 37, and 37 grazing days for the orchardgrass pasture. There were no significant differences among the orchardgrass pastures (Lots 1AB, 2AB, and 3AB) or among the fescue pastures (Lots 4AB, 5AB, and 6AB).

Data for the 1956 summer grazing period are summarized in Table II. For the 156 day grazing period, the average daily gains per test steer were: Lots 1AB, 1.07 lbs.; Lots 2AB, 1.44 lbs.; Lots 3AB, 1.33 lbs.;

TABLE I

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Winter Grazing Period:
2-10-56 to 4-6-56 (56 days)

Pasture number and description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head, lbs.						
Initial wt. (2-10-56)	619	619	626	616	619	613
Final wt. (4-6-56)	687	713	703	714	714	714
Total gain (56 days)	68	94	77	98	95	101
Daily gain (test steers)	1.21	1.68	1.37	1.75	1.70	1.80
Productivity of pastures						
Grazing days per acre ^a	37	37	37	51	51	49
Est. beef gain per acre	45	62	56	87	89	94
Acre req./head	1.51	1.51	1.51	1.10	1.10	1.14

^aL.S.D. (1% level) - 9.06 days per acre.

L.S.D. (5% level) - 5.97 days per acre.

TABLE II

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURE

Summer Grazing Period
4-6-56 to 9-9-56 (156 days)

Pasture number and description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head, lbs.						
Initial wt. (4-6-56)	687	713	703	714	714	714
Final wt. (9-9-56)	854	938	911	875	898	893
Total gain (156 days)	167	225	208	161	184	179
Daily gain (test steers)	1.07	1.44	1.33	1.03	1.18	1.15
Av. pasture cost/head ^a	\$22.26	11.28		18.48	9.84	
Productivity of pastures						
Grazing days per acre ^b	147	165	161	176	189	164
Est. beef gain per acre ^c	162	263	240	193	248	201
Acre req./head	1.06	.94	.97	.88	.82	.95

^aIncludes only the cost of the nitrate applied and the cost of applying.

^bL.S.D. (1% level) - 27.4 days per acre.

^cL.S.D. (5% level) - 12.0 days per acre.

^dL.S.D. (5% level) - 61.4 pounds per acre

TABLE III

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
2-10-56 to 9-9-56 (212 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head, lbs.						
Initial wt. (2-10-56)	619	619	626	616	619	613
Final wt. (9-9-56)	854	938	911	875	898	893
Total gain (212 days)	235	319	285	259	279	280
Daily gain (test steers)	1.10	1.50	1.37	1.22	1.31	1.32
Av. feed cost per head Pasture ^a	\$24.15	12.56	—	19.82	10.60	—
Av. animal grades ^b						
Initial feeder	12.0	12.0	12.5	12.0	12.0	12.0
Initial slaug.	6.0	6.0	6.5	6.5	6.0	6.0
Final feeder	10.5	10.5	10.5	9.5	9.5	10.0
Final slaug.	10.0	10.5	10.5	10.0	10.0	10.5

TABLE III (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
2-10-56 to 9-9-56 (212 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Financial results for test steers						
Initial cost/cwt.	\$20.00	20.00	20.00	20.00	20.00	20.00
Final value/cwt.	18.50	19.37	18.50	17.75	18.62	19.50
Initial cost/head	\$123.80	123.80	125.20	123.20	123.20	122.60
Final value/head	158.00	181.70	168.53	155.31	167.20	174.15
Feed cost/head	24.15	12.56		19.82	10.60	
Total cost/head	147.95	136.36	125.20	143.02	134.40	122.60
Returns/head over N. cost	\$10.05	45.34	43.33	12.29	32.80	51.55
Productivity and returns						
Grazing days/acre ^c	184	202	198	227	240	213
Est. beef gain/acre ^d	207	325	296	280	337	295
Acres req./head	1.15	1.04	1.06	0.93	0.88	0.99

TABLE III (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
2-10-56 to 9-9-56 (212 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Productivity and returns (continued)						
Gross returns/acre	\$29.73	55.67	43.33	34.52	49.31	51.55
Cost of N/acre	21.00	12.00	—	21.00	12.00	—
Returns/acre over N	8.73	43.67	43.33	13.52	37.31	51.55

^aIncludes only the cost of nitrogen applied and the cost of applying.

^bLow std. = 6.0, Std. = 7.0, High Std. = 8.0, Low G. = 9.0, Good = 10.0, High G. = 11.0,
Low Ch. = 12.0.

^cL.S.D. (1% level) = 30 days per acre; 5% level = 20 days per acre.

^dL.S.D. (1% level) = 59 pounds per acre; 5% level = 39 lbs. per acre.

