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Beef Cattle and Pasture Production in the East Texas Timberlands

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R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS

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Beef Cattle and Pasture Production in the East Texas Timberlands

E. K. Crouch and John H. Jones *

THIS PUBLICATION SUMMARIZES research results on the development and use of improved, permanent pasture with beef cattle during 1934-57 at the East Texas Pasture Laboratory near Lufkin.

The Laboratory was established in 1933 to determine means of improving old fields and cut-over timber land for pasture purposes. The principal work has been the production of milk and grass-fat slaughter beef calves. Sheep and goats were tried in combination with cattle, but this practice was discontinued because local interest favored the use of cattle, and it was difficult to manage three classes of livestock on less than 200 acres of pasture land.

The Laboratory site is fairly typical of the flat-woods area of the East Texas Timberlands. Approximately 143 acres are in improved pasture and 50 acres in woods pasture. About one-third of the improved pasture is creek bottomland which is composed largely of the Bibb soils (1)[1] that occupy about 15 percent of the area. These soils range from sands to heavy clays, depending on the nature of the local upland parent soil. They overflow frequently and may remain wet for long periods. Only small acreages are in cultivation. Since they are not as important for growing pine as some other soils, when cleared, pasture use appears to be best as a source of revenue.

The upland is composed largely of the Caddo and Lufkin sandy loams. They are gray soils and moderately productive. Timber is the dominant natural growth and shortleaf and loblolly pine are the principal species grown. Several species of oak, sweet gum and other trees occur and tend to occupy cutover areas. Reforestation, cultivation or the establishment of permanent pasture are alternative land uses of such areas.

Climatic conditions favor lush forage growth in the spring, but drouths usually occur during the summer and fall. With wet winters, forage left on the pasture does not make a satisfactory wintering feed. If the pasture cover is heavy in the fall, it must be grazed closely for the establishment and survival of clover seedlings. These factors tend to force rather complete removal of seasonal growth and to impose winter feeding problems. Winter feeding is a principal problem of the area. Reliance is now placed on the storage of summer hay and the purchase of protein supplements. Considerable acreages of cultivated lands in the area are fertilized and planted to oats, vetch and rye for winter pasture. Research is in progress on fall fertilization and sod-seeding of cool-season plants on mixed grass-legume pastures.

Pasture and livestock production problems are those found in any area where the climate and soils combine to produce a dominant growth of southern pine. The area is not a natural grassland and, unless improved, does not support a high level of livestock production. Native cattle produced on woodlands or unfertilized pasture are small and seldom fatten well in comparison with western and northern grassland standards. The chief limiting factor is a year-round supply of quality feed. The limiting mineral element, according to present knowledge, is phosphorus. Phosphorus supplied to cattle in the area in the stock water, in a salt lick or through phosphatic fertilization increases weight and thrift. With phosphorus, the mature weight of cattle is increased approximately 200 pounds per head. The effective use of phosphorus supplements presupposes the provision of ample forage.

Phosphatic fertilization is the most effective method of phosphorus supply with mowable pastures. It permits the establishment of mixed clover and grass pastures and increases the phosphorus content of such plants (2, 3). It is fortunate that supplying phosphorus only results in startling beneficial change in livestock, pastures and forage quality.

The adoption of a single improvement practice, as phosphorus supply, introduces a series of considerations on the cost of the practice, the cost of additional winter maintenance and the necessity for higher returns to meet such costs. It is possible that the addition of such a practice may introduce a series of new problems. This seems to be the case at the Lufkin Laboratory.

Cattle production in the East Texas Timberlands has doubled since the Laboratory was established. There is a parallel between the stocking rate of the Laboratory and of the area. The Laboratory had 29 Hereford heifers and a bull in 1935. In 1956, the Laboratory had 155 cattle of all ages, including 100 cows of breeding age. Several forces were involved in the increase in numbers. Cattle prices show an almost continuous advance since 1935. The cattle fever tick was eradicated during 1936-38, which permitted

*Respectively, superintendent, East Texas Pasture Laboratory, Lufkin, Texas, and professor, Department of Animal Husbandry, College Station, Texas.

[1]Numbers in parenthesis refer to literature cited.

the introduction of improved British beef breeds. Brahman blood for cross-breeding became available. Pastures were developed through clearing, phosphatic fertilization, seeding and mowing. Winter maintenance feeding received attention.

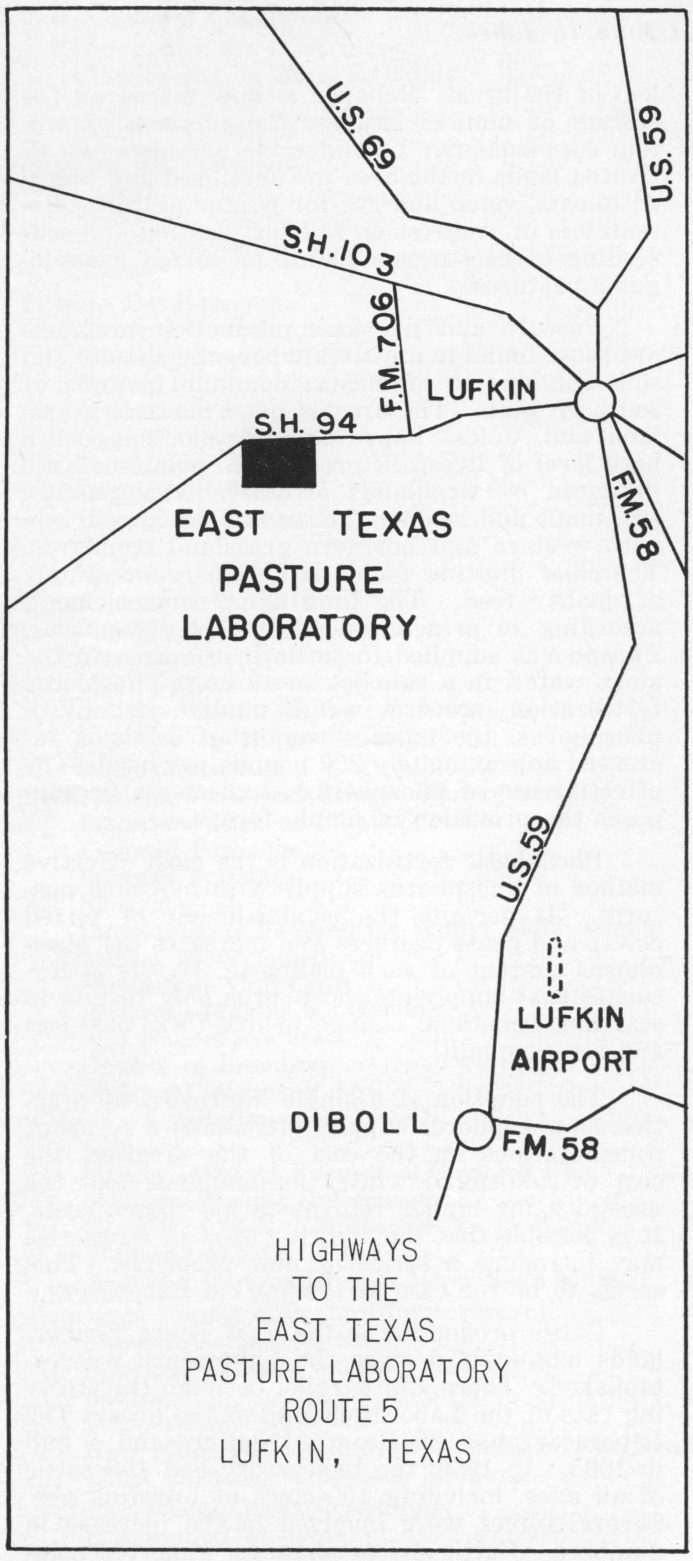


Figure 1. Location of East Texas Pasture Laboratory in relation to the highways.

Developments in both pastures and cattle were concurrent.

The Laboratory pastures are now well developed. The restricted acreage directs attention to vertical expansion. This becomes possible through greater feed production, increased numbers, improved breeding stock, larger calf crops and greater weaning weights. To produce more feed involves research on fertilizer rates, fast-growing, cool-season plants and supplemental irrigation. Perhaps part of the improved pasture land on the Laboratory should be turned to tilled feed crops, such as corn or sorghum hybrids for grain and to forage sorghums for roughage production.

ENVIRONMENTAL CONDITIONS

What Is the Location?

The East Texas Pasture Laboratory, known locally as the "Lufkin Station," is 6 miles southwest of Lufkin on State Highway 94, Figure 1. It is in the region identified as the East Texas Timberlands and, more specifically, is in the pine-hardwood belt of the Forested Coastal Plain. The latitude is 31° 23" North and the longitude is 94° 50" West.

What Is the Climate and Its Effect on Cattle?

The average growing season is about 240 days, with a possible range of 166 to 299 days. The average date of first killing frost is November 6; the range is October 8 to December 7. The average date of the last killing frost is March 10; the range is February 2 to April 25. The January daily temperature averages 50° and the July average is 84°. The historical extremes are 110° and -4° F. The mean of relative humidity is 82 percent. A temperature of 100°, therefore, may cause cattle more distress than 110° in higher, drier climates; likewise, lows of 20° chill cattle to a greater extent than weather several degrees colder where the air is drier. For example, tips of the ears and tails of baby calves have frozen and sloughed off following lows of 15° to 20° F.

The average daily wind movement by months ranges from about 1½ miles per hour in July, August and September to 5½ miles per hour for March. Extremes range from a high of 20 miles to 0.3 mile per hour. The prevailing direction of the wind is south to southeast from March through October and north from November through February.

The days are about equally divided among clear, cloudy and partly-cloudy. In winter, the sun may be obscured for 2 to 3 weeks at a time. Often during protracted cloudy, chilly weather, cattle drink little water and impactions may result if the feed is not laxative.

The 24-year average annual rainfall during 1934-57 was 48.44 inches, with extremes of 28.96 inches in 1954 to 71.08 inches in 1946, Table 1.

