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I. Wintering Calves in the Barn vs. Outside

II. Summer Grazing on Nitrated and Irrigated Pastures

III. Finishing After the Grazing Period

by

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AGRICULTURAL EXPERIMENT STATION
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CONTENTS

Production Of Slaughter Yearlings

by

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Introduction

Bluegrass was brought to American shores by the early colonists. It spread as the emigrants moved westward. It was observed growing luxuriously around the campsites on the trails into Pennsylvania, Virginia, Tennessee, Kentucky, Ohio, and other states. In Kentucky on the mineral-rich soils, it found conditions so favorable for a spectacular growth it was given the name of Kentucky bluegrass. It spread spontaneously, assisted some by the hand of men, deer, buffalo, cattle, and horses, until it became the backbone of pastures in most of the areas settled by the white men by 1800 and later. Many fine cattle, horses, and sheep have been produced largely on bluegrass over the years. It has many good qualities, also some weaknesses.

It has been estimated that there are 50 to 100 million acres of bluegrass pastures in the United States and 1.5 million acres in Tennessee. Some of the grass is on good land and well managed, but a considerable acreage has had little or no attention and is low in production.

Since bluegrass is fairly well adapted to many areas of Tennessee and a great area of the state's permanent pasture is now in bluegrass, it seemed advisable to study the place of bluegrass and its productiveness under different systems of management and fertilization.

Since it is desirable and also a common practice to buy cattle the previous fall which are to be used for grazing experiments, and since there are many unsolved problems in connection with wintering calves, a project was planned for the winter as well as the summer grazing period.

The following project was undertaken at the Tobacco Experiment Station at Greeneville:

I. Wintering Phase for Weanling Beef Calves

Treatment 1. In a well-ventilated barn on hay fed ad libitum.

Treatment 2. In an outside lot on hay (same as in treatment 1).

Treatment 3. On a mixed orchardgrass-bluegrass pasture with hay fed ad libitum.

II. Summer Grazing Phase on Bluegrass-Clover Pasture

Treatment 1. Bluegrass-hop and white clover pasture.

Treatment 2. Same as treatment 1 plus periodic applications of ammonium nitrate.

Treatment 3. Same as treatment 2 plus irrigation when necessary.

III. Dry Lot Fattening Phase

(All treatments as used on pasture trials fed same ration)

Analysis of variance techniques and the multiple range test were used in the statistical analyses of the data.

I. Wintering Calves in the Barn vs. Outside

PROCEDURE

A well-ventilated, roomy pen with water was provided for steers on treatment 1. Steers on treatment 2 were wintered in a well-drained outside lot in which there was some protection from wind. A gently rolling bluegrass-orchardgrass permanent pasture, in which there was considerable protection provided by the hills and trees, was used for steers on treatment 3. About 1 acre of pasture was provided per calf. Some surplus growth of pasture had accumulated at the time the calves were placed on the pastures for wintering. Hay and concentrates were fed in covered racks as was done in treatment 2.

One hundred and forty-four good to choice Hereford and Angus weanling steer calves from the Greeneville and Crossville cow herds and the East Tennessee feeder calf sales were used during the 4-year study. In each case weight, grade, breeding, and origin were considered in allocating the calves to the various winter treatments.

At the end of the wintering test, the calves were used in the summer pasture experiment. The calves were re-allotted as uni-

formly as possible, based on winter treatment, gain, weight, and grade. When pastures became short, or about September 30, the cattle from all treatments were removed from pasture and full-fed in the barn for about 70 days. The cattle were weighed every 28 days, graded, and appraised at the beginning and end of the winter, summer, and dry lot periods. A complete feed record, other than pasture, was also kept. Using the above method of allotting the calves, it was possible to study the effects of winter treatment on subsequent summer grazing and during the dry-lot periods.

RESULTS AND DISCUSSION

The major results are shown in tables 1 and 2. It should be noted that steers on treatments 1 and 3 made the same winter gain of 81 pounds per head which is considered fairly satisfactory for calves which are to be grazed the following summer. Steers on treatment 2, wintered outside in the rain and mud, gained 26 pounds less ($P<.05$) on the same amount and kind of feed as was fed to steers on treatment 1. The results in table 2 show that the gains of steers on treatments 1 and 3 were very consistent by years and higher than gains by steers on treatment 2.

The condition and individuality of the calves and weather conditions were no doubt partly responsible for differences in gains by years, but the quality of hay and amount of concentrates fed were also important. The gains were uniformly low on the low-grade hay fed the second year but were better on the good grade of hay fed the first year. A small amount of cottonseed meal or a mixture of cottonseed meal and corn and cob meal with varying grades of hays increased winter gains the third and fourth years.

The bluegrass-orchardgrass pasture, even though short, apparently supplied about 40% of the hay requirements for the winter ration in treatment 3 as compared to treatment 1. If the feed requirements were higher for calves wintered on the outside as compared to those in the barn, then the pasture supplied a higher percentage of the hay requirements.

The amount of manure recovered per head varied from over 2 tons in treatment 1 to about ¼-ton in treatment 3 (Table 1).

Influence of Winter Treatment on Subsequent Gains and Returns. The average gains for the steers on the various treatments, made on pasture and in the feed lot following the winter period, are shown in Table 2. Steers on treatments 1 and 3 both gained about the same as steers on treatment 2 during the winter feeding

period, and the small differences were not statistically significant. However, over the entire year, steers on treatment 2 gained about 20 pounds less than steers on treatments 1 and 3.