TABLE IV

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Period
9-9-56 to 12-2-56 (84 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head						
Initial wt. (9-9-56)	854	938	911	875	898	893
Final wt. (12-2-56)	1060	1136	1121	1058	1071	1116
Total gain (84 days)	206	198	210	183	173	223
Daily gain (test steers)	2.45	2.36	2.51	2.18	2.05	2.65
Av. da. ration						
Ground shelled corn	15.9	17.0	16.5	17.0	17.0	17.0
Cottonseed meal	2.2	2.4	2.4	2.4	2.4	2.4
Mixed grass hay	5.3	5.3	5.3	5.3	5.4	5.4
Av. feed per cwt. gain						
Concentrates	738	823	756	890	942	731
Roughage	216	225	212	243	262	203
Av. feed cost per head						
Concentrates	\$39.40	42.24	41.20	42.24	42.25	42.25
Roughage	4.45	4.45	4.45	4.45	4.53	4.53

TABLE IV (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Period
9-9-56 to 12-2-56 (84 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Av. animal grades ^a						
Initial slaughter(9-9-56)	10.0	10.5	10.5	10.0	10.0	10.5
Final slaughter(12-2-56)	10.0	10.5	10.5	10.5	10.0	10.5
Federal carcass grade	11.5	11.5	12.0	11.5	12.0	12.0
Returns per test steer						
Initial value per cwt.	\$18.50	19.37	18.50	17.75	18.62	19.50
Final value per cwt.	21.75	21.75	21.75	21.75	21.75	21.75
Initial cost per head	\$157.99	181.69	168.53	155.31	167.20	174.13
Final value per head ^b	\$224.02	239.79	234.68	223.37	227.07	238.16
Feed cost per head	\$43.85	46.70	45.65	46.70	46.78	46.78
Total cost per head	\$201.84	228.38	214.18	202.01	213.98	220.91
Returns per head over feed costs	\$22.18	11.41	20.50	21.36	13.09	17.25

^a L. Good = 10.0, H. Good = 11.0, L. Ch. = 12.0.

^b Calculated from selling weight and not the original weight when animals came off the experiment at Blount Farm.

Lots 4AB, 1.03 lbs.; Lots 5AB, 1.18 lbs.; and Lots 6AB, 1.15 lbs.

The difference in daily gains among lots were not statistically significant.

The orchardgrass-Ladino clover plus nitrogen pastures, Lots 2AB, produced the most pounds of beef per acre, 263 lbs. This was significantly ($P < .05$) more than that produced by Lots 1AB, 4AB, and 6AB. There were no significant differences in beef gains per acre among the fescue lots. The fescue-Ladino clover pastures (Lots 5AB) provided an average of 189 grazing days per acre which was significantly ($P < .05$) more than that provided by Lots 1AB, 2AB, 3AB, and 6AB. The lowest acreage required per head was 0.82 acre in Lots 5AB which was 0.24 acre less than that required per head in the straight orchardgrass pastures (Lots 1AB).

For the entire 1956 grazing year of 212 days (Table III), the average daily gains per test steer were: orchardgrass and nitrogen, Lots 1AB, 1.10 lbs.; orchardgrass, Ladino clover and nitrogen, Lots 2AB, 1.50 lbs.; orchardgrass and Ladino clover, Lots 3AB, 1.37 lbs.; fescue and nitrogen, Lots 4AB, 1.22 lbs.; fescue-Ladino clover and nitrogen, Lots 5AB, 1.31 lbs.; and fescue and Ladino clover, Lots 6AB, 1.32 lbs. Thus when winter and summer grazing seasons are combined, there was no significant differences in average daily gains between lots.

At the end of the first year, it was noted that a good percentage of the clover was disappearing in both the nitrated and non-nitrated pastures. The results of this study indicate that as the amount of

clover decreases the rate of gain of steers grazing these pastures will decrease. This is in agreement with results obtained in similar tests at the Highland Rim Experiment Station at Springfield, Tennessee.

For the 1956 grazing year the total amount of beef produced per acre was in favor of the fescue-Ladino clover nitrated pasture (Lots 5AB) and the orchardgrass-Ladino clover nitrated pasture (Lots 2AB) with an average of 337 lbs. and 325 lbs. of beef produced, respectively. The orchardgrass-Ladino clover pasture produced 296 lbs. of beef per acre which was significantly more ($P < .01$) than that produced from the nitrated orchardgrass pasture. The fescue-Ladino clover plus nitrogen pasture provided 240 average grazing days per acre which was significantly more ($P < .05$) than provided by Lots 1AB, 2AB, 3AB, and 6AB. The acreage required per head was 0.88 acre in Lots 5AB, which was 0.27 acre less than that required per head in Lots 1AB.

In dry-lot (Table IV) the average daily gains ranged from 2.05 lbs. (Lots 5AB) per head daily to 2.65 lbs. (Lots 6AB) per head daily, but differences in gains among lots were not significant due to the variation within treatments. The feed required per cwt. gain varied a great deal ranging from a low of 698 lbs. of concentrates for Lots 2AB to 945 lbs. for Lots 5AB. The low gaining lots on pasture (Lots 1AB, orchardgrass plus nitrogen) required only 740 lbs. of concentrates per cwt. gain and returned slightly more profit per head in the feed lot.

In analyzing the pasture and the dry-lot periods for 1956 no clear cut relationship was observed between the gains on pasture and

the gains in dry-lot for this one year's results. The returns per head over nitrogen costs were almost as great for the orchardgrass-Ladino clover pastures as for the orchardgrass-Ladino clover pasture that received nitrogen. The returns were greater for the non-nitrated fescue pasture than for the ones receiving nitrate. The least returns were realized from the straight grass pastures (Lots 1AB and 4AB).