TABLE 1. INCHES OF RAINFALL BY YEARS AND MONTHS AT THE EAST TEXAS PASTURE LABORATORY

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1934	4.94	2.98	5.74	4.61	2.46	.40	1.29	.37	5.69	.50	7.44	6.66	43.08
1935	2.96	3.01	2.47	6.20	23.28	2.70	3.51	1.19	1.94	3.01	5.33	5.11	60.71
1936	1.53	2.27	1.56	2.47	5.40	1.28	6.39	4.13	1.49	3.36	3.89	4.74	38.51
1937	8.61	2.14	4.08	2.12	1.28	5.25	1.78	3.74	6.72	4.28	7.79	5.34	53.13
1938	5.38	2.57	5.96	5.66	1.96	4.40	4.94	1.81	1.75	1.60	5.56	2.90	44.49
1939	8.77	6.41	2.49	2.05	2.56	2.30	1.98	3.06	1.09	2.06	5.16	10.72	48.65
1940	1.13	6.36	.63	7.02	5.61	4.44	3.36	4.12	4.31	3.62	14.65	7.71	62.97
1941	3.40	5.01	4.23	3.77	5.89	10.26	5.60	1.40	6.60	9.84	3.57	3.17	62.74
1942	1.53	2.10	2.36	5.43	4.86	5.01	.61	3.96	2.36	.32	3.29	3.57	35.40
1943	3.74	.87	2.94	.79	3.90	1.60	6.49	2.43	2.05	1.50	3.50	5.64	35.45
1944	7.00	2.83	4.87	2.94	14.97	2.57	1.95	6.25	1.44	.01	8.39	9.80	63.02
1945	4.17	3.79	4.47	4.38	5.52	5.70	2.81	4.87	3.66	5.82	2.16	3.97	51.32
1946	8.43	9.98	7.53	4.10	7.98	5.21	2.25	6.29	2.28	3.17	10.12	3.81	71.08
1947	7.22	2.32	4.84	1.74	7.33	4.31	.36	1.47	1.45	.89	5.89	4.40	42.22
1948	4.00	5.17	2.76	6.37	2.54	1.91	2.02	2.87	3.02	.47	6.56	2.50	39.99
1949	6.22	2.69	5.65	5.51	2.91	3.44	1.59	5.46	5.24	13.32	.39	7.17	59.59
1950	7.86	7.40	1.84	3.08	12.24	6.74	2.96	2.45	6.70	.73	.94	1.59	54.53
1951	2.79	2.93	5.86	.70	1.49	4.74	2.39	1.45	7.81	.74	2.01	3.47	36.38
1952	2.15	4.76	3.31	6.26	8.44	.87	3.68	1.50	.23	.00	7.98	4.77	43.95
1953	3.30	4.26	4.47	8.76	8.19	3.98	7.75	1.36	2.40	3.07	2.18	5.37	55.09
1954	2.36	.92	1.04	3.76	6.58	.13	2.36	.90	.22	4.94	3.50	2.25	28.96
1955	3.68	4.43	1.71	4.77	5.52	1.41	2.42	9.02	3.67	2.23	.95	3.05	42.86
1956	3.27	6.00	2.37	4.68	3.51	2.75	.68	1.40	.53	1.96	3.10	1.52	31.77
1957	3.06	2.93	5.62	8.74	2.47	4.24	1.39	1.09	5.34	11.04	8.08	2.78	56.78
Total	107.50	94.13	88.80	105.91	146.89	85.44	70.56	72.60	77.99	78.48	122.43	112.01	1162.67
Average	4.48	3.92	3.70	4.41	6.12	3.56	2.94	3.03	3.25	3.27	5.10	4.67	48.44

The longest period of dry years was from October 1950 through 1956, with only 1953 above normal. The average for these years was 39.84 inches. The cattle raiser stocked for normally high rainfall can be hurt seriously by below-normal conditions. A drop from 50 to 25 inches in a high rainfall belt is equally or more severe than a drop from 20 inches to 10 inches in the drier areas.

Excessive rainfall, as about 60 inches per year, hampers work and drainage becomes a problem on bottomland pastures. Cattle also are less thrifty in the wetter years. Most cattle producers characterize the climate as favorable to high yields of pasture during the growing season, but consider the winters difficult because forages do not cure satisfactorily and feed requirements are high because of wet and chilly weather. Summer heat often is depressing on the British breeds of beef cattle.

The Laboratory maintains daily rainfall and temperature records, Figure 2.

What Are the Soils on the Laboratory?

Three soil types occur on the Laboratory land. Lufkin and Caddo soils are on the upland and Bibb soils on the bottomland.

The bottomland is a silt loam and fine sandy loam, while the upland is fine sandy loam and very fine sandy loam. Chemical analyses of the upland soils are shown in Table 2. The average topsoil and the average subsoil were low in nitrogen, phosphorus and potash.

The Laboratory elevation varies from 220 to 270 feet within a distance of 1 mile. The topography is uneven, ranging from nearly flat to undulating, Figure 3. This partly explains the irregular shape and the small size of fields in the area.

The uneveness of the land and the broken nature of the surface make large-scale cattle operations difficult. In establishing improved pasture, it is expensive to prepare the land for the use of mowing equipment. The disturbed soil is subject to severe erosion. Very wet upland soil without a good sod is boggy for cattle. The heavier bottomland soils offer more support even though poorly drained. These gray sandy soils, although low in fertility, respond well to fertilization. They are not sticky when wet and there is no trouble in cattle from caked mud between the toes and mud balls on the tails.

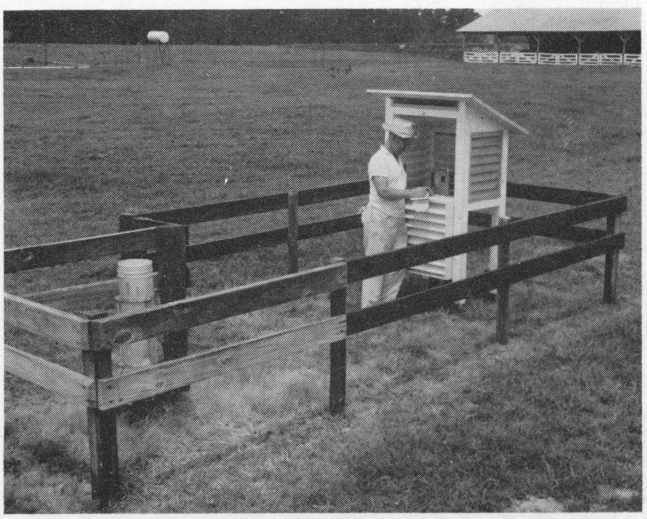


Figure 2. Temperature and rainfall records are kept at the East Texas Pasture Laboratory.

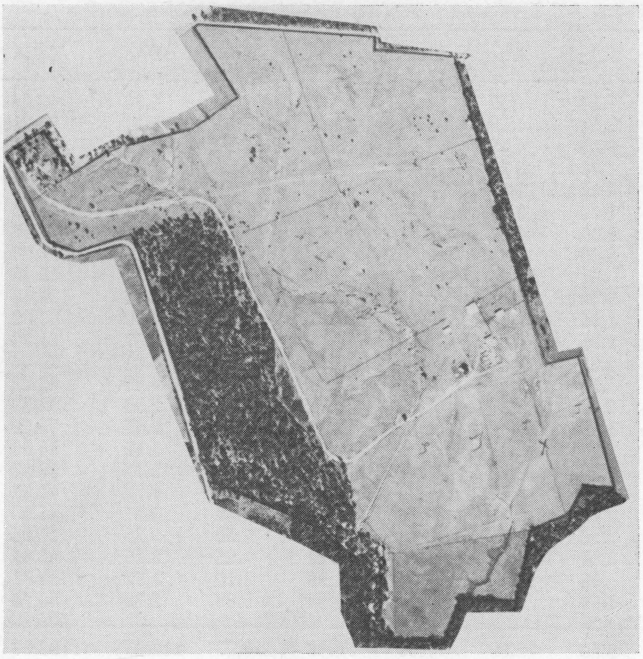


Figure 3. Aerial photo of the East Texas Pasture Laboratory, 211 acres, showing timbered and cleared areas and principal avenues of drainage. Scale approximately 1 inch = 1,320 feet.

The Lufkin and Caddo upland soils were sampled before fertilization. Chemical analyses are shown in Table 2. The sample of top soil was up to 7 inches deep and the subsoil from 7 to 19 inches. The analyses were completed by the State Chemist, Texas Agricultural Experiment Station.

TABLE 2. CHEMICAL ANALYSIS OF UNFERTILIZED UPLAND SOIL

Soil description	Nitrogen, percent	Parts per million		pH
		Active P_2O_5	K_2O	
Lufkin VFSL— top soil	.033	15.0	56	5.26
Lufkin VFSL— subsoil	.015	13.5	41	5.07
Lufkin VFSL— slope phase, top soil	.031	14.0	59	4.90
Lufkin VFSL— slope phase, subsoil	.031	14.0	69	5.11
Average Lufkin VFSL	.028	14.1	56	5.08
Caddo FSL— top soil	.028	19.0	64	5.56
Caddo FSL— subsoil	.012	16.0	190	6.14
Caddo FSL— slope phase, top soil	.025	31.0	90	5.77
Caddo FSL— slope phase, subsoil	.015	19.0	237	6.04
Average Caddo FSL	.020	21.2	145	5.88
Average of the 4 top soils	.029	20.0	67	5.37
Average of the 4 subsoils	.018	15.0	134	5.59

The Lufkin and Caddo soils were similar in percentage of nitrogen, but the Caddo soil had higher values for phosphoric acid and potassium oxide.

What Is the Native Vegetation?

The climax vegetative cover is timber, Figure 4. The trees may reach a height of 100 feet or more. Pines predominate, with oaks second. Most of the pine is merchantable as logs, poles, pulp wood and fence posts. Many of the oaks are salable for lumber and posts. Before the 1941 clearing, most of the pines were short-leaf with some loblolly and a few long-leaf. There were several species of oaks — red, white, water, post and others, with red oaks predominating. There were scattered sweet gum, elm and hickory.

Under these were smaller trees, such as dogwood, holly, mulberry, sassafras and catalpa. Below these, brush such as yaupon, Spanish mulberry and myrtle, were found. Grass and weeds occurred where the canopy of timber permitted. Species of the genera *Uniola, Sporobolus* and *Panicum* were the most numerous of the grasses present.

The grasses growing under or in the timber are sparse and weak for cattle production. Little browse is afforded by the brush and young timber, even in the spring. Oak acorns are of little value for cattle. Twenty-five to 100 acres of timberland may be required per cow.

PHYSICAL IMPROVEMENTS

Since an object of this publication is to present some practical information on production problems, necessary improvements are considered.

What About Fencing Problems?

The first cost of cattle fencing in the area is high because of numerous gullies and water courses and the necessity for building many water gaps. Post holes are easy to dig in the gray sand, but corner and gate posts are difficult to anchor. The heavier gauge galvanized wire is needed to resist corrosion. A fence, 44 to 46 inches high with three to five strands of barbed wire with posts 20 feet apart and three 1½ x 1½-inch creosoted stays between posts, is satisfactory, Figure 5. Electric fencing is satisfactory for temporary use and for use where no serious damage is done if it fails to hold the cattle.

The maintenance of fencing is expensive. Good wire lasts, but posts, unless treated, are short-lived. Home-produced split oak posts will rot at ground level after 3 or 4 years. Cedar posts from Central and West Texas may last 8 to 10 years. Pine posts treated with creosote or penta-chlorophenol will last 15 to 25 years. Pine posts, pressure-treated with creosote, in use since 1939, remain sound after 19 years. Treating is recommended at least for all corner and gate posts used in permanent fences because these posts are the foundation of the fence.

What About Stock Water?

The cattle are supplied with water in troughs. They seldom drink at potholes in the creeks or at the ponds. Small troughs, about 15 inches deep and 40 inches in diameter, or an equivalent capacity in a square trough, are preferred because small troughs may be drained and cleaned quickly, and fresh water moves in more rapidly.

With 20 to 40 pounds pressure on a 1-inch supply line, a good many cattle can water satisfactorily even with a small trough, Figure 6.

An 80-foot well capable of producing only 150 to 200 gallons of water per hour, but augmented with a large storage tank, was used for a number of years. This system was sufficient for 200 cattle, but there was little protection in case of a pump breakdown or the loss of storage water from a broken line. When this well became polluted by corral drainage, a 250-foot well of 750 gallons per hour capacity was provided. This water has the following analysis:

Alkalinity, as calcium carbonate	216 ppm
Sulfate, as SO_4	350 ppm
Chloride, as Cl	18 ppm
Hardness, as calcium carbonate	26 ppm

What Are the Needs for Shelter?

Barns and sheds for overnight shelter are available for practically all the cattle in case of severe ice storms. These buildings also are used for supplementary feeding in winter and for the protection of young calves and sick or crippled stock, Figure 7.

If left alone, the cows seem to prefer heavy timber for shelter. There have been few occasions when the cattle left the timber voluntarily for the sheds. These occurred when it was raining and freezing and trees were falling from the ice load. There seems to be less danger of colds and pneumonia where the cattle use the timber instead of the sheds, Figure 8.

