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BULLETIN 435 JULY 1972

Forage and Feed Systems for Beef Brood Cow Herds

GRASS-LEGUME VS. GRASS + N PASTURES
WINTER FEEDING OF BROOD COWS AND CALVES

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SUMMARY AND CONCLUSIONS

Four winter feeding programs and four summer pasture combinations involving cool-season legumes vs. nitrogen were compared in an experiment at the Tuskegee Experiment Field. Data from the 5-year project using 185 acres are summarized by winter and summer treatments.

Winter Feeding Treatments

- Cows full fed low quality Coastal bermudagrass hay lost more weight in winter than those fed cottonseed meal with the hay or those receiving higher quality Coastal hay or fescue grazing.
- Calves on rye creep-grazing (dams were on fescue pasture) averaged 1.5 pounds gain per day up to 108 days of age. Calves of cows fed poor hay or poor hay plus cottonseed meal gained 1.1 pounds per day. With cows fed good hay, calves gained 1.3 pounds per day.
- Effects of winter treatments of brood cows and calves showed up as differences in calf weaning weights. The average weight difference between calves from cows on poor hay and those on good hay or creep grazing was 35 pounds on March 25 and about 30 pounds at weaning.
- Cottonseed meal fed to cows did not affect growth of calves during the winter period.
- When winter and summer costs were considered, the highest net return for winter treatments was from poor hay full fed ($66.58 per calf) followed closely by the group full fed good hay ($62.80).

Summer Treatments

- Cows on grass that received no legume or nitrogen had an average net annual weight loss of 38 pounds, as compared with slight gains for cows on the other three treatments.
- Calves produced on legume pastures averaged 468 pounds at weaning. This was 30 pounds heavier than those from grass pastures receiving 100 pounds of N, which were in turn 50 pounds heavier than calves from no N-no legume pastures.

- Calves on legume pasture gained 1.9 pounds per day from the time they were put on summer pastures to weaning. Calves on grass without N or legume gained 1.4 pounds per day.
- Legume pastures cost about the same as pastures receiving 100 pounds of N.
- Highest net return per calf from summer treatments was from legume pastures ($68.44), followed by the legume plus 100 pounds N per acre ($60.64). Net return from pastures receiving 100 pounds of N per acre was $57.15 per calf, while no legume-no N pastures returned only $49.69.
- The most profitable combination of winter and summer treatments was full feeding of hay (either poor or good quality) in winter, followed by grazing on legume pasture in the spring. The two groups on these treatments had average net return of $71.43 per calf, with poor hay valued at $20 per ton and good hay at $25.

COVER PHOTOS

Front cover Differences in quality of pastures among the four summer treatments are evident in the color illustrations. Adding legume to the pasture mixture or using nitrogen on all-grass pastures resulted in greater production and better cattle performance.

Back cover These winter scenes illustrate differences in condition of cattle among the four winter treatments in the experiment. Cows getting good quality Coastal hay or grazing fescue lost less weight in winter than those on poor grass hay.

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FIRST PRINTING 4M, JULY 1972

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WINTER FEEDING OF BROOD COWS AND CALVES

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A PROFITABLE BEEF BROOD COW operation is dependent on economical production and utilization of ample forage. One of the most practical systems is to graze the pastures as needed and to make hay from any surplus forage produced. The hay is then fed during periods when grazing is not adequate.

Having legumes in the sward to furnish nitrogen for the grass plus providing the animals highly nutritious grazing is generally considered desirable. However, there exists the uncertainty of obtaining stands and good production from legumes. Use of pure grass swards and commercial nitrogen is an alternative to the growing of legumes. Decreases in cost of nitrogen fertilizers in recent years have resulted in increased use of nitrogen rather than depending on legumes in pastures. Except for advantages in nutritional values, growth distribution, and cost of production that favor the legume-grass swards, the alternative use of commercial nitrogen definitely would be more attractive.

Studies were conducted at the Tuskegee Experiment Field from 1964 to 1969 with the following objectives: (1) to evaluate and compare cool-season legumes and commercial nitrogen for summer grass pastures, and (2) to compare four winter feeding programs involving low and high quality Coastal bermudagrass hay, protein supplement, and winter grazing for cows and calves.

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REVIEW OF LITERATURE

Research in Florida in 1961 indicated that cost of producing beef calves could be 40 per cent less on clover-grass pastures than on grass pastures fertilized with nitrogen *(10)*. In comparison with clover-grass pastures, all-grass pastures were more costly, calves from these pastures were lighter, and cows weaned a lower percentage of calves. A later report *(11)* showed that heifers raised on clover-grass pastures were 104 pounds heavier at 30 months of age than those raised on straight grass pastures. Their respective calving rates were 96 versus 81 per cent and weaning percentages were 89 versus 76.

Clark *et al. (1)* in Maryland reported that where ladino clover can be grown in association with orchardgrass for 2 or 3 years, a desirable pasture can be maintained with a saving in nitrogen fertilization. However, nitrogen up to 200 pounds per acre substantially increased available forage from the orchardgrass when the stand of clover was poor. Donnelly and Langford *(2)* found that Warrior vetch in mixtures with small grains produced as much forage as grass alone fertilized with 160 pounds of nitrogen per acre. Knight *(9)* of Mississippi also demonstrated the value of a legume in the sward. He reported that crimson clover increased total forage production by 27 per cent when 200 pounds of N was applied to the associated Coastal bermudagrass and by 63 per cent when no N was applied.

Pensacola bahiagrass has given a forage yield comparable with Coastal bermudagrass in central and southern Alabama, but on wet soils it has been more productive *(6)*. Steer gains per acre on Pensacola bahiagrass have been higher than obtained on common bermudagrass, but lower than on Coastal. Satisfactory results have been obtained with beef brood cows and calves on Pensacola bahiagrass and clover or vetch.