Data summarizing the second year's (1957) grazing results are shown in Tables V, VI, and VII. During the winter period of 1957 very little hay was consumed. Hay consumption ranged from 2.4 lbs. per head daily for Lots 1AB to 1.3 lbs. per day for Lots 6AB. The average daily consumption was low due to the fact that an abundance of pasture was available when the steers were placed on the pastures.

During the winter grazing period of 1957, the average daily gains were generally lower than the gains during comparable periods of 1956. This could be attributed partly to the steers since the average weight was approximately 160 lbs. less than the weight of the steers used in 1956. Another contributing factor was the fact that even though there was an abundance of pasture at the beginning of the winter period, there was less forage than in 1956.

The average daily gains ranged from .93 lbs. per head for the orchardgrass plus nitrogen pasture (Lots 1AB), to 1.71 lbs. for the fescue plus nitrogen pastures (lots 4AB). Within the 3 treatments involving fescue there were no significant differences among the daily gains, neither was there any difference among the 3 orchardgrass treatments. Lots 4AB and Lots 6AB produced average daily gains that were

TABLE V

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Winter Grazing Period
1-4-57 to 3-29-57 (84 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head, lbs.						
Initial wt. (1-4-57)	458	458	452	450	450	452
Final wt. (3-29-57)	536	554	537	594	571	588
Total gain (84 days)	78	96	85	144	121	136
Daily gain (test steers) ^a	<u>.93</u>	<u>1.14</u>	<u>1.01</u>	<u>1.71</u>	<u>1.44</u>	<u>1.62</u>
Av. daily feed per head, lbs.	2.4	1.9	2.3	1.4	1.4	1.3
Hay						

TABLE V (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Winter Grazing Period
1-4-57 to 3-29-57 (84 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Productivity of pastures						
Grazing days per acre ^b	58	68	58	98	100	100
Est. beef gain per acre ^c	54	86	60	163	134	163
Acre reg./head exclusive of hay	1.45	1.23	1.45	0.85	0.84	0.84

^aL.S.D. (5% level) = .51 lbs. per head daily.

^bL.S.D. (5% level) = 12.7 days per acre.

L.S.D. (1% level) = 19.2 days per acre.

^cL.S.D. (5% level) = 37.3 lbs. per acre.

L.S.D. (1% level) = 56.6 lbs. per acre.

TABLE VI

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summer Grazing Period
3-29-57 to 8-30-57 (154 days)

Pasture Number and Description	1AB O + N	2AB O + N + L	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain per head, lbs.						
Initial wt. (3-29-57)	536	554	537	594	571	588
Final wt. (8-30-57)	706	740	755	749	706	715
Total gain (154 days)	170	186	218	155	135	127
Daily gain ^a	<u>1.10</u>	<u>1.21</u>	<u>1.41</u>	<u>1.01</u>	<u>0.88</u>	<u>0.82</u>
Av. pasture cost per head ^b	\$17.22	10.68	—	15.12	8.04	—
Productivity of pastures						
Grazing days per acre	187	172	176	212	230	224
Est. beef gain per acre	269	232	287	250	246	207
Acre required per head	0.82	0.89	0.87	0.72	0.67	0.68

^aL.S.D. (5% level) = .36 lbs. per head daily.

^bIncludes only the cost of the nitrate applied and the cost of applying it.

TABLE VII

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
1-4-57 to 8-30-57 (238 days)

Pasture Number and Description	1AB O + N	2AB O + N + L	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain/head						
Initial wt. (1-4-57)	458	458	452	450	450	452
Final wt. (8-30-57)	706	740	755	749	706	715
Total gain (238 days)	248	282	303	299	256	263
Daily gain (test steers)	1.04	1.19	1.27	1.26	1.08	1.10
Av. feed cost/head						
Pasture	20.37	11.88	—	16.17	8.64	—
Hay	2.06	1.95	2.03	2.01	2.06	2.01
Av. animal grades ^a						
Initial feeder	11.5	12.5	13.3	12.1	12.9	12.9
Initial slaughter	6.2	6.7	7.1	6.6	6.9	7.3
Final slaughter ^b	4.7	5.5	7.0	6.0	5.7	5.0

TABLE VII (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
1-4-57 to 8-30-57 (238 days)

Pasture Number and Description	1AB O + N	2AB O + N + L	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Financial results for test steers						
Initial cost/cwt.	\$20.00	\$20.00	\$20.00	\$20.00	\$20.00	\$20.00
Final value/cwt.	\$14.50	\$14.62	\$17.00	\$16.00	\$15.62	\$14.87
Initial cost/head	\$91.60	\$91.60	\$90.40	\$90.00	\$90.00	\$90.40
Final value/head	\$102.37	\$108.25	\$128.35	\$119.90	\$110.43	\$106.57
Feed cost per head	\$22.43	\$13.83	\$2.03	\$18.18	\$10.70	\$2.01
Total cost per head	\$114.03	\$105.43	\$92.43	\$108.18	\$100.70	\$92.41
Returns per head over feed costs	-\$11.66	\$3.02	\$35.92	\$11.72	\$9.73	\$14.16
Productivity and returns						
Grazing days per acre ^c	245	240	234	310	330	324
Est. beef gain per acre ^d	269	317	347	413	379	370
Acres required per head	0.97	0.99	1.0	0.77	0.72	0.73