Mineral and salt boxes are sheltered, as shown in Figure 9. They are placed in the fence line between pastures near the watering trough. The boxes are low for the convenience of the calves.

What Are the Needs for Shade?

In a timbered region, pastures rarely are without natural shade and both Hereford and Brahman x Hereford crosses will use it, Figure 10. Dense shade does not seem to be desirable because it may harbor parasites. Ticks, for example, are seldom found on cattle in open pastures, but they nearly always are present in timbered pastures in spite of eradication efforts.

Hereford cattle on creek bottom pasture without shade were observed for several years. Shades were built, Figure 11, to relieve the marked distress shown on hot, sultry days.

Figure 4. A typical stand of young timber on the Laboratory, 1941.

PASTURE DEVELOPMENTS

The Laboratory has had research on pasture development since its establishment. At that time, sparse patches of Bermudagrass, the bluestems, carpetgrass and common lespedeza were present in old field areas. There was a sparse growth of piney woods grasses among the timber. After 23 years of pasture development and continuous use, Bermuda and Dallis grasses and white and hop clovers provided 80 to 90 percent of the pasture forage. Carpetgrass and crimson clover provided most of the remainder. Numerous plants continue under trial. The principal pasture features of the Laboratory are shown in Figure 12. Improvements were made gradually.

What Are the General Considerations?

In most cases, land for pasture improvement is purchased with the merchantable timber removed. Several courses may be followed in clearing the remaining timber from the land. The low-first-cost, but slow, method is to deaden the timber and gradually establish the pasture. A high-first-cost, but rapid, course is to bulldoze, pile and burn the refuse. By the latter method, clearing, plowing, seeding and fertilizing may be done in a few weeks; the former method may take

Figure 5. The fence in the foreground is satisfactory and should last many years. Supplemental sprinkler irrigation has been used on a small test pasture since 1956. Ponds are available for irrigation water.

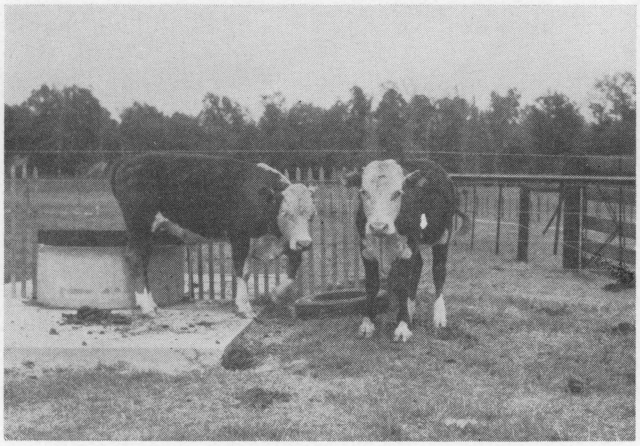


Figure 6. Concrete water trough and apron serving two small pastures. Note the use of paling to shield the barbed wire fence and the auto tire which holds a rubber pan for salt.

years. Numerous compromises are possible between the two extremes. Land in this area cleared and ready for pasture improvement will cost about $80 per acre, location not considered.

What Are the Principal Steps and Costs?

The Laboratory began clearing in 1941 on timbered upland which had been logged to an 8-inch stump about 1920. All merchantable timber was cut and sold, at approximately $11.00 per thousand-board-foot-stumpage, realizing about $35 per acre. The unmerchantable growth was removed gradually within the next 4 years and leveling was done as necessary for the use of grassland-type farming implements. It is estimated that these costs were covered by the $35 per acre received from the sale of the merchantable timber.

How Were the Upland Pastures Developed?

The area was gradually cleared during 1941-46 and Bermuda, Dallis and carpet grasses and white and hop clovers were established in spots. This natural sodding resulted because livestock grazing the acreage had the joint use of an adjacent bottomland pasture already established with these plants. The cattle also were wintered on the area and were fed hay from the bottomland pasture. Seedings were made in the old "burns" of brush and some fertility was gained through the supplemental feeding of cottonseed cake during the winters.

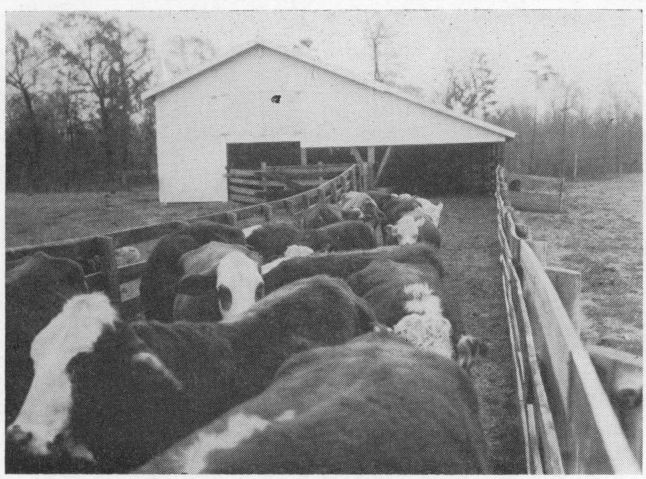


Figure 7. Cows leaving the feed and shelter shed.

Fertilizer was first applied in 1947 when superphosphate was used at the rate of 100 pounds of phosphoric acid per acre. There was no general seeding until 1950 when white, hop and crimson clovers and common ryegrass were sowed. Fertilizer applications and seeding, with estimated costs, are shown in Table 3. There was no fertilization during 1948-49. The annual cost of fertilizers, seed and labor since 1950 has averaged $12.54 per acre. The maintenance cost is estimated at $8 to $10 per year for pasture expected to produce 175 to 225 pounds of calf weight per acre. This is based on 1,100-pound cows, allowed 1½ to 2 acres per head, a 75 percent calf crop weaned at 450 to 500 pounds per calf, a 1 percent death loss and 10 years of productive life per cow.

When the $8 to $10 pasture-maintenance cost is added to the supplemental feed cost, the annual cost per acre approximates $25, which is considered about 50 percent of the total out-of-the-pocket expense and corresponds with the costs shown in Table 11.

How Were the Bottomland Pastures Developed?

The bottomland had been in cultivation when the Laboratory area was occupied in 1934, Figure 13. Persimmon sprouts were grubbed and the land was disked to smooth out the old crop rows and crayfish mounds. Ditches with well-sloped banks were cut to improve drainage.

First seedings, composed of Bermuda, carpet, Dallis, rye and rescue grasses; white, hop and other clovers; common, Kobe and other lespedezas, were made without fertilization. It became obvious that fertilization was necessary, and in the spring of 1935, an application was made of 4-8-4 at the rate of 200 pounds per acre. Sod formation was slow and total yield of the forage was light in 1935.

Superphosphate was applied in 1936 at the rate of 100 pounds of phosphoric acid per acre. The response of clover, especially white and hop, was good, and the grass cover was improved. The application of superphosphate was repeated in 1937. Although 200 pounds of phosphoric acid in 2 years was believed to be more than needed, response to the phosphate was good during 1938-42.

The pastures reached a peak in 1940, and the young Hereford cows living off this forage matured at an average weight of about 1,100 pounds, Figure 14. The dry cows became fat, averaging above 1,300 pounds. With no fertilization after 1937 and heavy grazing, the pastures began declining in 1942. By 1944, the clovers and Ber-

muda and Dallis grasses had nearly disappeared, being replaced by carpet grass. However, this decline in the quality of grazing had not caused a decline in cattle thrift.

By 1947, it was apparent that the pastures should be renovated. The sod was broken, a good seedbed was prepared, working in 1,000 pounds per acre of 5-10-5 and seedings of white clover, Dallis and carpet grasses, and common lespedeza were made. The pastures made a quick response to this renovation, except that the clover stand and growth never became as good as in 1940.

These bottomland pastures are estimated to have produced more pounds of calf gain per year than the upland since 1947 when fertilization began on the upland and comparisons became possible. The soil has been conditioned longer on the bottomland, which may account for most of the difference.

This creek-bottom land has its advantages and disadvantages compared with the adjacent upland for cattle. Most of the natural timber cover usually is unmerchantable hardwoods and, therefore, not as valuable as the pine timber usually found on the upland. The soil generally is richer in its natural state. Cattle are not as apt to bog completely in extreme wet weather. Forage on the bottomland will withstand short periods of drouth better than on upland, but if the drouth is prolonged, the situation is reversed. In the summer, particularly on hot, sultry days, the cattle prefer the upland. Here, there usually is some wind movement, whereas often in the bottom there is none, and the cattle become distressingly hot.

Forage Plants Tried

While Bermuda and Dallis grasses, white and hop clovers furnish the principal pasture at the Laboratory, other forage plants have been tried.

Has Coastal Bermuda Been Tried?

Patches of Coastal Bermudagrass have been established on both upland and bottomland soils for several years. Under heavy and continuous grazing and moderate fertilization, it has not spread, but within its established acreage it seems to be aggressive, keeping weeds and other grasses out. It seems to be more productive and more noticeable in the wetter growing seasons. Cattle do not graze it more severely than the surrounding vegetation.

If it were given more fertilizer and if not subjected to continuous and close grazing, it might spread. Whether the additional potential production would justify the extra expense has not been determined.

What Other Grasses Have Been Tried?

Buffelgrass failed when planted in the sod and in a prepared seedbed in the improved pasture, when subjected to grazing from the start. When planted on a prepared seedbed and protected from grazing and from other plants by cultivation, it survived and made fair growth. Perhaps it should be handled like Sudangrass or other temporary pasture plants.

Figure 8. "Pine sapling thicket" on the Laboratory, which is a favorite shelter of the cattle in winter.

KR Bluestem was seeded in 1950 on a prepared and fertilized seedbed. When subjected to grazing and competition with the established pasture plants, it disappeared.

Blue Panicgrass was tried at the same time and in the same manner as KR Bluestem and also disappeared.

Of the fescues, Kentucky 31 and Alta were tried and behaved similarly. Stands were easy to obtain, survival was good the first winter and growth was comparable with common ryegrass. However, they did not survive the summer with deferred grazing. These fescues had no apparent advantage over common ryegrass since they did not show the perennial characteristic. The only serious trouble from foot rot among the cattle was in 1953, coincident with the only pasture-wide planting of the fescues.

What About the Lespedezas?

It has been impossible to maintain lespedeza in competition with white and hop clovers. In the early stages of pasture development, lespe-

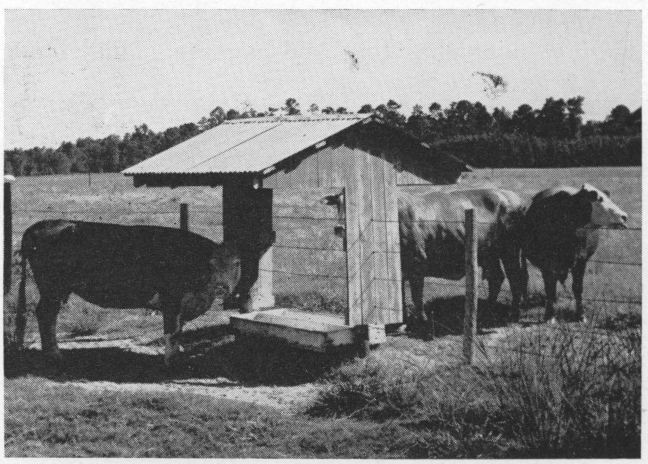


Figure 9. A mixture of 2 parts bone meal and 1 part salt is supplied in a sheltered trough placed near the water trough.