In addition to rates of gains, feed requirements and costs, financial statements are shown in tables 1 and 2. It will be noted that steers on all three winter treatments showed a decided loss for the winter period; the loss for treatment 2 was $5.47 more than for treatment 1 and $10.48 more than for treatment 3. This work was done during a series of years when the market was declining. The calves cost $35 per hundredweight the fall of 1951 and by the fall of 1954 they were down to $18.50. Each year market price of the cattle per hundredweight was lower on April 1 than on September 1. Ordinarily, stocker cattle will advance some from fall to spring and some profit over feed is obtained for wintering, but that was not the case in this work.

In evaluating the pastures, the slaughter grade and slaughter appraisals at the end of the summer grazing period were used. Stocker values were used at the beginning of the grazing period. Each year the cattle were worth less per hundredweight at the end than at the beginning of the grazing period. In the second year (1953) there was even a small minus return on the pasture. Some profits were made the other 3 years, and over the 4-year period, the returns during the summer grazing period averaged from $12 to $18 per head which would leave little if any net return on the pasture.

Returns for the dry lot period were more encouraging. Full-feeding on corn and legume hay raised the slaughter grade and price to the extent that gross returns over feed costs of from $14 to $19 per head were obtained.

In evaluating or applying this work, emphasis should be given to winter gains, winter rations, and the overall performance of the calves under the three methods of wintering. Such information could be used to calculate the financial returns under several price levels. For example in Table 1, the cost was about 38 cents per pound to place about 82 pounds additional weight on 520-pound calves wintered in the barn (treatment 1). Since these calves initially cost $124.34 each and used $31.44 worth of feed, the seller would have to obtain 25.9 cents per pound to cover the initial cost plus feed during the wintering period. A person planning on wintering these steers would have to receive 1.9 cents per pound more for the animals at selling time than he paid for them in order to break even on his initial cost plus feed fed.

Table 1. Results for Wintering Period.
A 4-year weighted average for 1951-1952, 1952-1953, 1953-1954 and 1954-1955

Item	Treatments 1 Wintered in barn	2 Wintered outside lot	3 Wintered on permanent pasture
Av. number steer calves per year	12.2	12	12
Av. weight per calf			
Initial weight (Dec. 7, av. date)	520.1	522.5	520.3
Final weight (April 12, av. date)	602.0	577.5	601.2
Gain—126 days	81.9	55.0	80.9
Daily gain*	.64	.43	.63
Av. daily ration, lb.			
Mixed hay (a)	11.87	12.06	7.09
Grain mixture (a), (b)	.78	.80	.78
Pasture (a)	none	none	*ad libitum*
Amount of manure recovered per head, lb.	4498	1292	553
Av. feed cost per head	$ 31.44	$ 31.99	$ 29.77
Av. feed cost per 100 lb. gain	$ 38.33	$ 58.27	$ 36.83
Grades and appraisals			
Av. initial feeder grade Dec. 7	LCh—	HG+	LCh—
Av. appr. value per cwt., Dec. 7 as stockers	$ 23.97	$ 23.73	$ 23.79
Av. appr. value per cwt., Apr. 12 as stockers	$ 21.97	$ 22.00	$ 22.47
Financial statement			
Av. initial cost per head, Dec. 7	$124.34	$124.01	$123.82
Av. appr. value head at end of winter period, Apr. 12	$132.32	$127.07	$135.14
Av. returns per head over feed and initial cost	—$ 23.46	—$ 28.93	—$ 18.45

* Rate of gain of steers in Lot 2 is significantly lower than that of steers in Lot 1 and Lot 3. ($P < .05$).

(a) Hay was charged at an average value of about $36.80 and the grain mixture fed the last 2 years, composed of CSM and corn and cob meal @ 73.80 per ton. Pasture charged @ 7½¢ per day (CSM = cottonseed meal).

(b) No concentrates fed first 2 years; 1 lb. CSM fed third year; 1¼ lb. CSM and 1¼ lb. CCSM the fourth year.

The important factor to a farmer considering such an operation is the margin needed between beginning and selling price in order to cover his feed costs. Of course, the farmer would also be interested in the margin needed to cover other items, such as labor, buildings, etc. Also, the manure accumulated from the steers kept in the barn would have some value. However, this experiment was not set up to evaluate these items. Similar computations can be made for other treatments and at different prices of feed and animals.

Table 2. Performance of Cattle Summary.

	Treatments		
	1	2	3
	Wintered in barn	Wintered in outside lot	Wintered on permanent pasture
Winter gains by years—pounds			
Average first year, 127 days (a)	113.0	95.0	114.0
Average second year, 133 days (b)	35.9	19.8	39.0
Average third year, 133 days (c)	73.7	37.8	76.1
Average fourth year, 111 days (d)	129.4	88.6	116.1
Winter and subsequent gains by periods—weighted 4-year average—pounds			
Av. winter gain, 126 days, head	81.9	55.0	80.9
Av. pasture gain, 168 days, head	212.7	228.5	232.0
Av. dry-lot gain, 70 days, head	186.0	177.7	166.0
Total pasture and dry-lot	398.7	406.2	398.0
Total all periods, 364 days	480.6	461.2	478.9
Winter and subsequent returns by periods—weighted 4-year average			
Av. returns over feed for winter, head	—$23.46	—$28.93	—$18.45
Av. gross returns on pasture, head	$11.94	$16.59	$18.20
Av. returns over feed for dry-lot	$19.63	$16.20	$14.62
Total pasture and dry-lot, head	$31.57	$32.79	$32.82
Total all periods, head	$ 8.11	$ 3.86	$14.37

(a) Fed good grade mixed hay
(b) Fed low grade mixed hay
(c) Fed low grade mixed hay and 1 lb. cottonseed meal
(d) Fed medium grade mixed hay, 1¼ lb. cottonseed meal and 1¼ lb. corn cob and shuck meal.