Harris *et al. (5)* concluded that mature brood cows can be wintered on hay alone provided they are in good flesh at beginning of the winter and have good quality spring grazing so that body weight losses can be recovered. Protein supplement was found to be necessary during winter for young cows to grow and reproduce normally when fed low protein grass hay. In another experiment Harris *et al. (4)* found that calves from cows fed 2 pounds of cottonseed meal daily and a limited amount of grass hay (17.6 pounds) while on browse pasture during winter were 47 pounds

heavier at weaning than those from restricted-fed cows – 484 versus 437 pounds.

The quality of Coastal bermudagrass hay varies depending on growing conditions. Hoveland *et al. (7)* reported that total production of hay was 25 per cent greater when harvested at 6-week intervals than at 4-week intervals, but crude protein content was 25 per cent less when the grass was clipped at 6-week intervals. Johnson *et al. (8)* found that hay cut at 32-day intervals and baled after 2 days was consumed in greater amounts and produced more milk than the same hay baled after 7 days and 0.77 inch of rainfall or than hay harvested after 56 days and cured immediately with heated air. However, Harris *et al. (3)* concluded that Coastal bermudagrass hay with digestible dry matter above 60 per cent cannot be readily obtained by controlling growth interval and method of curing. Their data revealed a low maximum nutritive value for Coastal hay and a narrow range in quality.

EXPERIMENTAL METHODS

This experiment involved use of 185 acres of coastal plain soils in a year-round management program for brood cow and calf herds. Soil types were predominantly Boswell very fine sandy loam and Boswell clay loam, with small areas of Susquehanna clay and alluvial lowlands. Summer and winter programs were conducted with the same cows. The experiment was begun in the fall of 1964 and continued for 5 years. There were four winter and four summer treatments with 16 test and 2 replacement cows on each treatment, making a total of 64 test and 8 replacement cows each year. The cows from each winter treatment were divided equally among the summer groups. Cows were kept in the same system throughout the experiment.

The winter treatments were:

A. Poor quality Coastal bermuda hay full fed.

B. Poor quality Coastal bermuda hay full fed plus cottonseed meal supplement. The CSM was started at 1 pound per head per day and increased up to 2 pounds as the season progressed.

C. Good quality Coastal bermuda hay full fed.

D. Fescue grazing for cows with rye creep grazing for the calves, with a total of 1.0 acre per cow. Hay was fed when fescue for grazing was inadequate. Two acres of rye was planted in September to provide creep grazing for the 16 calves in this group.

The summer treatments were:

I. Grass and legume plus 100 pounds nitrogen per acre – 26.0 acres total, 1.44 acres per cow.

II. Grass and legume – 31.6 acres total, 1.75 acres per cow.

III. Grass plus 100 pounds nitrogen per acre – 30.4 acres total, 1.69 acres per cow.

IV. Grass without legume or nitrogen – 39.7 acres total, 2.20 acres per cow.

Cattle Management

Cows were checked for pregnancy and weighed into the winter groups about October 15 before calving started in November. Winter feeding was started when summer grass forage was insufficient to maintain the cows.

Bulls were with cows from February 1 through May 31, resulting in a calving season from about November 10 through March 10. Bulls were rotated among groups weekly in a regular sequence.

Cows and calves were weighed out of the winter program and placed on the summer pastures when clover growth was sufficient to sustain the two groups on clover pastures. Average date of this transfer was March 28 and it varied from March 15 in 1967 to April 8 in 1968. Cattle placed on non-clover pastures at this time were fed hay until grass was sufficient for them.

Calves were weighed, castrated, and tagged at birth. They were weighed, graded, and weaned at approximately 250 days of age. Weaning weights were adjusted to the mean for age, sex, and age of dam.

Replacement cows, other than the two in each group mentioned earlier, were produced, maintained, and bred in a separate herd. Cows not pregnant when the winter program began were replaced. Cows were culled for production of inferior calves or other sub-normal performance not considered resulting from treatment in the experiment.

Pasture Management

Summer pastures were established stands of Coastal bermudagrass and Pensacola bahiagrass in the ratio of approximately 2 acres of Coastal to 1 of bahia. Legume pastures had ball clover

on all areas with crimson clover on uplands and white clover on lowlands. Clovers were reseeded and the sod disked lightly in October each fall where adequate natural reseeding was not anticipated.

All pastures were limed initially where soil test indicated a need. Legume pastures received 400 pounds per acre of 0-14-14 annually and non-legume pastures received this amount every other year. Nitrogen was split into two applications of 50 pounds per acre each on summer grasses and on the fescue and rye in the winter program. Summer pastures were cross-fenced into two areas for controlled grazing. Excess growth was cut for hay. Summer growth in the fescue pastures was cut for hay or grazed by the unassigned cows of the herd.

High quality Coastal bermuda hay was produced on separate meadow areas by using high rates of nitrogen and cutting frequently. Low quality hay came from areas receiving less nitrogen and less frequent cuttings. Pasture clippings and rained-on hay were fed to the groups receiving low quality hay. Additional hay was purchased as required.

Records and Analysis of Data

Records were kept for economic analysis of the data. These included fall and spring weights of cows, calf birth dates and weights, spring and weaning weights of calves, calf grades at weaning, and age of cows. Other records included amounts of hay and CSM fed, surplus hay removed from pastures, protein content of hay, CSM, fertilizer, and seed.

The data were analyzed by the method of least-squares, using year, sex of calf, and age of dam as independent variables. In addition, previous parity was considered in the analysis of cow weight. Regression analyses were used to remove the effect of date of calving on weaning weight. Analyses of variance for the different traits are shown in Appendix Tables 6 and 7 for cow weight and calf performance, respectively.