TABLE VII (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
1-4-57 to 8-30-57 (238 days)

Pasture Number and Description	1AB O + N	2AB O + N + L	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Productivity and returns (continued)						
Gross returns per acre	\$11.10	\$16.70	\$37.95	\$38.83	\$28.37	\$22.15
Cost of N per acre	\$21.00	\$12.00	—	\$21.00	\$12.00	—
Returns per acre over feed costs	\$11.91	\$2.94	\$35.92	\$15.22	\$13.51	\$19.40

^a Utility = 4.0, H.U. = 5.0, L. Std. = 6.0, Std. = 7.0, H. Std. = 8.0, L.G. = 9.0,
G. = 10.0, H.G. = 11.0, L. Ch. = 12.0, Ch. = 13.0.

^b L.S.D. (5% level) = .9.

^c Approaches significance at the five per cent probability level.

^d L.S.D. (5% level) = 46.1 lbs. per acre.

significantly ($P < .05$) more than those produced by Lots 1AB, 2AB and 3AB. Lots 5AB produced gains that were significant over those produced by Lots 1AB. The lots making the lowest daily gains consumed slightly more hay than did the higher gaining lots, although not very much hay was consumed by any of the lots.

The total pounds of beef produced and grazing days per acre during the winter grazing period were in favor of treatments involving fescue in various combinations and under different rates of nitrogen fertilization. The fescue nitrated pasture produced 163 lbs. of beef and 98 grazing days per acre. The fescue-Ladino clover pasture (Lots 6AB) produced 163 lbs. of beef and a total of 100 grazing days per acre. Highly significant ($P < .01$) results were obtained in favor of the fescue treatments (Lots 4AB, 5AB and 6AB) in both grazing days and beef gains per acre in all lots except Lots 5AB and it was significant ($P < .05$) over the orchardgrass treatments.

The lowest acreage required per head during the winter was 0.84 acre for Lots 5AB and 6AB. This was 0.61 acre less than the highest requirement of 1.45 acres per head in Lots 1AB and 3AB.

The steers during summer grazing period for 1957 in general did not make daily gains as good as those in 1956 (Table VI). The gains made by the steers on the fescue pastures were considerably lower during the summer than during the winter period. The orchardgrass-Ladino clover plus nitrogen (Lots 2AB) and orchardgrass-Ladino clover (Lots 3AB) produced daily gains (1.21 and 1.41 lbs., respectively) that were significantly higher ($P < .05$) as compared to gains of Lots 5AB

and 6AB (.88 and .82 lbs., respectively). The difference ($P > .05$) between treatments involving straight orchardgrass and straight fescue (Lots 1AB and 4AB, respectively) were not significant. The orchardgrass-Ladino clover lot produced the highest average daily gain for the 154 day summer period. The percentage of Ladino clover in the fescue pastures was considerably lower during the 1957 summer period than during the summer period of 1956 (Table XIII). From previous work and observations at this and other stations it appears that as the per cent of clover decreases the daily gains of steers decreases. The results obtained in this study are in agreement with previous findings and observations.

The grazing days and beef gains per acre were in favor of the fescue pastures, but the variation within treatments was great and differences among treatments were not statistically significant. An abundance of forage was available during most of the summer period which made it necessary to use extra grazing animals. The acreage required per head ranged from 0.89 acre for orchardgrass-Ladino clover plus nitrogen (Lots 2AB) to 0.67 acre for fescue-Ladino clover plus nitrogen (Lots 5AB).

The results for the 1957 winter and summer periods are presented in Table VII. The entire grazing period of 238 days was 26 days longer than the 1956 year. The average daily gains of steers for the year ranged from a low of 1.04 lbs. per head daily for Lots 1AB to a high of 1.27 lbs. for Lots 3AB. The differences among treatments for the gains made during 1957 were not statistically significant.

From the data presented in Table VII it is evident that the cattle were not in very good condition at the end of the summer period. The slaughter condition was actually lower than when they were put on pasture. This can be attributed in part to the cattle since they were approximately 160 lbs. lighter at the beginning of the trials than the cattle in 1956. These cattle were growing and gaining but were not gaining fast enough to improve their condition to a point where they would grade higher.

The orchardgrass and Ladino clover (Lots 3AB) produced cattle that graded significantly ($P < .05$) higher than the cattle grazed on the other lots (Table VIII). The appraised value per hundred weight was \$41.00 more for Lots 3AB than the highest of the other lots. This factor coupled with the low feed cost per head made the returns per head over feed costs much greater for this lot than any of the others. The returns per head ranged from a -\$11.66 (Table VII) for the orchardgrass pasture (Lots 1AB) to a high of \$35.92 for the orchardgrass-Ladino clover pasture (Lots 3AB).