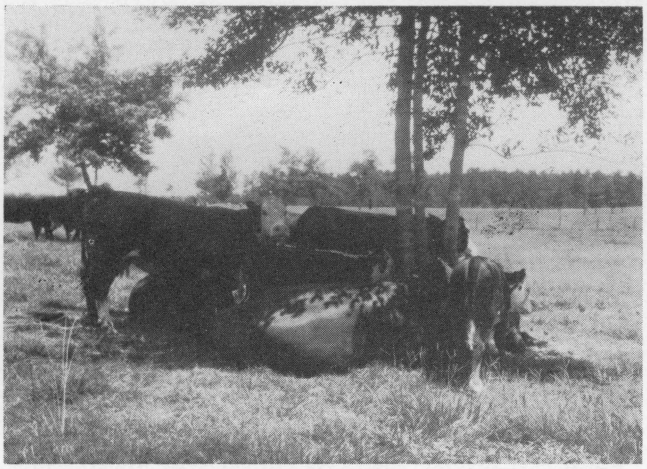


Figure 10. Cattle around natural shade in upland pasture.

deza furnished valuable summer feed. Common Kobe, Korean, Tennessee 76 and Sericea lespedezas were tried. Of these, common and Kobe remained in competition with the clovers and grasses longer than the others.

What About Temporary Winter Pasture?

Results from planting cool-season grasses and legumes in the fall on a prepared seedbed have been unsatisfactory for temporary winter pasture. The rainy winters wash the sandy, plowed soil before the cool-season plants establish a satisfactory cover. Also, with no sod to hold them up, cattle will cut-up the pasture and even bog down. Seeding the cool-season plants by drilling in the pasture sod has been more satisfactory than seeding on plowed land.

What About Temporary Summer Pasture?

Crops like Sudan and Pearl millet have been tried under dryland conditions. They have not produced enough pasture to justify the extra expense and labor. As with temporary winter pastures, there is danger of serious erosion when the sod is broken in preparing a seedbed.

What About Silage?

Trench silos were used during 1937-40 for ensiling sugar cane tops and bagasse. This silage and cottonseed hulls, on the basis of dry weight, had near equal value for wintering cows. Sweet sorghum was later grown for silage, but despite the growth of green manure crops and the use of commercial fertilizers, sorghum yields declined and the silage crop was discontinued. It was impossible to maintain trench silo walls in the deep sandy soil without concrete construction. It requires much less labor to feed baled hay, low in moisture, to a small group of cows than to hand-feed silage, high in moisture.

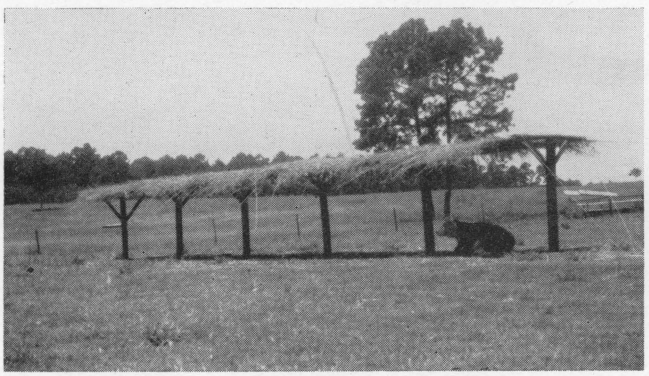


Figure 11. Net wire and switch cane shade, 8 by 60 feet, in bottomland pasture. The length is east and west.

What Is the Source of Hay Fed During Winter?

Hay is obtained by deferring grazing on the pastures. Year-after-year use of the same piece of grassland for hay presents the problem of maintaining the desired plants. It is believed that some grazing is required to hold the better species in a permanant sod.

What Yield of Hay Is Expected?

The usual stocking rate approximates 2 cows to 3 acres. The production in 45-pound bales during 1951-57 from an average of 18 acres was:

1951 - 1,100 bales	36.38 inches rainfall
1952 - 2,300 bales	43.95 inches rainfall
1953 - 7,800 bales	55.09 inches rainfall
1954 - 881 bales	28.96 inches rainfall
1955 - 2,879 bales	42.86 inches rainfall
1956 - 1,192 bales	31.77 inches rainfall
1957 - 3,203 bales	56.78 inches rainfall
Average - 2,765 bales	42.26 inches, or 6.18 inches below the 24-year average.

The yield of hay depends on the amount and seasonal distribution of rainfall. In good years, two cuttings, one in late spring and another in early fall, may be harvested. The quality of the hay depends largely on weather conditions at haying time. High quality hay with green color is rare.

Do Losses Occur from Poisonous Plants?

Few losses in the area may be attributed to poisonous plants. Two heifers were lost in a timbered area during the first years of establishment. Plant poisoning was suspected and a few wild cherry trees and some water hemlock, both of which are considered poisonous, were located. It is doubtful if native cattle, even though starved, will eat any of the few poisonous plants. Cattle new to the region may eat enough of such plants to become poisoned, even if not starved.

There apparently is some danger during the summer and fall in pastures where Dallisgrass predominates. Two bulls were lost in September of different years in a pasture where the Dallisgrass was infested with ergot, Figure 15. The cause of death could not be defined, but Dallisgrass was suspected and the pasture was mowed before it was grazed again.

There have been no losses from the sorghums, but the common cautions are observed in pasturing the small spots of Johnsongrass which occur in the bottomland pastures. Death losses from all causes approximate 1 percent per year.

Are Cattle Rotated on the Pastures?

Rotation is practiced to the extent permitted by the limited number of pastures. With a heavy concentration of cattle, perhaps the ideal rotation would be to give the cattle fresh grazing daily. But this becomes difficult, especially with the pasture breeding of several herds. It is doubtful if electric cross-fences would serve; therefore, many permanent-type cross-fences would be required.

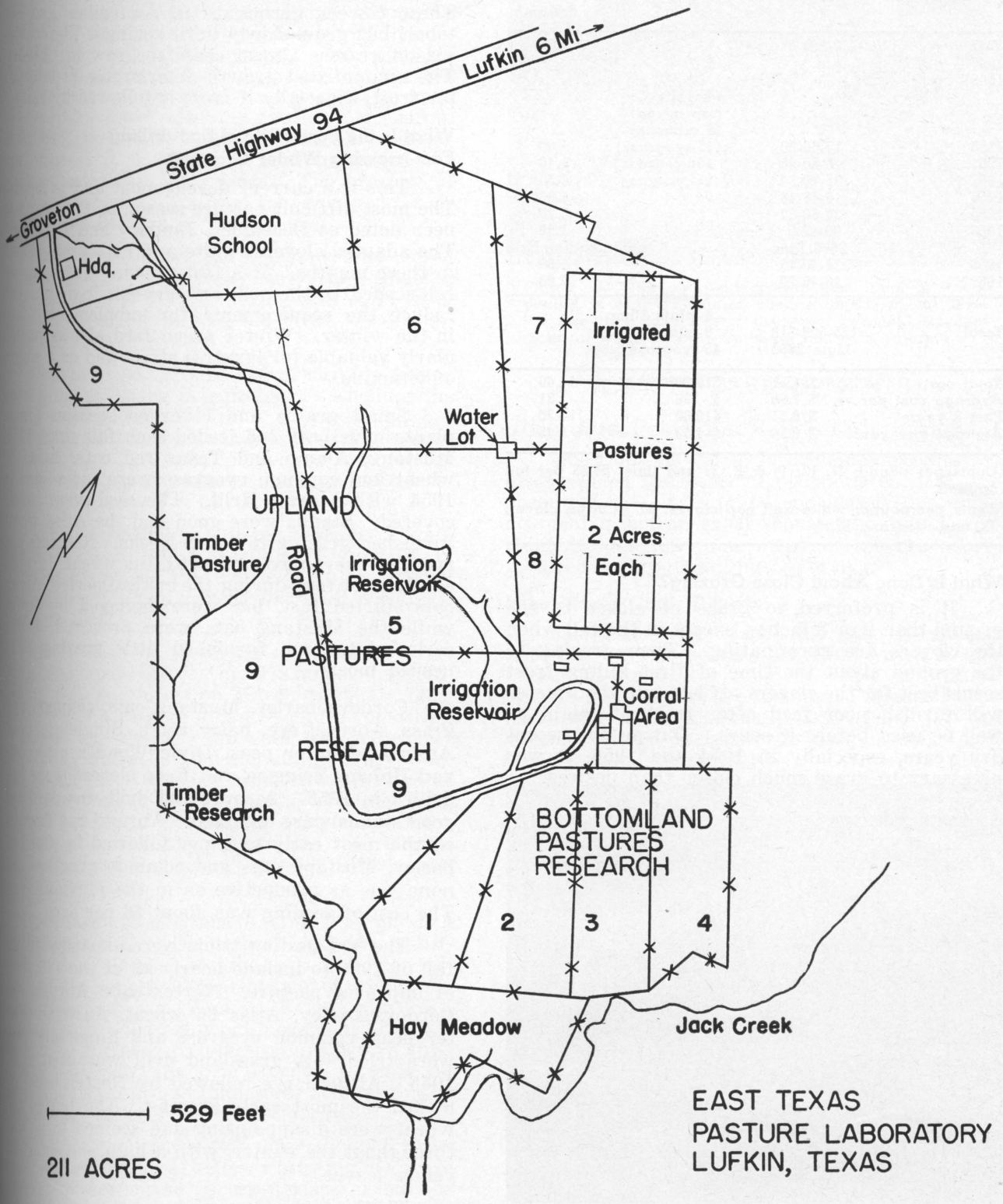


Figure 12. The East Texas Pasture Laboratory, 6 miles west of Lufkin in Angelina county. Beef cattle and pasture management investigations are conducted on mowable, fertilized pastures. The principal studies concern the year-round supply of feed and factors affecting beef calf production. Hereford and Brahman-Hereford crosses are used.

TABLE 3. FERTILIZATION AND SEEDING OF UPLAND CLEARED FOR PASTURE, 1947-57

Year	Fertilizer, N-P-K, pounds per acre	Seed, pounds per acre	Estimated labor and equipment cost per acre, dollars
1947	0-100-0		1.20
1948			
1949		(4-white & hop mixed) (8 crimson)	
1950	15-60-60	(15-ryegrass)	1.30
1951	15-60-60	15-ryegrass	1.40
1952	35-60-60	15-ryegrass	1.50
1953	0-48-48		1.60
1954	30-60-30		1.70
1955	20-40-0		1.80
	2660 lime		not including lime
1956	20-40-40		1.90
1957	40-40-20		2.00
Total	175-508-318 Lime 2660	4-white & hop 8-crimson 45-ryegrass	
Total cost	$84.51[1]	$10.60[2]	14.40
Average cost per yr.	$ 7.68	$ .96	1.31
Past 8 years	$76.51	$10.60	13.20
Average per year	$ 9.56	$ 1.33	1.65

[1]Cents per pound: N, 12; P, 8; K, 5; and lime, $5.25 per ton applied.

[2]Cents per pound; white and hop clover, 60, crimson clover, 35, and ryegrass, 12.

What Is Done About Close Grazing?

It is preferred to graze no closer to the ground than 2 or 3 inches, except in the fall when the clovers are germinating. Then grazing to the ground about the time of first killing frost seems best for the clovers. If left tall, the grasses will furnish poor feed after frost. It might as well be used before it sours. During the recent dry years, especially in 1954 and 1956, it was necessary to graze much closer than desired.