II. Summer Grazing on Nitrated and Irrigated Pastures

PROCEDURE

The Land. Two different land areas were used for this project. One was mostly hill land with a small amount of creek bottom; the other was all creek bottom. Both areas had been in sod consisting mostly of bluegrass, hop and white clover for about 15 years. The hill pasture was on Decatur soil which had suffered severe erosion before pasture was established. By terracing, use of barnyard manure, litter, lime, and mineral fertilizer, a fairly good sod had been established before this grazing test was started. The creek bottom land was shallow to rock in several spots and had some outcropping limestone rock as was also true in the hill land. Neither of these pasture areas was considered suitable as crop land. They were representative of large areas in East Tennessee which should not be plowed or row-cropped.

Experimental Design.

Treatment 1. Bluegrass-hop and white clover—three replications of 3 acres each.

Treatment 2. Same as 1 plus three to four applications of 100 pounds of ammonium nitrate applied at 60-day intervals—three replications of 2½ acres each.

Treatment 3. Same as 2 plus irrigation when necessary—three replications of 2 acres each.

Each treatment had one replication on the hill land and two on the bottom land. Each plot had access to the creek for water for the cattle. Barbed wire fences, some of which were electrified, were used.

Fertilization. Liberal amounts of barnyard manure, lime, and mineral fertilizers had been applied before this experiment was begun and sods were considered to be above average for East Tennessee. Soil tests at the beginning of the experiment showed that the pH and K levels were satisfactory but that some phosphate was required. Table 3 shows the fertilization for the 4 years. Ammonium nitrate was applied at rates of 400 to 450 pounds per acre per year. Four applications at 60-day intervals were made in 1952 and 1953 during March, May, July, and September. During 1954 and 1955 the September applications were omitted since the pastures were not grazed much after the middle of September. The fertilizers were charged at market prices and $1 per acre was charged for labor and machinery for each distribution.

Rainfall and Irrigation. Table 4 shows that the rainfall during the grazing period was 4.0, 5.8, 3.4, and 8.2 inches below normal for the respective years. An average of 8.6 inches of irrigation water was applied per acre per year during the 4-year period, which was 3.2 inches more than the deficit of rainfall (Table 4). Water was to be applied when the moisture fell below 10% in the top 6 inches of soil. Oven-dried soil samples were used to determine moisture contents.

Cattle. The steer calves used for the wintering experiment were used for these summer grazing studies. They were weighed every 28 days.

Grazing Management. The "Put and Take" method was used in regulating the stocking rate for each pasture. Three "test" steers were assigned permanently to each pasture plot and "extra" steers added or taken off in order to graze all pastures similarly. Each

pasture was scored according to the Tennessee Pasture Score Card (shown in Fig. 1) every 2 weeks.

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Pasture Report

Station Greeneville Project Pasture Date of Period June 2 to 16

Lot No. 3A	Sub Period 1		Sub Period 2	
	Date No. Days		Date No. Days	
	No.	Animal Days on Pasture	No.	Animal Days on Pasture
Regular Animals	3	14		
Extra Animals	1	14		

SPECIES IN PASTURE

Common Name	% Stand	Height Range	Height Av.	Stage of Growth
Bluegrass	70	2" to 12"	3"	Young - Pre-bloom - Bloom - (Seed) - Dormant
White clover	15	2 to 8	2½	Young - Pre-bloom - (Bloom) - Seed - Dormant
Hop clover	2	2 to 8	3	Young - Pre-bloom - Bloom - Seed - (Dormant)
Weeds	3	to		Young - Pre-bloom - Bloom - Seed - Dormant
Dallisgrass	10	2 to 6	3	(Young) - Pre-bloom - Bloom - Seed - Dormant
		to		Young - Pre-bloom - Bloom - Seed - Dormant

GERNERAL CONSIDERATIONS

1. Condition of Pasture: Washy - (Succulent) - Dry - Tough - Dead
2. Color: (Very Green) - Green - Drab - Brown
3. Carrying Capacity: Excess - (Sufficient) - Short - Insufficient
4. Thickness of Sod: (Very Dense) - Dense - Moderate - Thin
5. Footing: (Firm) - Soft - Very Soft
6. Grade: Excellent - (Very Good) - Good - Fair - Poor - Very Poor

WEATHER AND MOISTURE CONDITIONS

Date	Temperature Max.	Temperature Min.	Snow Inches	Rain Inches	Soil Moisture	Water Added
June 2	81°	42°				
3	83	44				
4	85	51				
5	86	54				
6	86	59				
7	77	60		.26"		
8	62	50		.21		
9	72	50				
10	74	57				
11	78	56		.13		
12	71	50		.01		
13	73	56				
14	71	51				
15	78	45				1.5

Form No. AH-5 558

Figure 1. The Tennessee Pasture Score Card used in scoring the pasture plots every 2 weeks.

Table 3. Fertilizer Application by Years.

Fertilizer and year used	Bluegrass-hop and white clover	Same as I + N	Same as I + N + irrigation
48% phosphate			
1952 lb. per acre	300	300	300
1955 lb. per acre	24	47	36
60% potash			
1955 lb. per acre	78	57	83
33% ammonium nitrate (a)			
1952 lb. per acre		450	450
1953 lb. per acre		415	415
1954 lb. per acre		300	300
1955 lb. per acre		300	300

In most cases, two men went over each pasture and recorded their findings on the score card. An attempt was made to regulate grazing to keep the quantity and quality of the pasture continuously as optimal as possible so that the animals could make reasonably good gains throughout the pasture season. Adjustments, if required, were generally made on the days the pastures were scored or the cattle weighed. However, due to error in judgment or change of weather, adjustments were made at other times. Information on the score card—such as stage of growth, height, carrying capacity, and grade—was used in determining whether to hold, add, or take off animals. A record was also kept on the score card (Fig. 1) of the grazing days for each period. The calculated beef gain was secured by mutiplying the grazing days of all steers (extra and test) by the daily gain of the three test steers.