The dry-lot period for 1957 consisting of 122 days is summarized in Table VIII. During the early part of this period serious respiratory infections developed in Lots 5AB and 6AB that resulted in serious weight losses. Due to this situation with Lots 5AB and 6AB no comparison can be made between these two treatments. Only generalizations can be made where Lots 5AB and 6AB are involved. Reasonably good gains were made in Lots 1AB, 2AB, 3AB, and 4AB but there was no statistical difference among lots. It is interesting to note that Lots 3AB graded higher and

TABLE VIII

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Period^a
8-30-57 to 12-30-57 (122 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	4	4	4	4	4	4
Av. wt. and gain/head						
Initial wt. (8-30-57)	706	740	755	749	706	715
Final wt. (12-30-57)	980	1026	1043	1031	965	924
Total gain (122 days)	274	286	288	282	259	209
Daily gain (test steers)	<u>2.25</u>	<u>2.35</u>	<u>2.36</u>	<u>2.31</u>	<u>2.12</u>	<u>1.71</u>
Av. daily ration						
Ground shelled corn	16.1	15.9	16.1	16.2	15.2	13.7
Cottonseed meal	2.0	2.0	2.0	2.0	1.9	1.7
Mixed grass hay	6.6	6.6	6.6	6.7	6.7	6.7
Av. fee/cwt. gain						
Concentrates	806	763	767	788	805	899
Roughage	296	283	283	291	317	393
Av. feed cost/head						
Concentrates	\$57.03	56.42	57.03	57.34	53.89	48.52
Roughage	\$8.05	8.05	8.05	8.17	8.17	8.17

TABLE VIII (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Period^a
8-30-57 to 12-30-57 (122 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Av. animal grades ^b						
Initial slaug. (8-30-57)	4.7	5.5	7.0	6.0	5.7	5.0
Final slaug. (12-30-57)	9.6	10.8	11.6	11.0	10.5	9.1
Fed carcass grade	9.2	9.7	11.0	10.0	8.5	8.5
Returns per test steer						
Initial value/cwt.	\$14.50	14.62	17.00	16.00	15.62	14.87
Final value/cwt.	\$22.50	23.00	24.00	23.00	22.00	22.00
Initial cost/head	\$102.37	108.25	128.35	119.90	110.43	106.57
Final value/head ^c	\$217.81	205.11	245.57	231.72	206.80	198.05
Feed cost/head	\$65.08	64.47	65.08	65.51	62.06	56.69
Total cost/head	\$167.45	172.72	193.43	185.41	172.49	163.26
Returns/head over feed	\$50.36	32.39	52.14	46.31	34.31	34.79

^aNo comparison made involving Lots 5AB and 6AB due to serious respiratory infections that developed at the beginning of the dry lot period.

^bH.U. = 5.0, L. Std. = 6.0, Std. = 7.0, H. Std. = 8.0, L.G. = 9.0, G. = 10.0,
H.G. = 11.0.

^cCalculated from selling weight and not the original weight when animals came off the experiment at Blount Farm.

returned more per head over feed costs than did Lots 1AB, 2AB, 3AB, and 4AB, but there was no statistical difference among lots. The carcass grades for the steers in 1957 were not as high as for the steers in 1956. In 1956 18 of the steers graded choice and 6 graded good. In 1957 only 3 graded choice with 15 grading good and 6 grading standard.

Data summarizing the two year's results are found in Tables IX, X, XI, and XII. It should be emphasized that this summary includes only two year's work and more work is needed before any definite conclusions or recommendations can be made. During the winter grazing period the fescue lots in all cases produced gains that were higher than the gains produced by the orchardgrass lots. In comparing orchardgrass pastures with fescue pastures it was found that the fescue pasture (Lots 4AB) produced average daily gains that were significantly ($P < .05$) higher than the orchardgrass pasture (Lots 1AB). The fescue-Ladino pasture (Lots 6AB) produced gains that were significantly ($P < .05$) higher than the orchardgrass-Ladino clover pasture (Lots 3AB). There was no statistically significant difference between the orchardgrass-Ladino clover plus nitrogen pasture and the fescue-Ladino clover plus nitrogen pasture (Lots 2AB and 5AB).

The total amount of beef produced per acre was in favor of the fescue lots. Lots 4AB and 6AB produced the most beef per acre and this was significantly greater ($P < .05$) as compared to Lots 1AB. There were no differences among the other lots during the winter period. It must be remembered that during both winter periods the cattle were

TABLE IX

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Winter Grazing Periods
1956 and 1957 (70 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	8	8	8	8	8	8
Av. wt. and gain per head, lbs.						
Initial wt.	538	538	539	533	534	532
Final wt.	611	633	620	654	642	651
Total gain	73	95	81	121	108	119
Daily gain(test steers) ^a	1.04	1.35	1.15	1.73	1.54	1.70
Av. daily feed per head, lbs.						
Hay	1.2	1.4	1.1	1.2	1.2	1.1
Productivity of pastures						
Grazing days per acre	47	52	47	74	75	74
Est. beef gain per acre ^b	49	74	58	125	111	128
Acre req./head	1.48	1.37	1.48	.88	.87	.85

^aL.S.D. (5% level) = .40 pound per head daily.

^bL.S.D. (5% level) = 74 pounds per acre.