RESULTS AND DISCUSSION

Hay Quality and Daily Feed Consumption

Averages of 24.2, 24.0, and 25.2 pounds of hay per cow and calf were fed daily to groups A, B, and C, respectively, Table 1.

TABLE 1. WEIGHT AND CRUDE PROTEIN CONTENT OF HAY FED AND AMOUNT OF CRUDE PROTEIN CONSUMED[1]

Performance measure	A— poor hay	B— poor hay + CSM	C— good hay	D— fescue + rye creep[2]
Hay fed daily, lb.	24.2	24.0	25.2	18.2
Crude protein content, pct.	7.0	7.2	11.4	8.7
Crude protein from hay, lb.	1.69	1.73	2.87	1.58
CSM fed daily, lb.	----	1.57	----	.60
Crude protein from CSM, lb.	0.00	0.57	0.00	0.22
Total crude protein fed, lb.	1.69	2.30	2.87	1.80
Crude protein requirement, lb.[3]	1.87	1.97	2.01	1.95

[1] Some browse was available during early winter.
[2] Hay and cottonseed meal fed when fescue not available. No measure was made of fescue intake.
[3] Based on NRC requirements for cows nursing calves first 3-4 months postpartum using average weight of cows within each treatment.

These cows also had access to limited browse on summer grass pastures during the early winter. The average of 18.2 pounds for winter treatment D is for hay fed after fescue had been grazed down. Fescue was on land not well suited for it and production was low because of loss of stand and poor growth. Cows on all treatments had access to sufficient dry matter to meet recommended daily requirements.

Crude protein content was determined by chemical analysis of samples taken every 2 weeks. Average daily crude protein fed was 1.69, 2.30, 2.87, and 1.80 pounds for treatments A, B, C, and D, respectively, Table 1. It is unlikely that cows on any of the winter treatments lacked sufficient protein, particularly when extra protein from browse and fescue is considered. Treatment A may have been borderline for protein, especially for young cows *(4)*.

Cow Weight Changes

WINTER. Yearly average weights and weight changes of cows as affected by winter treatments are reported in Table 2. Weight changes from fall (1)[1] to spring, spring to fall (2), and fall (1) to fall (2) are given. These weight changes represent average loss for the winter during which cows calved, average gain for the summer, and gain or loss for the year, respectively. Cows wintered on poor hay only (A) lost significantly more weight during the winter period than did cows on the other three treatments.

[1] Fall (1) is beginning of year, fall (2) is end of year.

TABLE 2. AVERAGE WEIGHTS AND WEIGHT CHANGES OF BEEF BROOD COWS AS AFFECTED BY WINTER TREATMENT

Performance measure	A— poor hay	B— poor hay + CSM	C— good hay	D— fescue + rye creep
Number of cows	76	74	74	76
Initial weight, fall (1),[1] lb.	1,035	1,056	1,071	1,041
Spring weight, lb.	776	838	863	833
Winter loss, lb.	—259 a[2]	—218 b	—208 b	—208 b
Summer gain, lb.	252 a	212 b	220 b	198 c
Fall (2) weight, lb.	1,028	1,050	1,083	1,031
Annual change, lb.	—7 ab	—6 ab	12 a	—10 b

[1] Fall (1) is beginning of year, fall (2) is end of year.
[2] Values within a line having different letter designations are different at ($P < .01$).

However, these cows regained more weight in summer than the other groups and returned to within 7 pounds of their fall (1) weights. Cows that grazed fescue (D) during the winter gained less the following summer than did cows on the other winter treatments. Cows fed good quality hay (C) had a net gain of 12 pounds for the year. This was significantly different from the 10-pound annual net loss for cows in the fescue group.

SUMMER. The effects of summer treatments on average weights and weight changes are given in Table 3 as weight changes from fall (1) to spring, spring to fall (2), and fall (1) to fall (2). Cows on legume and grass plus nitrogen (I) gained 30 and 25 pounds more in the summer than cows on legume (II) or nitrogen (III) pastures, respectively. Cows on un-nitrated grass (IV) gained 57 to 87 pounds less than the other groups and showed an average net annual loss of 38 pounds each year.

Summer treatment may affect subsequent winter weight loss, especially if summer gains are above normal. Winter weight

TABLE 3. AVERAGE WEIGHTS AND WEIGHT CHANGES OF BEEF BROOD COWS AS AFFECTED BY SUMMER TREATMENT

Performance measure	I— legume + 100 N	II— legume	III— 100 N	IV— no legume-no N
Number of cows	75	75	75	75
Initial weight, fall (1), lb.	1,067	1,043	1,050	1,043
Spring weight, lb.	822	830	821	836
Winter loss, lb.	—245 a[1]	—213 b	—229 a	—207 b
Fall (2) weight, lb.	1,078	1,056	1,052	1,005
Summer gain, lb.	256 a	226 b	231 b	169 c
Annual change, lb.	11 a	13 a	2 a	—38 b

[1] Values within a line having different letter designations are different at ($P < .01$).

losses were significantly greater for cows having been on pastures receiving nitrogen (I and III) than on the other treatments. However, treatments I, II, and III showed annual net gains of 11, 13, and 2 pounds, respectively. These gains were significantly ($P < 0.01$) different from the 38-pound loss by cows on un-nitrated grass (IV). Cows on the un-nitrated grass (IV) in summer had a net annual loss regardless of their previous winter treatment (Appendix Table 1). These losses were 41, 43, 27, and 42 pounds for cows from winter groups A, B, C, and D, respectively.