Table 4. Actual and Normal Rainfall and Irrigation by Years.
(For grazing period only)

Year	Actual Rainfall	Normal Rainfall	Irrigation (inches)
1952	18.3	22.3	9.0
1953	16.0	21.8	7.5
1954	16.3	19.7	7.5
1955	11.9	20.1	10.5
Total	62.5	83.9	34.5
Average	15.6	21.0	8.6

CATTLE GAINS

Table 5 summarizes the more important results of the summer grazing period. Daily gains of the cattle in treatments 1 and 2 were 1.32 pounds while those in treatment 3 gained 1.44 pounds. However, this difference in rate of gain was not statistically significant. These results indicate that adding nitrogen as in treatment 2 did not improve the quality of the bluegrass pasture, and that nitrogen

Table 5. Summary of Summer Grazing Phase.
A weighted average for years '52, '53, '54 and '55

Item	Bluegrass-clover	Treatments Same as I + N	Same as I + N + irrigation
General Information			
Number replications	3	3	3
Number acres per replication	3	2.5	2
Number test steers per replication	3	3	3
Av. length of grazing periods	165	168.2	168.2
Av. weight and gain per head, lb.			
Initial wt. (Apr. 15, av. date)	607	611.5	601.9
Final wt. (Sept. 30, av. date)	824	832.6	844.5
Gain	217	221.1	242.6
Daily gain test steers[a]	1.32	1.32	1.44
Average grades			
Feeder grade Apr. 15	HG+	HG—	HG+
Slaughter grade Sept. 30	Com.	Com.	HCom.
Average appraisals			
Feeder value, cwt., Apr. 15	$22.97	$22.61	$23.10
Feeder value, head, Apr. 15	$139.46	$138.26	$139.10
Slaughter value, cwt., Sept. 30	$18.21	$18.29	$18.97
Slaughter value, head, Sept. 30	$150.11	$152.31	$160.25
Financial returns and productivity of pasture			
Gross returns per head from pasture, head (test steers)	$10.65	$14.05	$21.15
Grazing days secured per acre (all steers)[b]	142.5	188.1	298.6
Calculated beef gain per acre, lb.[c]	201.2	268.3	424.1
Acres pasture required per head	1.161	.893	.566
Gross returns from pasture per acre	$9.16	$15.73	$37.37
Annual charge for fertilizer and irrigation per acre	$3.90	$20.96	$55.36
Returns from pasture over fert. + irrig. costs per acre	$5.26	—$5.23	—$17.99

[a] Differences in rates of gain are not statistically significant.
[b] Differences between treatments 1 and 3 and 2 and 3 are statistically highly significant ($P < .01$); difference between treatments 1 and 2 is statistically significant ($P < .05$).
[c] Differences between all treatment comparisons are statistically highly significant $P < .01$).

combined with irrigation as in treatment 3 produced pasture on which the cattle gained only slightly more than those on the untreated pasture.