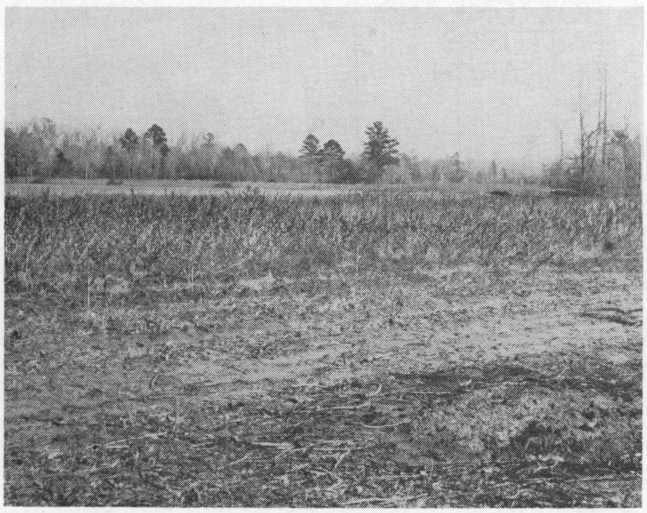


Figure 13. The old field creek-bottom land as it appeared when pasture improvement began in 1934. Compare this with Figure 14.

What Is the Most Critical Period for Pastures?

December, January and February are the critical months for pastures. This is the gap between the pasture supplied by the warm-season plants and the growth to grazing height of the cool-season plants, such as white and hop clovers. These clovers germinate in September and October, but grow slowly until spring. The warm-season grasses almost cease to grow in October. The accumulated growth deteriorates rapidly after frost, especially if frost is followed by rains.

What Is the Possibility of Sod-drilling Fast-growing Winter Grasses?

This is a current development and is logical. The most difficult pasture season of the year has been noted as December, January and February. The adapted clovers, white and hop, grow slowly in these months. If a fast-growing grass can be fall-seeded in the sod, any growth it makes will reduce the requirements for supplemental feed in the winter. Winter green feed also is particularly valuable for laxative effect and as a source of vitamins.

Small grains and other cool-season forage plants have been sod-seeded each fall since 1954. Mustang, Alamo and Texas red oats, Atlas 66 wheat and common ryegrass were sod-seeded in 1954 with a grain drill. The seed were barely covered. Stands were good and the Atlas wheat furnished grazing in a few weeks. Red oats and ryegrass were next and, with the wheat, furnished the most feed during the critical period. Alamo oats started fast, but were damaged by frosts, while the Mustang oats were prostrate during early winter and furnished little grazing when needed most.

Cordova barley, Mustang oats, common ryegrass, Abruzzi rye, hairy vetch, Singletary peas, Austrian Winter peas, Dixie Wonder peas, oats and Hubam, crimson and Rose clovers were fall-drilled in 1955. A grassland drill was used and good stands were obtained. Abruzzi rye furnished the most early grazing, followed by Cordova barley, Mustang oats and common ryegrass, but none was as productive as in the previous year. The cost of seeding was about $6 per acre.

The sod-seeding trials were expanded in the fall of 1956 to include nearly all of the 143 acres of improved pasture. Nortex oats, Abruzzi rye, Cordova barley, Atlas 66 wheat, Austrian Winter peas, common ryegrass and Singletary peas were tried. A grassland drill was used as in 1955. Abruzzi rye followed by Nortex oats furnished the most early grazing. The barley and wheat were disappointing and seemed to be sick throughout the winter, with a high percentage of yellow leaves.

The best plant to use has not been fully determined, but the results for 3 years indicate Abruzzi rye is the most reliable.

What Use Is Made of Surplus Growth in the Spring?

Spring surpluses are the rule, but do not occur every year. In using improved pastures with breeding cattle, it is difficult to maintain a balance between numbers and forage production. This is because of seasonal differences in forage production and the fixed capacity of the cattle. Obviously, management does not permit stocking the number of breeding cattle necessary to consume an abundance of spring growth nor can the stocking rate be based on the scant production during winter. Moving cattle off a pasture as it becomes closely grazed usually is impractical, but if it is closely grazed too often the stocking rate must be reduced. The practice of holding pasture in reserve for emergencies is questionable because of the expense.

Management attempts a compromise based principally on the summer carrying capacity. This results in a varying spring and early summer surplus of forage and the provision of supplemental feed in winter.

How to make the best use of surplus forage growth in the spring is a problem. Ensiling the spring grasses and clovers is a possibility, but has not been attempted. Hay is difficult to cure in the spring. The usual procedure is to let the growth stand until summer, despite a loss in quality, then harvest it as baled hay.

Another method of using surplus spring growth is to buy light yearlings, Figure 16, in late winter and sell them after a 90 to 100-day grazing period. This method was tried with good results in 1954.

Thirty head of Hereford steer calves averaging 363 pounds and costing $18.50 per hundredweight were purchased on March 3, 1954. They were allowed a 21-acre upland pasture consisting of grasses and clovers, but were fed, principally hay, until grazing became abundant. They were sold June 1 for $18.50 per hundredweight and at an average weight of 530 pounds. The net gain was 167 pounds in 88 days, or 1.9 pounds daily. The acre-gain was 238 pounds and the returns, less hauling and feed costs, were $22.45 per steer and $32 per acre.

This result is mentioned as an example of a possibility. Cattle of the desired kind may be difficult to buy. It may be necessary to buy in advance of the supply of grazing and if so supplementary feeding is necessary. Selling may be a problem in that the prinicpal movement of stocker cattle to northern pastures occurs before June 1. The yearlings cannot be expected to make an appreciable gain in less than 90 to 100 days. The pasture surplus may be overestimated.

Another recourse is to winter calves for the use of spring pastures. Here wintering costs are involved, however, the spring demand usually is strong for short yearlings. A part of the Laboratory's 1957 calf crop was saved for investigation of this method of management.

Figure 14. The old field creek-bottom land as it appeared in May 1940 after pasture improvement. Note the size and condition of the cows and the excellent stand of white clover. Compare this with Figure 13.

CATTLE DEVELOPMENTS

Disorders, Pests and Related Management

Questions on cattle disorders and pests are discussed on the basis of accumulated data and observations. It is to be considered that management is not an exact science and that judgement factors determine many of the procedures involved in day-to-day husbandry.

What About Cattle Disorders?

The Laboratory has been heavily stocked with cattle for 23 years. There have been no outbreaks of contagious diseases, such as anthrax or pink-eye. Calves are vaccinated against blackleg, using a blackleg-malignant edema type of vaccine. Mixed bacterin was used in calf vacci-

Figure 15. Registered Hereford bull, 5 years old. Died in the night, September 1955, from an unknown cause while on Dallisgrass pasture.

nation for several years but was discontinued. Eye trouble has occurred that might have been called "pink-eye," but there have been no serious outbreaks. There was an outbreak of "pink-eye" among the goat herd in 1944, but it did not spread to the cattle. Watering at the eyes has occurred in the summers, mostly among the Hereford cows, but occasionally among the Brahman-Hereford crosses. There have been three cases of cancer-eye among the Hereford cows.

Frequent tests have never shown evidence of tuberculosis or brucellosis disease; however, calfhood vaccination for brucellosis has been practiced since 1955.

White and hop clovers are abundant in the spring, but there have been no observed cases of bloat serious enough to require treatment. Except for one young cow found dead on clover pasture in 1954, there have been no deaths that could be attributed to this disorder. The first case of photosensitization was noted in the spring of 1957. There has been little trouble from foot-rot except in 1953 when the pasture contained a considerable amount of fescue. Mastitis became rather serious at one time, but, after discarding the milking tube and reducing to a minimum the milking-out of large-teated cows, the trouble has almost disappeared.

There is danger in the spring from excessive bleeding following dehorning. The cause is not determined although the clovers may be involved. At any rate, surgical procedures should be avoided, or, if they become necessary, they should be done carefully, Figure 17.

The practice is to dehorn in the spring the steer and heifer calves, but calves saved for bulls are not dehorned. If the horns are soft, they are cut off smooth with the head with a knife and seared with a Franklin-type dehorning iron. If the horns are too hard for the knife, a Barnes-type dehorner or saw is used. This work is done when the calves are 2 to 3 months old, therefore, the knife usually is the only cutting instrument needed. Searing should leave a peanut-brown colored burn over the whole horn button base and into the surrounding hair. After searing, a fly repellent is applied.

This method of dehorning does not permit shaping to give a pointed poll, but, because of the danger of excessive bleeding, cutting is held to a minimum. Calves with Brahman breeding usually have a large horn base which requires a large, deep cut, if pointing is tried. Searing is done to stop bleeding and to kill any horn tissue missed by the cutting instrument. Scurs and other malformed horns seem to stem mainly from failure to sear long enough.

Impaction may occur during winter if green feed is not available or if the supplementary feeds do not have some laxative effect. With cows calving in the spring, the lush growth increases milk flow to such an extent that enlarged teats and broken-down udders often result. This happens too often with good producing cows. The feet wear slowly on the soft sod and small pastures where only a minimum of walking is necessary. This requires foot trimming for some individuals.

Other unexplained disorders occur. Some seem to be connected with digestion. Cows frequently go "off feed" for several days and lose weight, but finally recover without treatment. Occasionally calves are unthrifty when conditions appear favorable. Cows, mostly the Herefords, may fail to shed their hair in the spring, even though in good condition. The hair on their calves may become long and harsh, despite enough condition to warrant a soft coat.

The principal unexplained disorders are connected with calving. Too many cows are difficult to settle and are late breeders, and too many calves are born dead or weak. There are too many retained after-births with resulting loss of weight, thrift, milk production and often the weaning of a stunted calf. The problem is obscure, since in the same herd and on the same pastures

Figure 16. Stocker steers pastured in the spring of 1954.

other cows are thrifty and produce strong calves. These troubles as they relate to the percentage calf crop will be discussed later.

What About External Parasites?

Screwworms, spinose ear ticks, Lone Star ticks, heel flies, mosquitoes, horn flies, stable flies, the horse and deer flies, buffalo gnats and lice occur. These pests are troublesome, but may be controlled by four or five sprayings per year with available insecticides. Lone Star ticks, most flies and mosquitoes have been held in check with very little extra handling of the cattle. Usually the cattle are sprayed only when being penned and worked for some other reason.

Spinose ear ticks continue to be a problem despite treatment each time the infestation is general enough to justify handling.

Buffalo gnats have not become a problem, but they have been noted during unseasonally warm, wet weather in late winter and spring.

The screwworm problem has not been severe. Most of the screwworm cases occur in the drier periods. Heel flies have caused little disturbance and few warbles are found in the backs of the cattle during the fall and winter.

Ticks, including the Long Star tick, may infest cattle heavily under certain conditions. Long-haired cattle just brought into the area suffer most from heavy infestations, Figure 18. Cattle production in this section developed rapidly after the eradication of the cattle fever tick during 1937-40.

What About Internal Parasites?

Fecal examinations show that the cattle harbor the stomachworm and other intestinal parasites. The corrective procedure is to provide good nutrition for the cattle and, where indicated, to use therapeutic medication. The heavy rate of stocking largely prevents the use of pasture rotation sufficient for parasite control.

Young cows, suckled down thin, occasionally develop stomachworm infection—as scours, watery swelling under the jaw or "bottlejaw" and a cottony appearance of gums and eyelids. Fecal examinations usually show a heavy infestation of internal parasites. Most of the cattle so affected will respond to additional feed and drenching with phenothiazine.

Periodic drenching, spring and fall, was undertaken in 1946 to determine if the generally thrifty herd could be made more thrifty. This practice was discontinued after 2 years since the results did not seem to justify the expense.