Cow weight changes are of little importance, within certain limitations, unless calf weaning weight or per cent calf crop are affected. The only effect of summer treatments on cow performance that appeared important was the failure of cows on un-nitrated grass (IV) to regain their weight of the previous fall each year. Although each cow had 2.2 acres of pasture and forage appeared to be adequate, the condition of cows in this group deteriorated each year.

Calf Performance

The primary objectives of this test were to determine how winter and summer treatments affected calf performance to weaning. These effects were determined by weighing calves at birth, when transferred from winter to summer programs, and weighing and grading at weaning.

WINTER. Winter treatment had no effect on birth weight of calves, Table 4. This was expected since most calves were born

TABLE 4. AVERAGE PERFORMANCE OF CALVES FROM BIRTH TO WEANING AS AFFECTED BY WINTER TREATMENT

Performance measure	A— poor hay	B— poor hay + CSM	C— good hay	D— fescue + rye creep
Number of calves	76	74	74	76
Birth weight, lb.	61	60	62	61
Weight, end of winter, lb.	177	177	211	213
Age, end of winter, days	106	108	116	103
Daily gain, winter, lb.	1.09	1.08	1.28	1.48
Adjusted weight, end winter, lb.[3]	179	177	201	220
Adjusted weaning weight, lb.	431 a[1]	418 a	449 b	456 b
Weaning score[2]	10.2	10.3	10.4	10.6
Summer gain, lb.	254 N.S.	241 N.S.	238 N.S.	243 N.S.

[1] Values within a line having different letter designations are different at ($P < .01$).

[2] 9 = Good minus; 10 = Good; 11 = Good plus; 12 = Choice minus.

[3] Calf weight adjusted to average age of 108 days.

each year shortly after the winter program was begun. At the end of the winter feeding period (average date March 28) calves in groups C and D were heavier than those in A and B. Calves that had rye grazing (D) averaged gaining 1.5 pounds per day, as compared with 1.1 pounds for the poor hay groups (A and B). Calves on good hay (C) gained 1.3 pounds per day during this period. CSM fed to cows did not affect winter growth of calves.

The adjusted weaning weights of calves on treatments A and B were significantly lower than those on C and D. No difference existed between the averages for A and B or between C and D. In general, weaning weights of calves reflected response of their dams to winter treatments. One would expect calves on treatment B to be equal to or superior to those on treatment A. The data in Figure 1 show that this was the case except for calves on summer treatment IV that did not include legume or nitrogen, and where gains were less than on other pastures. Calves from Group A when placed on summer treatment IV performed relatively better, whereas those from Group B performed relatively poorer, when compared with calves from the other groups. This unexplained interaction accounted for practically all of the difference between weaning weights of groups A and B.

These data show that the effects of winter treatments were carried through the pasture period and were expressed in wean-

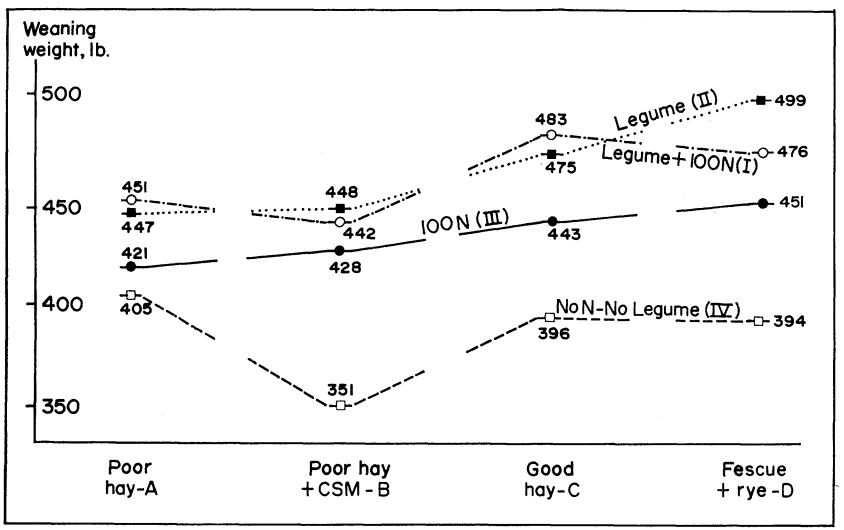

FIG. 1. Weaning weights of calves from the winter and summer treatments.

ing weights of the calves (Appendix Table 2). Calves in groups A and B averaged 35 pounds lighter than C and D calves on March 25 and about 30 pounds lighter at weaning. Slaughter grade at weaning did not differ significantly among calves from the different winter treatments.

SUMMER. The most important results from this study are the differences in response of calves to the summer treatments. There were no birth weight differences because of summer treatment, Table 5, but calves produced on legume pastures (I and II) were 30 pounds heavier at weaning than calves from grass pastures receiving 100 pounds N (III). High quality of the legume grazing probably accounts for part of the increased growth. Calves from nitrated grass pasture (III) averaged 50 pounds heavier than those produced on grass without nitrogen (IV). The addition of nitrogen to grass-clover pastures did not result in heavier calves at weaning, as shown by comparing treatments I and II.

Calves on legume pastures (I and II) gained 1.9 pounds per day from the time they were put on summer pastures to weaning. Calves on grass without nitrogen gained only 1.4 pounds per day.

Summer treatments affected slaughter grade at weaning. Group I had a higher average slaughter grade than Group III, and Group IV calves had a significantly lower average grade than any of the other groups. However, there was no significant difference in grade between groups I and II or between II and III.

Calf gain per acre of summer pasture was calculated by dividing the average summer gain by acres per cow in each group.