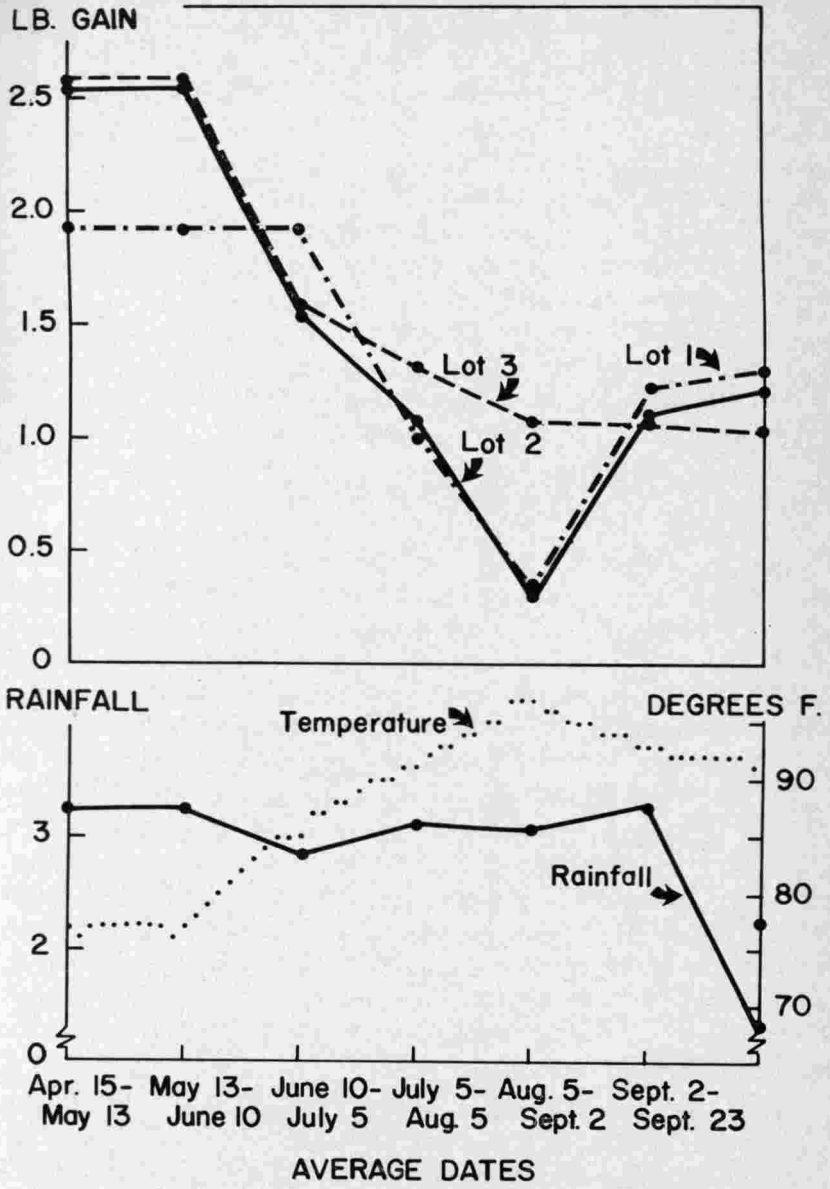

Figure 2. Average daily gains, rainfall, and maximum daily temperatures by periods.

Figure 2 shows the 4-year average daily gains by periods and the relation of gains to rainfall and temperature. Applying nitrogen, as in treatments 2 and 3, produced earlier and better pasture during the first period which increased the gains during the first period over those in treatment 1. The nitrogen applications made in May and July did not seem to affect the daily gains. The curves show that the gains follow the usual trends—that is, high gains during the early part of the grazing season gradually decline to August.

The gains also correspond in general to the seasonal growth and quality of bluegrass which may be another reason, in addition to temperature, why gains declined during July and August. There were spotty periods of drought and low humidity, but they were generally followed by heavy rains. The curve on rainfall shows no apparent shortage of rainfall during July and August when gains were low; however, moisture was a factor during this period because irrigation prevented the severe drop in daily gains during July and August.

ACRE GRAZING DAYS AND BEEF GAINS

Daily gains indicate the quality of pasture, provided there is enough forage for the cattle to eat. Grazing days should be a fair measure of the amount of pasture produced for consumption, but care should be used in evaluating acre grazing days. In attempting to appraise different pasture treatments, extra cattle were added when there was an excess feed supply available in order to utilize the pasture growth, and in so doing, the number of grazing days was increased. Sometimes this resulted in a lot of grazing days with very little beef gain because the pasture, though sufficient in supply, was so low in quality and palatability that the cattle made very poor or no gains.

"Beef gain," therefore, is a more reliable measure than grazing days. It is a combined expression of the quality of the pasture, or daily gain, and carrying capacity. Mistakes in stocking pastures may produce high, moderate, or low daily gains. However, fairly accurate results are attained by using beef gains because the daily gains and grazing days compensate for each other.

Added nitrogen produced more pasture and produced it earlier, and therefore produced more grazing days and beef ($P<.05$). Grazing days and beef yields were highest in the early spring. Nitration plus irrigation, as in treatment 3, increased the grazing days 59% ($P<.01$) and the beef yields 58% ($P<.01$) over those in treatment 2.

Irrigation increased the percent of clovers and also seemed to produce a stronger root system in the grass which enabled this pasture to make a strong, quick growth in the spring after the winter dormant period. The pastures in treatments 2 and 3 were nitrated alike in the spring and there was little irrigation until late May or June. Yet the irrigated pastures or treatment 3 graded higher and produced more feed and beef than those in treatment 2 during the first part of the grazing season and before there could have been benefits from irrigation.

Since it was possible to control the moisture in treatment 3 and not necessary to carry a surplus of grass in anticipation of drought or slow growth of the pastures, these pastures were grazed closer and more completely than those in the other treatments. This practice, aside from other conditions, therefore resulted in more grazing days and beef gains per acre for this treatment.

The beef gains per acre for the 168-day grazing period for the three treatments were 201.2, 268.3, and 424.1 pounds respectively. The carrying capacity of the pastures (acres required per animal) was 1.16 acres in treatment 1 as compared to .89 and .57 acres in treatments 2 and 3, respectively.

CHANGES IN PASTURE COMPOSITION

Table 6 and Figure 3 show detailed information on composition of the pastures under the three treatments. This information was obtained from the pasture scores which were made every 2 weeks during the 4 years for each replication—a total of 423 scorings. Some very definite observations were made regarding the composition and changes due to the application of nitrogen and irrigation:

1. None of the pastures had sufficient clover the first year; furthermore, none of them reached a sufficiently high percentage of clover during the 4 years for a top-producing pasture—the highest average being 22.8%. In later years these pastures had 30% clover and produced more satisfactory results.
2. Nitration stimulated the growth of grass and depressed the growth of clover. The pastures in treatment 2 contained 7.3% clover at the beginning and only 1.8% the last year, while the unnitrated pastures started with 6.7% clover and increased to 15% the last year.
3. Nitration did produce earlier and more luxuriant pasture for the first 28-day period of the season.
4. Nitration and irrigation combined did not depress the clover. This combination increased the percentage of clover from

11.7% to 18.1% during the 4 years, vs. 6.7% to 15.0% for the unnitrated-unirrigated treatment, or about the same percentage increase. However, white clover was increased from 9.6%