The first serious trouble with stomachworms in cattle did not occur until the summer of 1957 with 30 2-year old non-native Hereford steers. These steers had been confined for more than a year on 24 acres of permanent pasture. Other cattle also were used in the pasture as necessary

Figure 17. A calf dead from excessive bleeding after dehorning in the late spring. The blood would not clot.

to accomplish close grazing. About one-third of the pasture received supplemental irrigation and heavy applications of fertilizer.

The steers made low gains through the growing season, but the home-grown cattle made an average gain. The four most severely affected steers failed to respond to repeated drenchings with phenothiazine, but were saved after treatment with the copper-nicotine sulfate drench and full drylot feeding.

Sheep and goats kept during 1934-46 were drenched routinely, but death loss occurred despite treatments.

A study was begun in 1951 to determine whether internal parasites might be inhibiting

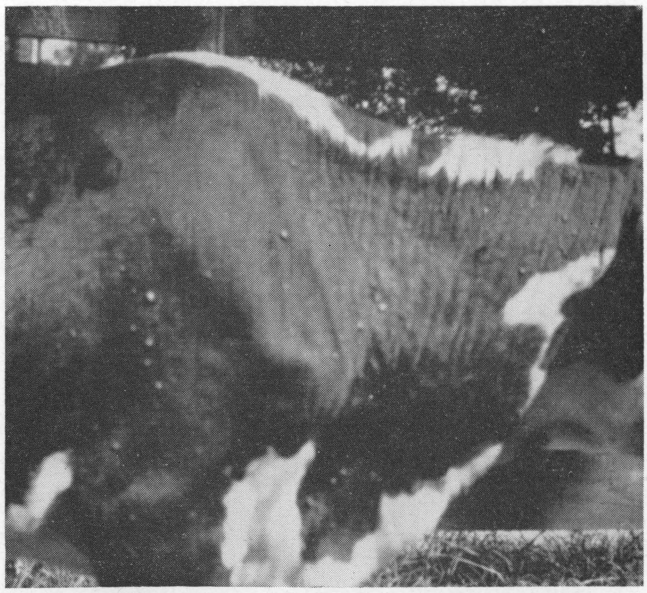


Figure 18. A Hereford heifer heavily infested with hard ticks at the Laboratory in 1936, prior to the eradication of the cattle fever tick.

Figure 19. Phenothiazine-treated calves at the end of the test, September 10, 1956. Average daily gain 1.70 pounds.

the growth of 3 to 7-months-old nursing calves. Three groups of calves were used the first 2 years. One group received 1 gram of phenothiazine daily; another received 1 ounce per 100 pounds live weight every 3 weeks. The third group was not treated. Daily dosing was discontinued after 3 years, but the control group and the group dosed at 3-week-intervals were continued.

Nine to 11 calves were used in each group. Each year the calves were divided into the treatment groups as evenly as possible according to breeding, sex, weight and mothering ability of the dams, Figures 19 and 20. Fecal counts were taken monthly and part of the calves were slaughtered for examination of the intestinal tract. The results are shown in Table 4.

Calves apparently are thrifty and make good gains without worming as long as the milk supply is good and there is good grazing for the mothers. Both fecal and intestinal tract counts of worms and worm eggs indicate some control from the treatments with phenothiazine. Calf gains, however, failed to reflect beneficial effect. Dosing at intervals of 3 weeks and daily dosing accomplished near equal control. The work is being continued since it is necessary to watch for internal parasites each year. Only 2 of the 7 years in the study were above average in rainfall and heavier infestations are expected in wet than in dry years.

What About the Use of Minerals?

The Laboratory practice is to supply a mixture of 2 parts feeding bone meal and 1 part granulated salt as a free choice lick, Figure 9. The use of this mixture is based on continued observations since 1935 and research reported in 1926 by H. Schmidt (7). This research was in an area deficient in phosphorus. The supply of bone meal-salt licks is not necessarily a solution to mineral problems, but is a good practice according to present information.

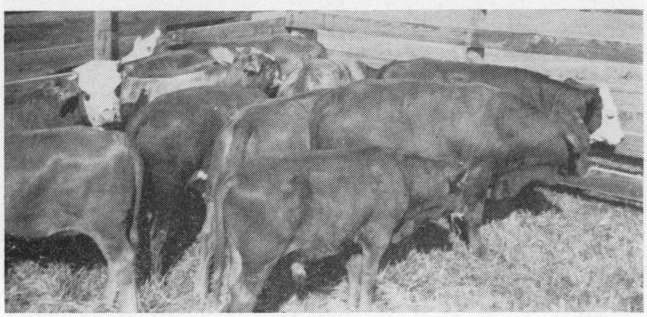


Figure 20. Untreated calves at the end of test, September 10, 1956. Average daily gain 1.83 pounds.

TABLE 4. DAILY GAINS IN POUNDS FOR NURSING CALVES DOSED WITH PHENOTHIAZINE

Year	Daily treatment	3-week treatment	No treatment
1951	1.70	1.97	1.85
1952	2.25	2.02	2.17
1953	1.97	1.95	1.91
1954	None	1.85	1.80
1955	None	1.74	1.90
1956	None	1.70	1.83
1957	None	1.89	2.08
Average	1.97	1.87	1.93
Average, first 3 years	1.97	1.98	1.98

The first work with cattle at the Laboratory concerned mineral deficiencies. Treatment groups of five Hereford heifers each were force-fed copper, cobalt, iron and bone meal in comparison with a check group receiving salt only as a lick. The heifers were drenched daily with a solution of the copper, cobalt and iron. Bone meal was fed by spoon. All had salt as a lick and the treatments were for 1 year. Weight response favored the copper group over the controls by 42 pounds per head. The treatments were continued using the same cattle with their first calves at side. There were no differences among the groups when the calves were weaned, however, with the treatment transferred from the cows to the calves through the first winter after weaning, Figure 21, the calves receiving copper had an advantage of 24 pounds per head. The limited results were not significant and the treatments could not be continued because of the calf crop failure in 1938. In this period, the group receiving bone meal raised more calves and an analysis of the pasture forage indicated a deficiency of phosphorus. Comparisons were made later between sources of phosphorus.

An inorganic source of phosphorus, dicalcium phosphate, was compared with bone meal, an organic source, in mixtures with salt, self-fed as licks. The defluorinated dicalcium phosphate salt lick was unpalatable and was discontinued as a means of phosphorus supply.

Later bone meal, salt and a 2-to-1 mixture of bone meal and salt were supplied in separate mineral boxes. In this trial, the straight bone meal was largely ignored, but approximately equal amounts of salt were consumed whether mixed or unmixed with bone meal. Although the cattle did not seem to crave the bone meal at any time, the practice of supplying breeding cattle

with bone meal and salt as a lick near the water troughs has been continued. This was done to be sure of an adequate intake of phosphorus at all times. Basically, the practice considers that mature pasture forage and weathered forage may be low in minerals. The pastures were fertilized with superphosphate and supplementary cottonseed cake was fed during the winter. Cottonseed cake is a source of phosphorus and phosphate in the soil increases the phosphorus content of the vegetation (2). While it is believed the Laboratory cattle receive ample intakes of phosphorus, bone meal is supplied for insurance. There is no evidence of any deficiencies, yet the place of trace minerals in the nutrition of the Laboratory cattle should be investigated further.

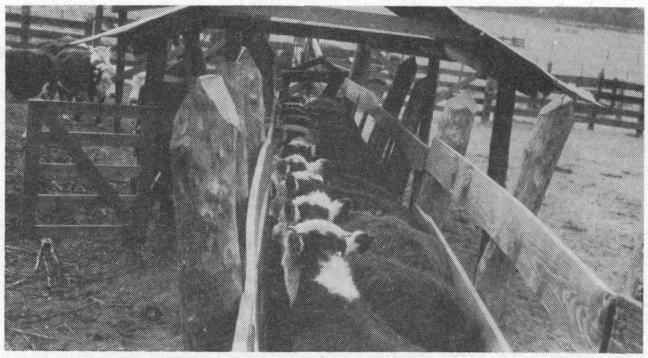


Figure 21. Calves lined in chute for daily dosage of minerals, December 1937.

What About Winter Maintenance Feeding?

Winter maintenance feeding is an important problem in the East Texas Timberlands and at the Laboratory. Table 5 shows the principal information on the supplemental or winter maintenance feeding of beef cows during 1946-56, or for 11 seasons. Records are available during 1934-45, but are less applicable. The 11 seasons cover both good and poor pasture seasons and both high and low feed costs. Feeding records are kept on all other cattle, such as replacement heifers and bulls, but are not shown. The records for the cows, the largest and most important group, show the principal factors in winter maintenance feeding. The data apply to an intensive operation.

The 11-year average supplemental allowance of roughage, Table 5, was 5.6 pounds of roughage and 2.49 pounds of concentrates daily per 1,038-pound cow for 132 and 120 days, respectively. At values of $15 (approximately cost per ton of Laboratory-produced hay) and $70 per ton, respectively, for roughage and concentrates, there is an expense of $16 per cow per winter. The 1,000-pound live weight units in replacement heifers and herd bulls receive approximately one-third more feed than is fed per 1,000 pound of cow weight. This increases the maintenance cost to approximately $20 per year per 1,000 pounds of herd weight and is within the range of the feed costs shown in Table 11.

The herd bulls are fed during the breeding season if necessary for the maintenance of breeding condition. The additional feed supplied the heifers is to permit early development for breeding as yearlings. If bred as yearlings, a weight of 600 pounds is desired by April 1. The first winter after weaning then becomes a critical development period and liberal feeding is necessary.

The allowance of $70 per ton for concentrates, mostly 41 percent protein cottonseed cake,

TABLE 5. SUPPLEMENTAL FEEDING OF COWS 1946-47 TO 1956-57, 11 WINTER SEASONS

Item	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	Average
	— — — — — — — Averages in pounds per head unless otherwise noted — — — — — — —											
Number of cows	35	36	30	48	49	70	63	76	86	92	83	64
Initial weight, Nov. 1	959	911	976	1016	1116	1084	1191	1134	1137	1200	1154	1080
Final weight, April 1	824	879	915	1012	1007	1050	1051	1021	1065	1084	1051	996
Weight loss	135	32	61	4	109	34	140	113	72	116	103	84
Calves born during wintering period	19	3	17	12	29	44	57	59	49	52	62	37
Weight of calves, April 1	110	163	130	184	147	140	164	182	150	161	186	158
Gain or loss per cow with calf	—74	—18	10	42	—22	54	9	28	13	—25	36	8
Start of feeding												
Roughage	11/20	11/11	11/13	12/22	12/1	11/15	10/14	12/2	9/7	11/5	10/22	11/9
Concentrates	11/20	11/11	11/13	12/22	12/1	12/1	10/14	11/21	11/7	12/1	11/3	11/18
End of feeding												
Roughage	3/22	3/22	3/16	3/15	3/31	3/31	3/11	3/24	3/12	3/31	3/15	3/21
Concentrates	3/22	3/22	3/16	3/15	3/31	3/31	3/11	3/24	3/12	3/31	2/14	3/18
Days roughages fed	122	132	123	83	121	137	148	112	186	146	144	132
Days concentrates fed	122	132	123	83	121	122	148	123	125	121	103	120
Daily:												
Cottonseed meal or cake		1.89	2.06	2.34	1.29	.62	.76	1.64	1.61	1.31	1.24	1.34
Other concentrates	3.00			2.34		2.26	1.68	.36	1.81	1.25		1.15
Station grass hay	11.4	7.6	5.7	11.8	12.2	9.06	7.22	8.23	8.13	5.00	2.40	4.1
Other hays or roughage		6.0	4.8						1.00		4.50	1.5
Mineral lick[1], oz.	1.23	.75	.88	.37	.83	.50	.48	.46	.50	.56	.53	.54

[1]Two parts bone meal and 1 part salt.

is conservative. The principal part of the roughage fed was grass hay produced on the Laboratory. Had more hay been produced, perhaps more would have been fed. Some producers in the area allow much greater winter weight losses than the Laboratory, but it is believed that the rates of feeding shown in Table 5 are conservative.