TABLE 5. AVERAGE PERFORMANCE OF CALVES FROM BIRTH TO WEANING AS AFFECTED BY SUMMER TREATMENT

Performance measure	I— legume + 100 N	II— legume	III— 100 N	IV— no legume- no N
Number of calves	75	75	75	75
Birth weight, lb.	62	64	61	62
Age end of winter, days	110	111	106	105
Adjusted weight, 108 days, lb.	194	202	191	190
Adjusted weight, 250 days, lb.[1]	463 a	468 a	436 b	387 c
Summer gain, lb.	269 a	266 a	245 a	197 b
Daily gain, summer, lb.	1.89	1.87	1.75	1.39
Weaning score[2]	11.1 a	10.7 ab	10.4 b	9.3 c
Gain per acre, lb.	187	151	145	89

[1] Values within a line having different letter designations are different at ($P < .01$).

[2] 9 = Good minus; 10 = Good; 11 = Good plus.

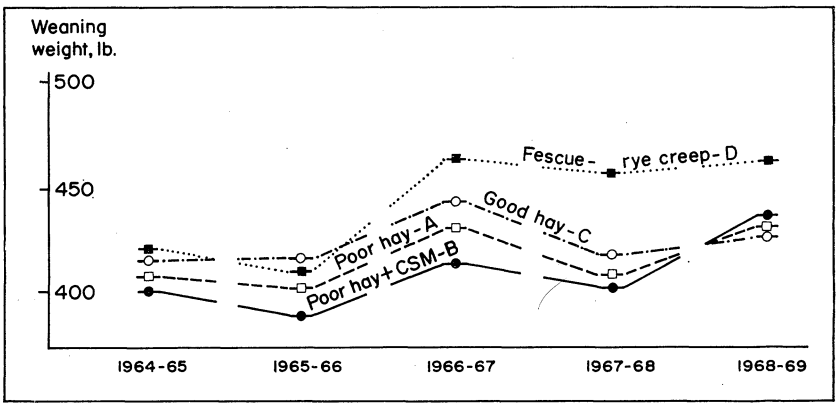

FIG. 2. Annual weaning weights of calves from winter treatments for 5 years.

Gain per acre varied from 187 pounds for Group I to 89 pounds for Group IV. Treatments II and III produced 151 and 145 pounds per acre, respectively. These figures may be important in cases where acreage for beef cattle is limited or land values are high.

Effects of the winter and summer treatments on weaning weights of calves were quite consistent throughout the 5-year period. Calves from the fescue-rye creep (D) winter treatment were heavier at weaning than any of the other groups in 4 of the

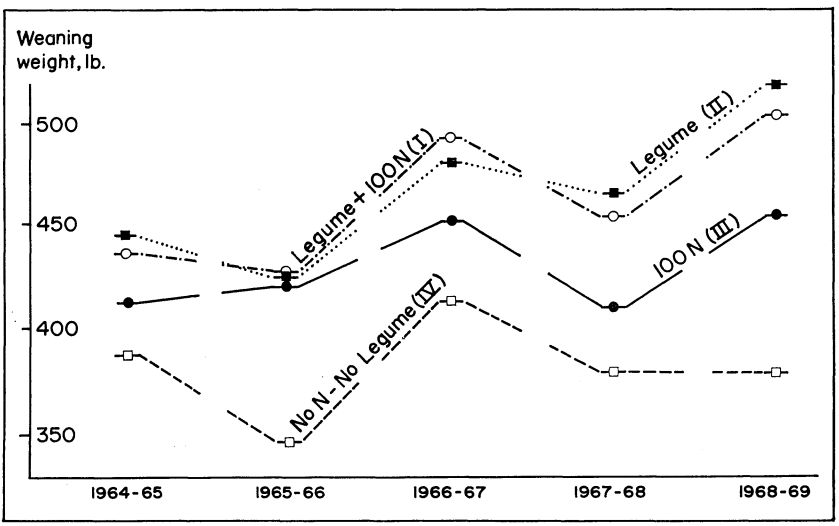

FIG. 3. Annual weaning weights of calves from summer treatments for 5 years.

5 years, Figure 2. Differences among the other three winter treatments in their effect on weaning weight were small.

Summer pastures that included legumes (I and II) produced heavier calves at weaning than non-legume pastures (III and IV) in each of the 5 years, Figure 3. Their superiority over the 100-pound nitrogen treatment (III) was greater in the last 3 years as stands and growth of legumes in the pastures improved. Calves from pastures that received no nitrogen or legume were lighter than calves from all other summer treatments each year.

ECONOMIC ANALYSIS

Feed costs varied from $32.40 per cow for the group full fed poor hay (A) to $53.70 each for those provided fescue and rye creep grazing (D), Table 6. These wintering costs are high because of the long feeding period – 134-day average, from November 13 to March 28. Costs for the fescue (D) group were unusually high because of low production of fescue and the large amount of supplemental feed required by this group.

TABLE 6. QUANTITIES AND COSTS OF WINTER FEED

Performance measure	A— poor hay	B— poor hay + CSM	C— good hay	D— fescue + rye creep
Hay fed per cow, total, lb.	3,240	3,220	3,380	2,730
Hay fed per cow per day, lb.	24.2	24.0	25.2	18.2
Cottonseed meal fed per cow, total, lb.		210		80
Cost of hay per cow[1]	$32.40	$32.20	$42.20	$24.40
Cost of cottonseed meal[2]		8.90		3.40
Cost of fescue per cow[3]				22.00
Cost of rye per cow[4]				3.90
Total winter cost per cow	$32.40	$41.10	$42.20	$53.70

[1] Good hay valued at $25 per ton, poor hay at $20 per ton.
[2] Cottonseed meal valued at $85 per ton.
[3] One acre fescue per cow. Two-thirds of annual cost charged to winter program.
[4] Two acres of rye for creep grazing 16 calves; annual cost $33 per acre.