TABLE X

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summer Grazing Periods
1956 and 1957 (155 days)

Pasture Number and Treatment	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	8	8	8	8	8	8
Av. wt. and gain per head, lbs.						
Initial wt.	611	633	620	654	642	651
Final wt.	780	839	833	812	802	804
Total gain	169	206	213	158	160	153
Daily gain (test steers) ^a	1.09	1.32	1.37	1.02	1.03	.99
Av. pasture cost/head ^b	\$19.74	10.98	—	16.80	8.94	—
Productivity of pastures						
Grazing days/acre ^c	167	168	168	194	209	194
Est. beef gain/acre	215	247	263	221	247	204
Acres req./head	.93	.92	.92	.80	.74	.80

^a L.S.D. (5% level) = .29 pounds per head daily.

^b Includes only the cost of the nitrogen applied.

^c L.S.D. (5% level) = 31 days per acre.

TABLE XI

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
1956 and 1957 (225 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	8	8	8	8	8	8
Av. wt. and gain/head						
Initial wt.	538	538	539	533	534	532
Final wt.	780	839	833	812	802	804
Total gain	242	301	294	279	268	272
Daily gain(test steers)	1.07	1.34	1.31	1.24	1.19	1.21
Av. feed cost/head						
Pasture	\$22.26	12.22	—	17.99	9.62	—
Hay	\$1.03	.97	1.01	1.00	1.03	1.00
Av. animal grades ^a						
Initial feeder	11.7	12.2	12.9	12.0	12.4	12.4
Initial slaughter	6.1	6.3	6.8	6.5	6.4	6.6
Final slaughter	7.3	8.0	8.7	8.0	7.8	7.7
Financial results for test steers						
Initial cost/cwt.	\$20.00	20.00	20.00	20.00	20.00	20.00
Final value/cwt.	\$16.50	16.99	17.75	16.87	17.12	17.18

TABLE XI (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Summary of Winter and Summer Grazing Periods
1956 and 1957 (225 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Financial results for test steers (continued)						
Initial cost/head	\$107.70	107.70	107.80	106.60	106.60	106.50
Final value/head	\$130.18	144.97	148.44	137.60	138.81	140.36
Feed cost/head	\$23.79	13.19	1.01	19.00	10.65	1.00
Total cost/head	\$131.49	120.89	108.81	125.60	117.55	107.50
Returns/head over feed costs	\$-.80	24.18	39.62	12.00	21.26	32.85
Productivity and returns						
Grazing days/acre ^b	214	221	216	268	285	268
Est. beef gain/acre ^c	238	321	321	346	358	332
Acres req./head	1.05	1.02	1.04	.84	.75	.84
Gross returns/acre	\$20.41	36.18	40.64	36.67	38.84	36.85
Cost of N/acre	\$21.00	12.00	—	21.00	12.00	—
Returns/acre over feed costs	\$1.59	23.30	39.62	14.37	25.41	35.47

^aL. Std. = 6.0, Std. = 7.0, H. Std. = 8.0, L.G. = 9.0, G. = 10.0, H.G. = 11.0,
L. Ch. = 12.0, Ch. = 13.0.

^bL.S.D. (5% level) = 36.2 days per acre, L.S.D. (1% level) = 49.7 days per acre.

^cL.S.D. (5% level) = 57 pounds per acre.

TABLE XII

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Periods^a
1956 and 1957 (103 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
No. of test steers	8	8	8	8	8	8
Av. wt. and gain/head						
Initial wt.	780	839	833	812	802	804
Final wt.	1020	1081	1082	1044	1018	1020
Total gain	240	242	249	232	216	216
Daily gain (test steers)	2.33	2.35	2.42	2.25	2.10	2.10
Av. daily ration						
Ground shelled corn	16.0	16.4	16.3	16.6	16.1	15.3
Cottonseed meal	2.1	2.2	2.2	2.2	2.1	2.0
Mixed grass hay	5.9	5.9	5.9	6.0	6.0	6.0
Av. feed/cwt. gain						
Concentrates	772	793	762	839	874	815
Roughage	256	254	247	267	289	298
Av. feed cost/head						
Concentrates	\$48.21	49.33	49.12	49.79	48.07	45.38
Roughage	6.25	6.25	6.25	6.31	6.35	6.35

TABLE XII (continued)

PERFORMANCE OF YEARLING STEERS GRAZING NITRATED AND UNNITRATED
ORCHARDGRASS, FESCUE AND LADINO CLOVER PASTURES

Dry Lot Periods^a
1956 and 1957 (103 days)

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Av. animal grades ^b						
Initial slaughter	7.3	8.0	8.7	8.0	7.8	7.7
Final slaughter	9.8	10.6	11.0	10.7	10.2	9.8
Fed. carcass grade	10.3	10.6	11.5	10.7	10.2	10.2
Returns per test steer						
Initial value/cwt.	\$16.50	16.99	17.75	16.87	17.12	17.18
Final value/cwt.	\$22.12	22.37	22.87	22.37	21.87	21.87
Initial cost/head	\$130.18	144.97	148.44	137.60	138.81	140.35
Final value/head	\$220.91	222.45	240.12	227.54	216.93	218.10
Feed cost/head	\$54.46	55.58	55.37	56.10	54.42	51.73
Total cost/head	\$184.64	200.55	203.81	193.70	193.23	192.08
Returns/head over feed costs	\$36.27	21.90	37.11	33.84	23.70	26.02

^aThe fact that Lots 5AB and 6AB in 1957 were set back by respiratory infections should be considered before making any comparison with other lots.