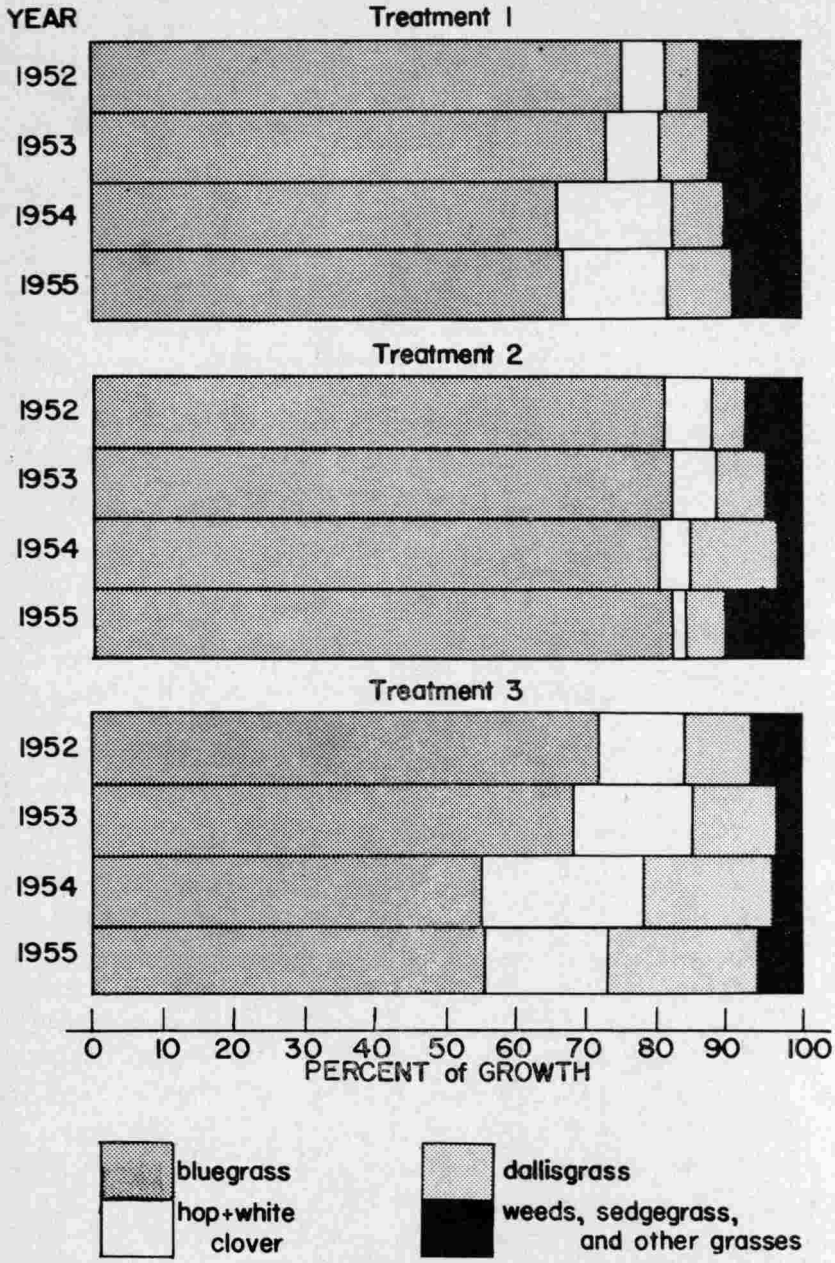

Figure 3. Composition of pastures.

to 15.9% in the combination, from 4.6% to 9.0% in the unnitrated-unirrigated treatment, and decreased from 5.0% to 1% in the nitrated pasture.

5. Nitration and irrigation approximately doubled the percentage of dallisgrass—a vigorous, palatable, hot-weather grass which fits in well with bluegrass. At times it made up 50% of the forage and was a factor in increasing grazing days and beef yields in this treatment.
6. The fertility level, particularly nitrogen, and the management followed were effective in practically eliminating sedgegrass but not foxtail.

Table 6. Composition of Pastures, Greeneville. A Four-Year Average for 1952, 1953, 1954, and 1955 (An Average for Entire Grazing Period of 12 to 13 Bi-Weekly Pasture Scorings)

Treatment 1. Bluegrass, hop and white clover						
	White	Hop	Blue	Dallis	Sedge	Other grass & weeds[a]
			Percent of stand			
1952	4.6	2.1	75.0	4.7	8.9	4.7
1953	3.3	4.6	72.8	7.1	6.0	6.2
1954	4.0	12.4	65.9	7.0	2.5	8.2
1955	9.0	6.0	66.1	9.3	.6	9.0
Av.	5.2	6.3	70.0	7.0	4.5	7.0
Treatment 2. Same as 1 + Nitrogen every 60 days						
	White	Hop	Blue	Dallis	Sedge	Other grass & weeds
			Percent of stand			
1952	5.0	2.3	80.4	4.9	4.1	3.3
1953	2.3	3.7	81.9	7.8	.2	4.1
1954	3.4	2.2	84.1	7.1	.1	3.1
1955	1.0	.8	81.6	6.0	—	10.6
Av.	2.9	2.2	82.0	6.4	1.1	5.3
Treatment 3. Same as 2 + irrigation						
	White	Hop	Blue	Dallis	Sedge	Other grass & weeds
			Percent of stand			
1952	9.6	2.1	71.7	10.2	6.4	—
1953	15.7	1.6	67.6	11.6	—	3.5
1954	20.9	1.9	54.8	18.4	—	4.0
1955[b]	17.4	.7	54.8	21.1[b]	—	6.0
Av.	15.9	1.6	62.2	15.3	1.6	3.4

[a] Orchardgrass, bermudagrass, crabgrass, foxtail, nettles, buttercup, dandelion, and onions.

[b] Dallis and foxtail somewhat similar in early stages, more grass was listed as foxtail in 1955. These grasses increased materially under irrigation.

FINANCIAL INTERPRETATIONS

An attempt is made in this work to report the performance of the various pastures, and in addition the cost of the various pasture treatments, appraised values of the cattle, and the net returns per acre from yearling steers. This is so that farmers and stockmen may have a clearer picture of the possibilities of bluegrass pastures, under different systems of management, as a land use program.