Costs per acre of summer pasture varied from $16.80 for the no nitrogen-no legume pasture (IV) to $37.00 for the legume-100 N treatment (I), Table 7. Costs per cow (determined by multiplying per acre costs by acres per cow) varied from $35.50 for Group IV to $49.80 for Group I.

Values of calves at weaning by winter and summer groups, presented in Figure 4, were determined by using the adjusted weaning weight and a price of 33 cents per pound. Since lower grades tend to be associated with lighter weights and higher

TABLE 7. COSTS OF PASTURE PER ACRE AND PER COW FOR THE SUMMER TREATMENTS

Performance measure	I—legume + N	II—legume	III—nitrogen	IV—no N-no legume
	Dollars	*Dollars*	*Dollars*	*Dollars*
Variable costs per acre				
Fertilizer				
Ammonium nitrate	9.00	.....	9.00	.....
0-14-14	8.00	8.00	4.00	4.00
Fertilizer application				
Ammonium nitrate	2.00	.....	2.00	.....
0-14-14	1.60	1.60	.80	.80
Clover seed	2.40	3.10	.....	.....
Weed control	1.00	1.00	1.00	1.00
Fixed expenses per acre				
Land ($100/acre @ 7%)	7.00	7.00	7.00	7.00
Establishment of grass[1]	4.00	4.00	4.00	4.00
Establishment of legume[2]	2.00	2.00	.....	.....
Total cost per acre	37.00	26.70	27.80	16.80
Less value of hay cut at $10 net per ton	2.40	1.90	2.50	1.10
Net cost of pasture per acre	34.60	24.80	25.30	15.70
Hay fed per cow in spring	.....	.....	1.50	1.00
Total summer cost per cow	49.80	43.40	44.30	35.50
Acres per cow	*1.44*	*1.75*	*1.69*	*2.20*

[1] Establishment cost of bahia and Coastal bermuda of $40 per acre prorated over a 10-year period.
[2] Establishment cost of legumes of $20 per acre prorated over a 10-year period.

grades with heavier weights, it was decided that these factors would tend to offset each other in the feeder calf market. Therefore, a single price was used for all calves.

Summer treatments had more effect on calf values than did winter treatments. Calves from pastures with legume (I and II) were worth about $10 per head more than those from nitrated-only pastures (III), Appendix Table 3. Calves from pastures without legume or nitrogen (IV) were worth about $15 to $25 less than those of the other groups.

Calves from winter treatment D (fescue plus rye) were the best of the winter groups. They averaged $2 per head more at weaning than value of calves from the good hay (C) treatment; Group C calves, in turn, were about $6 and $10 per head better than calves from the poor hay (A and B) treatments, respectively.

When the winter-summer combinations are considered, all groups of calves from legume pastures (I and II) were more valuable than any from groups III or IV. The best calves of the 16 treatment combinations were from fescue-rye (D) in winter and legume (II) summer pasture. They were valued at $164.67 each.

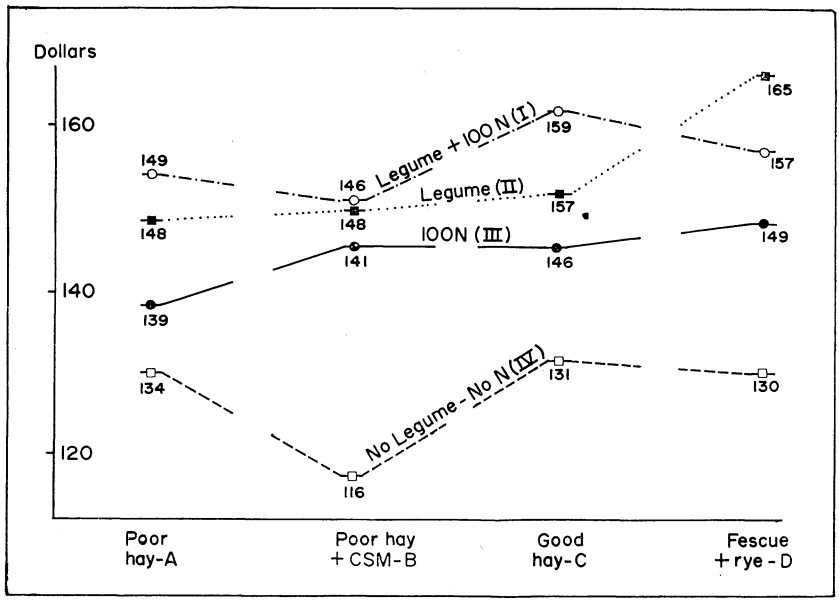

FIG. 4. Average adjusted values of calves from winter and summer treatments. Values shown are based on weaning weight × 33¢.

The poorest group was from the poor hay + CSM (B) and no N-no legume treatment (IV), with a value of $115.83.

Costs per cow for the 16 winter-summer treatment combinations ranged from $68 for treatments A and IV to $104 for treatments D and I, Figure 5 and Appendix Table 4. Legume pastures cost about the same as those receiving 100 pounds of N from ammonium nitrate.

Net returns to operator's labor, management, and capital (excluding land) for the winter-summer combination treatments are given in Figure 6 and Appendix Table 5. Costs recorded in tables 6 and 7 do not include all costs involved in beef cattle production. No charge is made for labor, capital other than land, or such miscellaneous costs as salt, insecticides, veterinary expenses, or sale costs.