^b7.0 = Avg. std., 8.0 = high std., low good 9.0, Avg. good 10.0, High good 11.0, Low choice 12.0.

placed on the pastures in January and February. If they had been placed on pastures in November the results might have been different.

The results for the summer grazing periods for both years are summarized in Table X. The average grazing period consisted of 155 days for the two years and the average daily gain per test steer was: orchardgrass plus nitrogen (Lots 1AB), 1.07 lbs.; orchardgrass-Ladino clover plus nitrogen (Lots 2AB), 1.32 lbs.; orchardgrass-Ladino clover (Lots 3AB), 1.37 lbs.; fescue plus nitrogen (Lots 4AB), 1.02 lbs.; fescue-Ladino clover plus nitrogen (Lots 5AB), 1.03 lbs.; and fescue-Ladino clover (Lots 6AB), .99 lbs. It can be noted here that the orchardgrass lots produced a higher average daily gain than did the fescue lots which is the reverse of the winter gains. There were no statistical differences among the fescue lots or among the orchardgrass lots. The daily gain made by steers in Lots 3AB was significantly ($P < .05$) greater than the gain made by steers in Lots 4AB, 5AB, and 6AB. The only other statistically significant difference was between Lots 2AB over Lots 6AB. The low gains for the fescue lots could probably be attributed to the disappearance of a large amount of the Ladino clover in Lots 5AB and 6AB. The daily gains for the summer period in 1956 were higher than for the same period in 1957 which may reflect to some extent the disappearance of the Ladino clover. Table XIII summarizes the percentage of clover and grasses by periods for the two years. The information was obtained by scoring the pastures every two weeks and estimating the percentage of clovers and grasses, and then taking an average of all scorings to get an average for the period.

TABLE XIII

PERCENTAGE COMPOSITION OF THE VARIOUS PASTURES BY PERIODS

1956 - 1957

Pasture Number and Description	1AB O + N	2AB O + L + N	3AB O + L	4AB F + N	5AB F + L + N	6AB F + L
Winter period - 1956:						
Orchardgrass	95.8	67.5	67.2			
Fescue				98.5	67.5	64.0
Ladino clover	2.3	31.5	29.8		29.5	32.0
Weeds	1.9	1.0	3.0	1.5	3.0	4.0
Summer period - 1956:						
Orchardgrass	96.0	59.0	47.0			
Fescue				99.0	60.0	57.0
Ladino clover	2.0	40.0	51.0		37.0	41.0
Weeds	2.0	1.0	2.0	1.0	2.0	2.0
Winter period - 1957:						
Orchardgrass	95.0	63.0	65.1			
Fescue				99.7	77.5	77.0
Ladino clover	2.0	35.0	31.9		22.0	23.0
Weeds	3.0	2.0	3.0	.3	.5	
Summer period - 1957:						
Orchardgrass	96.0	72.0	50.2			
Fescue				99.0	90.0	91.0
Ladino clover	1.7	27.4	45.6		9.0	8.0
Weeds	2.3	.6	4.2	1.0	1.0	1.0

The total grazing days for the summer period was in favor of the fescue lots, with Lots 5AB producing the highest of 209 days. This was significantly ($P < .05$) greater than that produced by Lots 1AB, 2AB, and 3AB. Even though Lots 5AB produced the most grazing days per acre it did not produce the greatest amount of beef per acre. Orchardgrass-Ladino produced the most pounds of beef per acre (263 lbs.) but there were no significant difference among any of the pasture. The lowest acreage of pasture required per head was 0.74 acre for the fescue - Ladino plus nitrogen pasture (Lots 5AB) which was 0.19 acre less than the highest requirement of .93 acre per head for Lots 1AB.

The data for the winter and summer grazing periods of 1956 and 1957 are summarized in Table XI. The average length of the grazing season for both years was 225 days. The average daily gains ranged from 1.07 lbs. for the orchardgrass pasture (Lots 1AB) to 1.34 lbs. for the orchardgrass-Ladino clover plus nitrogen pasture (Lots 2AB), but the differences in daily gains among treatments were not statistically significant.

The average number of grazing days per acre produced by the various pastures over the two year period ranged from 285 days for Lots 5AB to 214 days for Lots 1AB. All of the fescue pastures produced significantly ($P < .05$) more grazing days than did the orchardgrass pastures. The total beef produced was in favor of the cattle on fescue pastures, but only the cattle in Lots 5AB produced significantly more beef as compared to the cattle grazing the

orchardgrass pastures. The orchardgrass pasture (Lots 1AB) produced the least pounds of beef over the 2 year period. All other pasture groups produced gains that were similar and all produced significantly ($P < .05$) more beef than the orchardgrass plus nitrogen pasture group (Lots 1AB).

The cattle grazing orchardgrass-Ladino clover pasture (Lots 3AB) returned the most profit over feed cost, with the fescue-Ladino clover pasture cattle (Lots 6AB) being second. The application of the nitrogen over the two year period did not produce more gains and as a result less profit was received from the cattle grazing pastures receiving nitrogen than those grazing pastures that did not receive nitrogen. Not only was less profit realized from the cattle where nitrogen was applied, but the results of this study as shown (Table XIII) show that there was less clover present in the orchardgrass pastures that received nitrogen (Lots 2AB) than in the orchardgrass pasture that did not receive nitrogen (Lots 3AB). From other studies as well as this study, there is an indication that nitrogen will drive out the clover. In the fescue pastures, however; a much more competitive condition existed and both the nitrated and the non-nitrated had very little at the end of the second year.