Cattle which are to be grazed are usually obtained in the fall and wintered for economical and efficient gains on grass, so the plan of management in this project followed closely that used by many cattlemen. Profit from grazing steers depends upon cost of forage production, the level of cattle prices, and whether the trend of prices is up or down. In interpreting these results three price levels or trends are used:

1. Based on the actual appraised prices secured during the years '52, '53, '54, and '55.
2. Based on stockers costing $20 in the spring and being worth $19, $19, and $19.50 for the respective lots at the end of the grazing season.
3. Based on stockers costing $25 in the spring and being worth $24, $24, and $24.50 for the respective treatments at the end of the grazing season. Since the cattle in treatment 3 gained a little more, graded somewhat higher, and were appraised higher 3 of the 4 years, a difference of 50 cents in margin is used for this treatment. The same gains, acre costs and requirements, as found in these trials, were used for each interpretation (see Table 7).

Gross acre pasture returns are in favor of nitration and nitration plus irrigation in each of the three interpretations. However, the annual cost of fertilizer and irrigation found were $3.90, $20.96, and $55.36 per acre for the three respective treatments (Table 8). Thus the 120 pounds of actual nitrogen, a very liberal application, with machinery and labor costs for application boosted the acre cost $17.06 over those for no nitrogen (treatment 2 over 1). Irrigation, in addition to nitrogen, where 8.6 inches at $4 per acre inch were applied, raised the cost of treatment 3 $51.46 per acre over the cost for treatment 1.

Using price levels 1, 2, and 3 as described above, the following conclusions result:

1. Nitrogen (treatment 2) did not show any net return over no nitrogen (treatment 1) at any price level. Any increase in

returns of this treatment due to performance of the cattle or acre requirements was more than absorbed by the cost of the nitrogen.

2. Nitrogen plus irrigation (treatment 3) at price levels 1 and 2 showed less favorable returns than those received in treatment 1. However, at price level 3, nitrogen plus irrigation (treatment 3) showed more favorable returns than treatments 1 and 2. Incidentally, this price level of cattle has not prevailed during recent years. When grazing beef cattle, nitration and irrigation of bluegrass pastures, as in this experiment, should be undertaken with caution, unless a very favorable situation for high returns exists.

Table 7. Acre Pasture Returns Based on Three Different Price Levels.

	Treatments		
	1	2	3
	Bluegrass-clover	Same as 1 + N	Same as 1 + N + irrigation
Interpretation 1—Actual prices prevailing			
Av. appraised stocker value in spring/cwt.	$22.97	$22.61	$23.10
Av. appraised slaughter value in fall/cwt.	18.21	18.29	18.97
Margins received	— 4.76	— 4.32	— 4.13
Gross returns per acre	9.16	15.73	37.37
Fertilizer costs per acre	3.90	20.96	20.96
Irrigation costs per acre			34.46
Net returns over costs per acre	5.26	— 5.23	—17.99
Interpretation 2—Cattle @ $20.00 level			
Av. appraised stocker value in spring/cwt.	$20.00	$20.00	$20.00
Av. appraised slaughter value in fall/cwt.	19.00	19.00	19.50
Margins allowed	— 1.00	— 1.00	— .50
Gross returns per acre	30.34	40.30	78.07
Fertilizer costs per acre	3.90	20.96	20.96
Irrigation costs per acre			34.46
Net returns over costs per acre	26.44	19.34	22.71
Interpretation 3—Cattle @ $25.00 level			
Av. appraised stocker value in spring/cwt.	$25.00	$25.00	$25.00
Av. appraised slaughter value in fall/cwt.	24.00	24.00	24.50
Margins allowed	— 1.00	— 1.00	— .50
Gross returns per acre	39.69	52.68	99.45
Fertilizer costs per acre	3.90	20.96	20.96
Irrigation costs per acre			34.46
Net returns over costs per acre	$35.79	$31.72	$44.09

Table 8. Summary of Fertilizer and Irrigation Costs per Acre.

	Bluegrass-hop and white clover	Same as I + N	Same as I + N + irrigation
Annual charge for phosphate and potash (b)	$3.90	$ 3.90	$ 3.90
Annual charge for nitrate (a)		$17.06	$17.06
Annual charge for irrigation, 8.6 inches @ $4 per acre-inch			$34.40
Av. annual charge for fertilizer and irrigation	$3.90	$20.96	$55.36

(a) Applications were made at 60-day intervals—March, May, July, and September.
(b) Fertilizer was charged at market price for the year applied, the total cost being spread over 4 years. Fertilizer applications were made according to soil tests in an attempt to get all replications to an equal level. In 1955, all replications did not receive equal applications and, therefore, the costs varied somewhat, in which case an average was taken and used for the cost in all lots. A charge of $1 per acre was made for each application of amonium nitrate or other fertilizer. The price of phosphate varied from $60 to $68 per ton; the potash cost $60 and the ammonium nitrate from $70 to $78 per ton. The phosphate and potash charge is an average—the same for all lots justified by an attempt by soil testing to raise all pasture to the same level of fertility.

III. Finishing After the Grazing Period

From December 7 up to September 30, when it was considered advisable to end the grazing period, these yearlings had gained about 300 pounds almost entirely on roughage and pasture. Their slaughter grade at this time was standard. They were excellent stockers but their intrinsic value as slaughter cattle had not fully been realized. These young cattle had grown and gained about the expected amount, but were not fat and ready for the slaughter market. Previous work reported in Tennessee Bulletin 283 has shown that such cattle could be put in desirable slaughter condition for Tennessee markets by giving them a full feed of concentrates and legume hay for about 70 days. This plan was followed.