Average net return per calf was $58.98. The most profitable overall winter treatment was the poor hay group (A) at $66.58, followed closely by the group full fed good Coastal hay (C) at $62.80. The good hay group may have been overcharged by evaluating the good hay at $5 per ton more than poor hay. Actually good grass hay usually can be produced as cheaply as poor hay by

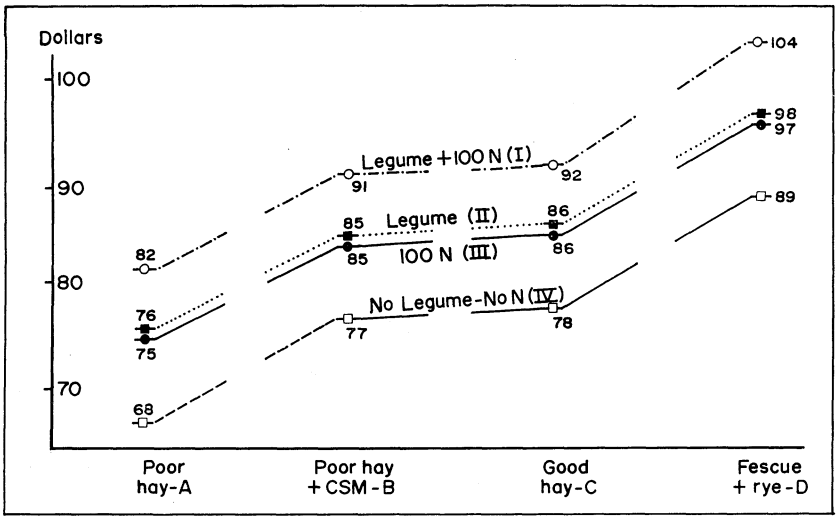

FIG. 5. Average annual costs per cow for winter and summer treatments.

increasing nitrogen application. This increases the yield per acre while improving protein content. Calves from cows fed cottonseed meal (B) showed lower net returns ($53.34) than the group (A) fed only hay ($66.58).

The highest net return from a summer treatment was $68.44 for the legume (II) treatment, followed by $60.64 for legume plus

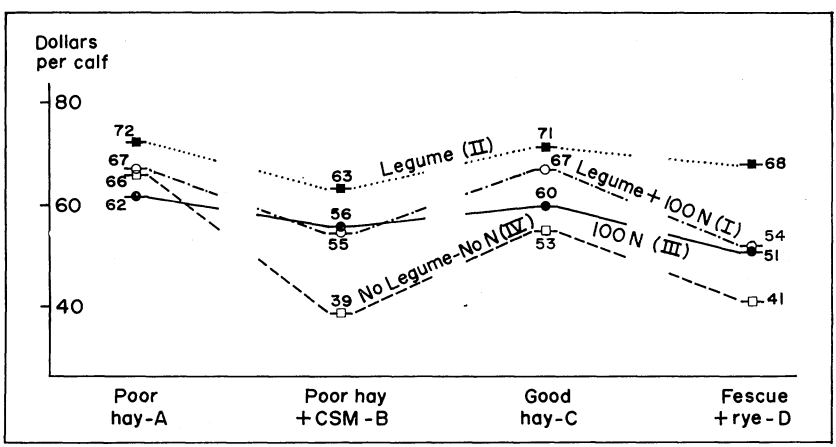

FIG. 6. Average net returns from calves from winter and summer treatments. Amounts are net returns to operator's labor, management, and capital (excluding land).

nitrogen (I). Addition of 100 pounds of nitrogen to legume pastures (I) was not a profitable practice in this experiment. The most profitable combination was A and II, which combined the poor (cheap) hay winter program and the legume summer pastures. Net return per calf in this group averaged $71.71.

Based on this 5-year study and the procedure used to value calves, legumes are definitely more profitable in pastures for brood cow herds than is ammonium nitrate at $60 per ton. Use of 100 pounds of nitrogen was profitable on non-legume pastures but did not pay where legumes were included. These data support recommendations that legumes be included in pasture mixtures. Annual reseeding of legumes is needed in sods where reseeding is not adequate for good stands. When good stands are not obtained, commercial nitrogen is needed to improve forage quality and increase growth and carrying capacity.

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APPENDIX

APPENDIX TABLE 1. FIVE-YEAR AVERAGE COW WEIGHTS, GAINS AND LOSSES IN THE DIFFERENT WINTER AND SUMMER TREATMENTS

Summer treatment	Winter treatment				
	A	B	C	D	Average
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Fall (1) weight					
I	1,038 (19)[1]	1,083 (19)	1,108 (18)	1,038 (19)	1,066 (75)
II	1,015 (19)	1,107 (18)	1,028 (19)	1,022 (19)	1,042 (75)
III	1,021 (19)	1,017 (18)	1,069 (19)	1,091 (19)	1,050 (75)
IV	1,068 (19)	1,016 (19)	1,082 (18)	1,007 (19)	1,043 (75)
Average	1,035 (76)	1,056 (74)	1,071 (74)	1,040 (76)	1,051 (300)
Winter weight loss					
I	257	259	243	219	245
II	247	193	196	218	214
III	267	231	197	223	229
IV	268	190	196	171	207
Average	259	218	208	208	224
Spring weight					
I	781	824	865	819	821
II	768	914	832	804	830
III	754	786	872	868	821
IV	800	826	886	836	836
Average	776	858	863	832	827
Summer weight gain					
I	256	278	266	222	256
II	263	203	229	209	226
III	262	221	214	228	231
IV	226	147	169	129	169
Average	252	212	220	197	221
Fall (2) weight					
I	1,037	1,102	1,131	1,041	1,077
II	1,031	1,118	1,061	1,014	1,056
III	1,016	1,007	1,086	1,096	1,057
IV	1,026	973	1,055	965	1,005
Average	1,028	1,050	1,083	1,029	1,048
Gain or loss fall (1) to fall (2)					
I	−1	19	23	3	11
II	16	11	33	−8	13
III	−5	−10	17	5	2
IV	−41	−43	−27	−42	−38
Average	−7	−6	12	−11	−3

[1] Number of cows.