The performance of the cattle in the dry-lot period for the two years did not reveal a uniform relationship between the performance of cattle on pasture and their subsequent gains on dry-lot. A summary of the data for the two years is shown in Table XII, but it must be remembered that serious respiratory infections developed in Lots 5AB and

6AB the second year. This in all probability accounts for part of the lower average daily gain made by these lots. Over the two year period slightly more feed per hundred weight gain was required by the steers that were grazed on the fescue pastures (Lots 4AB, 5AB, and 6AB), but differences were not statistically significant. In general the average carcass grades of the cattle for the two years varied only slightly with Lots 3AB averaging about one-third of a grade higher. The returns per head ranged from \$37.11 for Lots 3AB to \$21.90 for Lots 2AB, but the returns in dry-lot did not follow the same pattern as they did for the pasture period.

TABLE XIV

FEED AND FERTILIZER PRICES

	Ammonium Nitrate	Ground Shelled Corn	Cottonseed Meal	Grass Hay
Cost per ton	\$80.00	\$50.00	\$65.00	\$20.00
Cost of applying fertilizer	\$1.00 per acre			
Cost of clipping pastures	\$1.00 per acre			

CHAPTER V

SUMMARY

This investigation was undertaken with 6 pasture treatments in duplicate to evaluate orchardgrass and tall fescue pastures alone and in combination with Ladino clover under varying rates of nitrogen fertilization as reflected in beef cattle gains and forage production. The following pasture combinations were used, orchardgrass plus nitrogen, orchardgrass-Ladino clover plus nitrogen, orchardgrass-Ladino clover, fescue plus nitrogen, fescue-Ladino clover plus nitrogen and fescue-Ladino clover. Steer calves were used to graze these pastures starting in the fall and continuing to approximately September 1. Then they were full-fed in dry-lot for 60 to 122 days. During the winter grazing period, cattle grazing the fescue pastures made significantly higher average daily gains as compared to cattle grazing orchardgrass pastures. Fescue pastures produced significantly ($P < .05$) more pounds of beef per acre than did the orchardgrass pastures for the same period. The orchardgrass plus nitrogen pasture produced the least pounds of beef per acre, (49 lbs.) as compared with 128 lbs. produced by the fescue-Ladino clover pasture.

For the winter period the fescue pastures provided more grazing days per acre than did the orchardgrass pastures; however, none of the differences were statistically significant.

During the summer grazing period, the cattle grazing orchardgrass - Ladino clover plus nitrogen and orchardgrass - Ladino clover produced gains that were significantly greater than any of the other pasture groups. There were no differences among the average daily gains of steers on the remaining pasture groups.

For the summer period the orchardgrass pastures produced more total beef gains per acre when compared with the gains produced by the fescue pastures. The differences in total gains however, were not statistically significant.

No differences were found in the total number of grazing days produced among the fescue pastures or the orchardgrass pastures. However, the fescue - Ladino plus nitrogen pastures produced significantly more grazing days than any of the orchardgrass pastures. The average pasture cost per head was greatest for the steers on the straight orchardgrass and straight fescue pastures due to the additional cost of the nitrogen which was applied to these pastures.

For the combined winter and summer periods for 1956 and 1957, there were no significant differences among the average daily gains of steers on the various pastures. The straight orchardgrass pasture produced only 238 lbs. of beef per acre which was significantly lower than that produced by any other pasture group.

The fescue pastures produced a significantly greater number of total grazing days per acre than did the orchardgrass pastures (winter and summer grazing periods). However, the differences in total grazing days per acre among the orchardgrass pastures or among the fescue pastures were not statistically significant.

The highest returns per acre over feed costs were obtained from steers grazing the orchardgrass - Ladino clover pasture and the second highest returns were obtained from steers on the fescue - Ladino clover pasture. Steers grazing straight fescue returned more per head over feed costs as compared with straight orchardgrass. Over the two year period the application of nitrogen did not produce enough greater gains to pay for the cost of the nitrogen and as a result less profit was realized from the pastures receiving nitrogen.

The cattle grazing the pastures containing the most Ladino clover graded higher than those grazing the pastures containing little or no Ladino clover.

During the two year period, there was a definite decrease in the percentage of clover remaining in the orchardgrass pasture which had received nitrogen as compared with the orchardgrass - Ladino clover pasture which had not received nitrogen applications. The Ladino clover in the fescue pastures showed a definite decrease during the two year period; however, there was no difference between the nitrated and non-nitrated fescue pastures. There was an indication that as the percentage of clover in the pastures decreased, the rate of gain of the steers grazing those pastures decreased.

During the dry-lot period, there were no significant differences among the average daily gains and in general no relationship was observed between the gains made on pasture and the gains made in dry-lot. However, the steers on the orchardgrass - Ladino clover pastures which

had the highest daily gains on pasture and graded higher at the end of the pasture period returned the most profit per head over feed costs for the two year period.

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