The cattle were taken off pasture and confined in pens with watering facilities in a well-ventilated barn. They were fed all the concentrates (7 parts corn, cob, and shuck meal and 1 part cottonseed meal) they would clean up, and legume and mixed hay ad libitum. The steers from each pasture treatment were fed as separate lots.

PERFORMANCE OF CATTLE

Since there was not much difference in summer gain or slaughter grade of these cattle coming off pasture, there was little difference in gains or feed requirements during the fattening period (Table 9). As might be expected for a short feed, the daily gains were good and feed requirements moderate. One hundred pounds

gain was made on about 630 pounds of concentrates and 420 pounds of mixed hay. The slaughter grades were raised about one full grade. The carcasses of each lot graded good, and, at a dressing percent of 58%, these 1,000-pound cattle produced a very desirable kind of beef in carcass weight and grade for Tennessee markets. The packers were well-pleased with cattle of this type and finish.

Table 9. Summary of Dry-Lot Fattening Phase.
A Weighted Average for Years 1952, '53, '54, and '55

Item	Treatments		
	1	2	3
	Bluegrass-clover	Same as 1 +N	Same as 1 + N + irrigation
Av. number steers	9	8.5	9
Av. weight per steer lb.			
Initial weight (av. date Sept. 30)	824.0	826.3	844.5
Final weight (av. date Dec. 9)	997.8	1009.0	1009.0
Gain 70 days	173.8	182.7	164.5
Daily gain*	2.48	2.61	2.35
Av. daily ration lbs.			
Legume and mixed hay	10.4	10.5	9.9
Corn and cob meal	13.7	13.6	13.1
Cottonseed meal	1.97	1.95	1.88
Av. feed requirements per 100 lb. gain lbs.			
Legume and mixed hay	420	408	425
Corn and cob meal	555	530	560
Cottonseed meal	79	76	80
Av. feed cost per 100 lb. gain (a)	$ 25.14	$ 23.98	$ 25.42
Av. feed cost per head	43.62	43.81	41.80
Marketing information, grades, and appraisals			
Slaughter grade Sept. 30	Std. +	Std. +	H. Std. —
Slaughter grade Dec. 9	HG	G+	HG
Carcass grade (Federal)	G	G	G+
Appraised value cwt. Sept. 30	$ 18.21	$ 18.29	$ 18.97
Appraised value cwt. Dec. 9	20.98	20.76	21.09
Dressing percentage (selling wt. and hot carcass wt. basis)	57.9	58.2	58.4
Financial statement			
Appraised value per head Sept. 30	$150.11	152.31	$160.25
Feed cost per head	43.62	43.81	41.80
Cost per head Dec. 9 (initial and feed)	193.73	196.12	202.05
Appraised value head Dec. 9	209.34	209.55	212.80
Av. margin secured during fattening period	2.77	2.47	2.12
Net return over initial and feed costs	$ 15.61	$ 13.43	$ 10.75

(a) Hay charged at approximately $38.80 and grain mixture 7 parts corn and cob meal and 1 part CSM @ $53.40 ton.
* Differences in rates of gain are not statistically significant.

As mentioned on page 500, emphasis should be given to the actual performance of the animals, as a basis for developing financial estimates of returns under other price levels. The financial statement in Table 9 illustrates the returns under one set of stated prices. An average gross return of about $13 per head was realized in addition to the prices charged for the farm-grown feeds.

To date, 82 lots of yearling cattle, grazed until about September 1, have been given a short, full-feed in dry-lot, at the various Tennessee Branch Stations. Each of the 82 lots has returned a margin over and above feed costs. The value of a dry-lot feeding period should be more fully realized by cattle grazers. Thousands of yearlings similar to these cattle are grazed annually and thrown on the fall market in a condition too low to interest the packer. Sometimes these cattle will find a fair reception as feeders at higher prices than packers can pay, but generally feeders try to buy their feeder cattle below that paid for finished cattle. Recognition of the facts involved should cause more producers to give yearlings a short full-feed before marketing them and thereby make a return above feed costs and furnish the market with a better grade of beef than otherwise.

Summary

Steer calves were wintered 1) in the barn, 2) in an outside lot, and 3) on an orchardgrass-bluegrass pasture. They were then grazed on 1) unnitrated, 2) nitrated, and 3) nitrated and irrigated bluegrass-clover pastures until September 30th. Later they were given a 70-day full-feed in the barn, all during 4 different years. The following conclusions seem warranted:

THE WINTERING PERIOD

Steer calves wintered in the barn gained 82 pounds or 27 pounds more and returned $5.47 more per head than calves subjected to the cold weather, rain, and mud in an outside lot on the same amount of feed.

Calves wintered on orchardgrass-bluegrass pastures gained as well as those wintered in the barn. The pasture replaced about 40% of the hay requirements.

THE GRAZING PERIOD

Applying 120 pounds of nitrogen without irrigation practically eliminated the clovers in the bluegrass pastures. This situation is considered undesirable for a productive pasture.

Although nitrogen increased the acre-beef yield 33% over pastures not nitrated, its use proved to be uneconomical at any of the price level interpretations applied.

Nitration plus irrigation did not depress the clovers but improved the average quality and carrying capacity of the pasture and acre-beef yields.

Nitration plus irrigation increased the acre cost $51.46. This combination of practices would not be profitable unless cattle prices were very high.

The bluegrass pastures treated with lime, phosphate, and potash returned $26.44 per acre over fertilizer costs with cattle at $20 per hundredweight. This was the highest return of any of the treatments at this price level. It would appear that bluegrass pastures constitute a good land-use for considerable acreages in East Tennessee.

DRY LOT PERIOD

A short dry-lot feeding period of 70 days was desirable and profitable in producing good slaughter cattle from these yearlings after the grazing trials were concluded.

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