While on pasture, the cattle had access to shelter and the feeds were supplied under shelter, Figures 7 and 22, to avoid waste during rain. The feeding was done according to need and only to supplement the pastures. More feed was used in bad than in fair weather. The older, weaker or more timid cows also received preferential treatment.

The data in Table 5 do not determine optimum levels of supplementary feeding nor the weights at which cows should be maintained, but represent a judgement of conditions.

The cow herd shows the same average weight at the start of supplemental feeding in mid-November as at the close in March if the weights of the calves are included. Without the calves, the average supplemental feeding period weight loss was 84 pounds per head. This does not reveal the complete situation regarding weight variations during the supplemental feeding period. There is evidence of poor milk flow and failure to re-breed after severe weight losses. When to increase feed to halt severe losses is determined by the apparent strength of the individuals rather than by the pounds or percentage of maximum body weight that may have been lost. It is recognized that big cows, fat in the fall, may be allowed to lose a large amount of weight. Thin, small cows have little weight to lose. Strong flesh at the outset of winter reduces winter feed costs, particularly for cows 5 to 9 years old.

Figure 22. Winter maintenance feeding of cows. The feed troughs are sheltered. The hay rack is made of peeled pine poles over the troughs. Very little hay is wasted where the hay is rationed. Each cow is allowed about 30 inches of trough length.

The differences among years in beginning and ending dates of supplemental feeding result from pasture conditions — a reflection of the weather. It was necessary to begin roughage feeding as early as September 7, 1954 because of extreme summer drouth. On the other hand, the late start of feeding in 1949, December 22, was possible because of late frost. The average beginning date of fall roughage feeding was November 9, or slightly past the average date of first killing frost, November 6. The earliest discontinuance of concentrate feeding was February 14, 1957. The weather was favorable for plant growth in January and the pastures had been sod-seeded with small grains in the fall of 1956.

The 11-year summary of supplemental feeding for winter maintenance indicates a requirement equivalent to 700 pounds of roughage and 300 pounds of concentrates per 1,000-pound cow; approximately 400 pounds of concentrates and 925 pounds of roughage were required for herd bulls and weaned heifer calves being developed for breeding purposes. These amounts could be varied, depending on the cost of concentrates and the price and quality of the available roughage, to get the most economical ration. However, the amount of roughage indicated is believed to be near the minimum under existing pasture conditions.

The principal feeds used have been grass hay and cottonseed meal or cake, but other feeds were tried.

A 24.5 percent protein cube containing urea and peanut hulls was tried in 1946-47, but it was not palatable. Twenty-one percent protein range pellets were tried. Converted rice bran, containing 25 percent pulverized limestone, was used as part of the feed for 3 winters. Meat scrap meal was used as a source of protein in 1953-54. Molasses and molasses containing urea, ground ear corn and ground sorghum grain also were tried.

In a 96-day test, November 24, 1954 to February 28, 1955, with urea used to replace one-third of the protein allowance, the urea group of 12 cows made an average gain of .81 pound daily, as compared with 1.18 pounds for the comparable group which did not receive urea.

An attempt is made to produce the winter requirements of hay from the pastures. It was necessary to buy additional roughage in 4 of the 11 years. Cottonseed hulls and ground corn cobs have been used; also a small amount of alfalfa hay for feeding weakened animals. Hay from the pastures is composed mainly of Burmuda, Dallis and carpet grasses, with the first cutting containing some clover. Because of the adverse climatic factors, it has been difficult to cure bright forage retaining some green color for hay. A shortage of hay of good quality is typical of the area and, as a result, the wintering cost is excessive.

Mineral consumption was higher in the winter of 1946-47 than in the following years. The herd weight loss was high and cattle losing weight on pasture tend to consume large amounts of salt. It is not clear whether the increased consumption is a result of general hunger or idleness. The application of superphosphate was increased in the following years, Table 3, and any possible need for phosphorus should have been lessened as a result of the fertilization.

A constant increase in numbers and weights of cows wintered without an increase in acreage or in the average amount of supplemental feed is shown in Table 5. This has been largely a result of heavier fertilization since 1951-52 and occurred despite protracted drouth starting in 1950 and becoming critical in 1954 and 1956. These data apply to an intensive operation rather than to a more extensive one in which summer-grown pasture forage may supply winter needs on the pasture with the cattle doing the harvesting. Under intensive conditions, supplemental winter feeding forms a large part of the annual operating expenses. At the Laboratory, this cost is approximately $20 per year per 1,000 pounds of live weight maintained.

Breeding Management

Unexplained disorders, principally associated with breeding, were mentioned in the preceding discussion. The calf crops produced and the breeding management involved are presented.

What Is the Percentage Calf Crop?

The average of 21 calf crops from the first, in 1937, through 1957, is 76.6 percent dropped and 70.6 percent weaned, Table 6. This is considered about the normal percentage for the region, taking in all types of cattle raising operations—favorable and unfavorable—for calving. On the Laboratory, with most everything appearing favorable, it is believed that the total weaned should be about 20 percent greater. The pastures are highly fertilized with nitrogen, phosphorus, potash and lime and grazing consists mainly of plants considered among the best for the region: Bermuda and Dallis grasses and white and hop clovers. The pastures are small and the cows and bulls are kept in a strong condition in winter, and often get fat in summer. They are never allowed to become weak because of feed shortage. When pasture is scarce, as in winter, supplemental feed is provided.

Two Laboratory practices not conducive to high rates of conception are single-sire breeding herds and a controlled breeding season. The bulls are with the cows about 4 months, usually from April 1 to August 1. There would be more calves if the bulls were with the cows all year. Year-round breeding is the most common practice in the region. The Laboratory tried this for 2 seasons and increased the percentage calf crop, as shown in Table 7, but the increase was mainly in summer calves. These summer calves were decidedly inferior and the practice was stopped. It was preferred to let the slow-breeding cows miss a summer calf and get back to earlier calving.

The use of more than one bull should increase the number of calves. This is suggested unless it is necessary to know the sire of each calf.

There have been more hard-to-settle cows among the Herefords than among the Brahman

TABLE 6. CALVING RECORD, 1937-57

Year	Cows eligible,	Known abortions		Calves dropped		Dry cows		Calves dead or weak at birth			Calves dead from other causes before weaning			Calves weaned			Calving season
	No.	No.	%	No.	%	No.	%	No.	%[1]	%[2]	No.	%[1]	%[2]	No.	%[1]	%[2]	
1937	27	2	7.4	24	88.9	1	3.7	4	16.7	14.8	2	8.3	7.4	18	75.0	66.7	Mar to Aug
1938	26	0	0	7	26.9	19	73.1	1	14.3	3.8	0	0	0	6	85.7	23.1	April to Oct
1939	23	0	0	13	56.5	10	43.5	0	0	0	0	0	0	13	100.0	56.5	Dec to April
1940	27	0	0	21	77.8	6	22.2	1	4.8	3.7	1	4.8	3.7	19	90.4	70.4	Oct '39 to June '40
1941	26	0	0	22	84.6	4	15.4	0	0	0	1	4.5	3.8	21	95.5	80.8	Jan to Nov
1942	25	0	0	24	96.0	1	4.0	2	8.3	8.0	0	0	0	22	91.7	88.0	July to Nov
1943	27	0	0	6	22.2	21	77.8	0	0	0	0	0	0	6	100.0	22.2	May to Aug
1944	37	0	0	29	78.4	8	21.6	0	0	0	0	0	0	29	100.0	78.4	May to Aug
1945	40	0	0	18	45.0	22	55.0	0	0	0	0	0	0	18	100.0	45.0	Mar to Aug
1946	26	0	0	20	76.9	6	23.1	1	5.0	3.8	0	0	0	19	96.2	73.1	Feb to Nov
1947	35	1	2.9	29	82.9	5	17.1	0	0	0	1	3.4	2.9	28	96.6	80.0	Dec '46 to Aug '47
1948	40	0	0	30	75.0	10	25.0	4	13.3	10.0	1	3.3	2.5	25	83.4	60.0	Dec '47 to Jun '48
1949	60	0	0	52	86.7	8	13.3	4	7.7	6.7	0	0	0	48	92.3	80.0	Feb to Jun
1950	56	0	0	38	67.9	18	32.1	0	0	0	0	0	0	38	100.0	67.9	Jan to May
1951	52	0	0	36	69.2	16	30.8	2	5.6	3.8	0	0	0	34	94.4	65.4	Jan to May
1952	57	0	0	49	86.0	8	14.0	2	4.1	3.5	0	0	0	47	95.9	82.5	Dec '51 to May '52
1953	74	0	0	57	77.0	17	23.0	4	7.0	5.4	0	0	0	53	93.0	71.6	Dec '52 to Apr '53
1954	77	0	0	72	93.5	5	6.5	6	8.3	7.8	0	0	0	66	91.7	85.7	Nov '53 to Sept '54
1955	84	0	0	81	96.4	3	3.6	8	9.9	9.5	0	0	0	73	90.1	86.9	Nov '54 to Oct '55
1956	98	0	0	71	72.4	27	27.6	8	11.3	8.2	0	0	0	63	88.7	64.3	Nov '55 to Jun '56
1957	88	0	0	71	80.7	17	19.3	7	9.0	8.0	0	0	0	64	91.0	72.7	Oct '56 to May '57
21 yrs.	1005	3	.3	770	76.6	232	23.1	54	7.0	5.4	6	.8	.6	710	92.2	70.6	

[1] Of calves dropped.
[2] Of cows eligible.

x Hereford crosses. In instances, the bulls used, both Brahman and Hereford, failed to settle cows. Routine testing of semen has shown very little infertility among the Brahman and Brahman x Hereford cross bulls used in recent years.

The percentage calf crop would probably be increased by using Brahman x Hereford crosses entirely instead of using both Herefords and crossbreds. Some advantage also might be gained in using Herefords raised in the area.

Two groups of Hereford females have been brought in as weaned calves, the first from Martin county in 1934 and the second from Llano county in 1946. At the time it was not possible to buy Hereford females raised in the region that had the required quality and uniformity. No Brahman females have been used. The Brahman crosses have resulted from the use of Brahman bulls. The trend in the area now is toward the use of British or British x Brahman bulls on cows carrying varying amounts of Brahman blood.

Before the pastures were improved, cows with calves at side usually failed to settle until the calves were weaned. This tendency has not been so noticeable the past 8 or 10 years. With cows failing to settle while nursing calves for 6 or 7 months, they cannot calve oftener than every other year, if breeding is controlled for a seasonal 3 to 4-month calving span. This probably explains why the most common practice in the region is to keep the bulls out the year-round. The other extreme is to keep the bulls with the cows from April 1 to August 1. This, as stated, is the Laboratory practice. Other cattlemen keep the bulls away from the cows only during September, October, November and December, and, by this means, avoid summer calves.

Table 6 shows that, in 21 calf crops, about 70 of 100 cows weaned calves. The range was from 23 cows in 1938 and 1943 to 89 in 1956. Among the 30 cows per 100 that did not wean calves, 24 failed to settle; the other 6 calved normally, but the calves at birth were either dead or weak and soon died.