APPENDIX TABLE 2. THE EFFECT OF WINTER AND SUMMER TREATMENT ON CALF PERFORMANCE

Summer treatment	Winter treatment				
	A	B	C	D	Average
Slaughter grade					
I	11.2 (19)[1]	11.0 (19)	11.3 (18)	10.9 (19)	11.1 (75)
II	10.6 (19)	10.7 (18)	10.3 (19)	11.4 (19)	10.7 (75)
III	10.0 (19)	10.7 (18)	10.3 (19)	10.5 (19)	10.4 (75)
IV	9.2 (19)	8.7 (19)	9.7 (18)	9.6 (19)	9.3 (75)
Average	10.2 (76)	10.3 (74)	10.4 (74)	10.6 (76)	10.5 (300)
Adjusted weaning weight, lb.					
I	451	442	483	476	463
II	447	448	475	499	468
III	421	428	443	451	436
IV	405	351	396	394	387
Average	431	418	449	456	442
Weight at spring weighing, lb.					
I	176	186	224	204	198
II	176	185	227	245	208
III	170	170	198	208	187
IV	189	167	194	188	185
Average	178	177	211	211	194
Age at spring weighing, days					
I	104	114	120	102	110
II	102	104	123	114	111
III	105	102	110	108	106
IV	114	112	105	89	105
Average	107	108	115	103	108
Birth weight, lb.					
I	63	62	64	57	62
II	63	62	67	64	64
III	62	58	59	65	61
IV	60	60	64	62	62
Average	62	61	64	62	62

[1] Number of calves.

APPENDIX TABLE 3. AVERAGE ADJUSTED VALUE[1] OF CALVES BY WINTER AND SUMMER TREATMENTS

Summer treatment	Winter treatment				
	A	B	C	D	Average
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*
I	148.83	145.86	159.39	157.08	152.79
II	147.51	147.84	156.75	164.67	154.19
III	138.93	141.24	146.19	148.83	143.80
IV	133.65	115.83	130.68	130.02	127.54
Average	142.23	137.69	148.25	150.15	144.58

[1] Value based on weaning weight × 33¢.

APPENDIX TABLE 4. AVERAGE ANNUAL COSTS PER COW BY WINTER AND SUMMER TREATMENTS

Summer treatment	Winter treatment				
	A	B	C	D	Average
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*
I	82.20	90.90	92.00	103.50	92.15
II	75.80	84.50	85.60	97.10	85.75
III	76.70	85.40	86.50	98.00	86.65
IV	67.90	76.60	77.70	89.20	77.85
Average	75.65	84.35	85.45	96.95	85.60

APPENDIX TABLE 5. AVERAGE NET RETURNS[1] OF CALVES BY WINTER AND SUMMER TREATMENTS

Summer treatment	Winter treatment				
	A	B	C	D	Average
	Dol.	*Dol.*	*Dol.*	*Dol.*	*Dol.*
I	66.63	54.96	67.39	53.58	60.64
II	71.71	63.34	71.15	67.57	68.44
III	62.23	55.84	59.69	50.83	57.15
IV	65.75	39.23	52.98	40.82	49.69
Average	66.58	53.34	62.80	53.20	58.98

[1] Net returns to operator's labor, management, and capital (excluding land).

APPENDIX TABLE 6. LEAST-SQUARES ANALYSIS OF VARIANCE FOR COW WEIGHT AND WEIGHT CHANGES

Source	d.f.	Mean square for weights					
		Fall (1)	Spring	Winter change	Fall (2)	Summer change	Year change
Years	4	14576.0*	124421.2**	125787.5**	31882.4**	106530.2**	77362.2**
Winter treatment	3	17074.8	94585.3**	42570.5**	41670.2**	40438.0*	6528.3
Summer treatment	3	9053.0	3653.8	20964.9**	65703.7**	97831.6**	39829.9**
Parity	1	39.4	35812.5**	38228.5**	24938.9	981.1	26728.3**
Age of dam	12	92918.2**	62014.7**	5847.5	70112.9**	3989.2	7955.3**
Year × winter treatment	12	6446.8	9983.7**	11265.0**	6884.7	3889.3	6677.2*
Year × summer treatment	12	9812.5	2903.2	9206.8**	15849.6**	13941.2**	6522.7*
Winter × summer treatment	9	29060.5**	29655.6**	7086.1*	32804.3**	8237.0**	1269.4
Error	243	6758.8	4932.6	3398.3		4932.6	3290.9

* $P < 0.05$.
** $P < 0.01$.

APPENDIX TABLE 7. LEAST-SQUARES ANALYSIS OF VARIANCE FOR CALF BIRTH WEIGHT, WEANING WEIGHT, AND SLAUGHTER SCORE

Source	d.f.	Mean square for traits		
		Birth weight	Weaning weight	Slaughter score
Years	4	1279.2**	33853.9**	25.9**
Winter treatment	3	66.1	22023.9**	2.1
Summer treatment	3	66.9	90427.8**	41.8**
Sex of calf	1	632.2*	41846.3**	6.6
Age of dam	12	377.2**	9434.1**	4.0
Year × winter treatment	12	128.7	1945.0	1.9
Year × summer treatment	12	41.5	3838.5	3.4
Year × sex	4	88.8	2573.3	1.0
Winter × summer treatment	9	103.7	3109.9	2.4
Winter treatment × sex	3	48.7	517.4	0.5
Summer treatment × sex	3	8.6	1354.9	0.6
Regression	1	150.7	6.3	5.8
Error	232	108.4	2741.6	1.9

* $P < 0.05$.
** $P < 0.01$.