The hard-to-settle cows usually follow about the same pattern each year. They come in heat and accept the bull for one or two periods after April 1, when the bulls are first put out. Then such cows are quiet through the last of May, all of June and part of July, thus giving the appearance of being safely with calf. During the latter part of July, they again come in heat. A few settle, but most do not.

Among the 5 to 6 percent of the cows producing the calves that die at birth, or shortly thereafter, most of the calves are hydrocephalus or "water-headed." Only a few of these may be readily detected. In most of the cases, the brain cavity has to be opened to detect this abnormality. Other cattle raisers in the region seldom complain of stillborn or weak-at-birth calves. A recent genealogical analysis of the birth records of the 54 dead or weak calves in the 21 calf crops indicates strongly that heredity is involved, even though many have been crossbred calves. The percentage of abnormalities has tended to increase in the past few years. A study is to be continued to determine if heredity is the cause. If it is, all individuals involved may be sold for slaughter. If it is not, the search into the environment for other factors that might be the cause of the trouble will be continued.

The 23 percent of cows difficult to settle is the main factor contributing to the low percentage calf crop. It seems reasonable that this is caused by environment, but there may be a connection between the cause of the hard-to-settle cows and that of the cows giving birth to dead or weak calves. If it is a nutritional deficiency, it has not prevented the breeding cattle from reaching good weight and size at maturity; the calves produced also are satisfactory. This is the illogical aspect: the cows appear to be well nourished yet many do not calve as well-nourished cows should. Some producers who see the herd nearly every year, but usually in spring or summer, believe the cows get too fat for good breeding condition. It is agreed that breeding cattle that become fat and remain so for long periods, such as highly fitted show cattle, may have their fertility jeopardized.

What Months Are Preferred for Calving?

The best months for calving have been January, February and March with the average date falling in the first half of February. The cows calving in January usually continue to give plenty of milk until the grass rises in March, Figure 23. Cows seem to be easier to settle in breeding for January to April calves because the first

TABLE 7. CALF CROP—4-MONTH VERSUS 9-MONTH BREEDING SEASON

Year	Cows bred	Regular breeding season, April 1 to August 1		Post-season breeding ending January 1		Total	
		Dropped	Weaned	Dropped	Weaned	Dropped	Weaned
		Percent					
1951	52	69.2	65.4	No breeding		69.2	65.4
1952	57	86.0	82.5	"		86.0	82.5
1953	74	77.0	71.6	"		77.0	71.6
1954	77	84.5	77.0	9.0	9.0	93.5	85.7
1955	84	73.8	66.7	22.6	20.2	96.4	86.9

half of the breeding season occurs in April and May when the pastures are at their best and the cows are gaining rapidly.

Cows calving in late March, April and May may have teat and udder trouble, whether light or heavy milkers, because of the lush pastures usually present. Calves dropped in October and November may become stunted even with an above average supply of feed for the cow. Creep feeding is not effective because of the age of the calves. Summer calves, or those dropped from June through September, have not been desirable.

The first Laboratory calf crop, in 1937, was dropped from March to June. At this time the pastures had not been developed. Several calves were weak and March weather was cold and wet. In following years the cows were bred to start calving in April. This avoided the bad weather, but there were too many summer calves and pastures declined in condition before breeding could be completed. Extending the breeding season from April 1 to January 1 was tried for the 1954-55 calf crops, Table 7. The calf crop was increased 9 percent in 1954 and 22.6 percent in 1955, but the summer calves resulting from fall breeding generally were unthrifty.

With an improved level of nutrition through continued pasture fertilization, the use of supplementary feeds and success in fall sod-seeding of cool-season plants, fall calving may develop. This is primarily because fall calves may reach good slaughter condition in June and the early market usually is favorable.

At What Age Are Heifers Bred?

All yearling heifers weighing over 600 pounds at the beginning of the breeding season, April 1, have been bred since 1952, Figure 24. All reaching this weight before the close of the breeding season on August 1 were placed in the breeding herd. Those not reaching the minimum weight were held over until the next season.

There has been little trouble in calving heifers as long as a bull known to sire calves small at birth was used. When a bull known to sire calves of average size was used, there was considerable trouble, with a high percentage of the heifers having to be helped, a few dead calves and one heifer lost.

Breeding the heifers as yearlings was tried in the hope of getting more consistent breeders. Before 1952, the plan of holding them until 2 years old seemed to result in too many barren cows. If they failed to breed as "twos" they usually became very fat as "threes" and often were difficult to settle, if settled at all. It is the practice to sell the first calves of the bred-as-yearling heifers at 2 to 3 months of age. This is done so that the young mothers will not be "suckled down" during the breeding season and, therefore, probably fail to breed back.

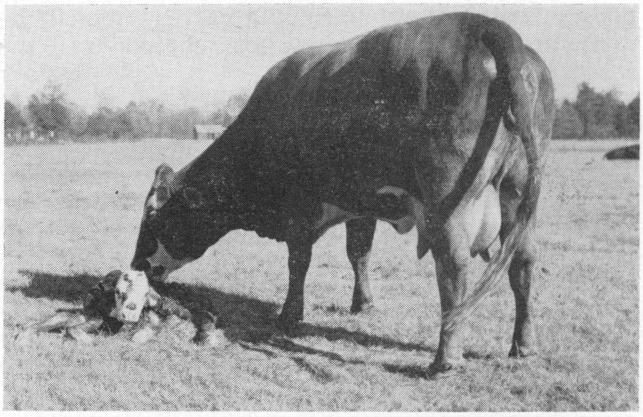


Figure 23. This calf, born December 20, may be a little too far from March grass; however, he has a better than average mother. October or November birth would have been too early for conditions prevailing on the Laboratory.

Since the practice of breeding the heifers as yearlings was begun, there have been fewer barren cows, but it is too early to determine if they will be more consistent breeders.

Despite the indication of fewer barren cows and the probability of more consistent breeding, these advantages may not offset the additional calving trouble and death loss expected when heifers are bred as yearlings. In breeding as yearlings, more special attention is required at calving.

Should Breeding Be Controlled?

If summer calves are not wanted, the bulls should be taken out in September, October and November. If fall calves are not desired, the bulls should be kept away from the cows until April 1. This leaves a 5-month breeding season of April, May, June, July and August.

Controlled breeding definitely lowers the percentage calf crop dropped. It is a matter of judgement whether to breed the year-round and approach a 100 percent calf crop, but have some unthrifty calves; or to control the breeding season and have fewer, but better calves.

Hot weather and the decline in pasture quality reduce the milk flow and the late calves make

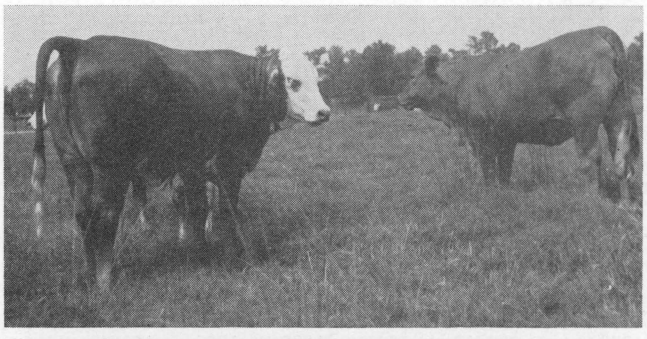


Figure 24. These crossbred Brahman-Hereford yearlings weighed well over 600 pounds at the beginning of the breeding season April 1 and, with their large frames, did not have difficulty calving.

poor growth. Cows with late calves seem to be difficult to settle and may not rebreed until the following spring.

What Is the Preferred Weaning Age?

The preferred practice is to wean at about 7 months of age. The variation, above and below the average, is 30 to 40 days. More calves are weaned on the Laboratory about October 1 than at any other time. There is a tendency to wean all except the very young calves at the same time to save labor in handling the cattle. October 1 is about the latest practicable date for weaning, if the cows are to be given a chance to gain some weight before winter.

While the younger calves may show greater weight per day of age than the older ones, it is suggested that earliness be given strong consideration in the selection of replacement heifers. This is done at the Laboratory partially because it is desired to have yearlings weighing 600 pounds on April 1 so that they can be bred.

Cattle Adaptation and Growth

In charting the development of both cattle and pastures, records have been kept of cattle weights by months. Samples of these data are presented in Table 8. These data are useful in planning pasture and cattle management.

TABLE 8. INDIVIDUAL COW WEIGHTS IN POUNDS, BY MONTHS, CALVING AND WEANING

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Av.	Calf weight at weaning
Cow No. 1—½ Brahman x ½ Hereford—14 calves in 14 breedings, all raised														
1941							Born	90	145	200	235	255		
1942	290	310	365	400	435	500	530	580	630	645	630	600	493	
1943	610	570	570	605	710	735	810	815	825	930	905	880	747	
1944	920	950	890[e]	725	775	765	885	850	885[w]	890	900	840	856	510
1945	855	865	905[e]	850	895	920	940	935	930[w]	955	930	920	908	390
1946	945	960[e]	770	845	930	940	925	990	980[w]	965	1025	1010	940	530
1947	1045	1040[e]	880	845	895	870	890	945	960[w]	960	900	945	931	530
1948	970	1000	1035	1015[e]	860	920	990	1010	985[w]	1020	1045	985	986	485
1949	1010	1050[e]	940	940	1020	1110	1155	1135	1100[w]	1130	1160	1195	1079	520
1950	1195	1220[e]	1120	1100	1100	1145	1160	1145	1135[w]	1150	1200	1215	1157	620
1951	1305	1225[e]	1070	1015	1030	1100	1110	1140	1140[w]	1155	1140	1120	1128	550
1952	1155[e]	1080	1030	1030	1050	1050	1115	1140	1205[w]	1190	1225	1260	1128	645
1953	1245	1225[e]	1215	1115	1080	1235	1200	1225	1280[w]	1230	1275	1265	1216	555
1954	1310[e]	1235	1090	1090	1115	1125	1185	1180	1205[w]	1200	1200	1185	1177	575
1955	1270[e]	1130	1050	1070	1135	1190	1245	1220	1230[w]	1220	1265	1270	1191	730
1956	1145[e]	1105	1100	1070	1125	1130	1130	1175[w]	1170	1155	1150	1135	1132	550
1957	1140	1150	1145	1195	[e]	1170	1130	1195	1190	1170	1155	1120[w]	1160	475
Av.[1]	1026	1007	948	932	944	994	1025	1042	1053	1060	1069	1059	1014	548
Cow No. 2—½ Brahman x ½ Hereford—13 calves in 14 breedings, all raised														
1941							Born	115	145	195	220	245		
1942	270	295	305	350	410	465	500	555	525	625	640	610	467	
1943	590	550	545	575	690	725	770	765	815	900	900	850	723	
1944	880	925	895	835[e]	815	905	905	905	915[w]	915	915	915	893	355
1945	885	900	905	865[e]	895	880	865	920	915[w]	950	940	940	905	400
1946	915	920	860	885[e]	852	870	965	975	960[w]	965	965	975	923	435
1947	960	910	855	780	780	865	935	1040	1115	1180	1185	1185	982	
1948	1130	1140[e]	1010	870	910	1015	1050	1090	1050[w]	1045	1125	1055	1041	565
1949	1080	1105[e]	975	870	965	1080	1130	1150	1120[w]	1140	1125	1180	1077	520
1950	1200	1180[e]	1090	1095	1090	1190	1170	1165	1145[w]	1160	1160	1170	1151	510
1951	1185	1060[e]	1040	975	1025	1110	1190	1145	1135[w]	1145	1175	1110	1108	515
1952	1115	1070[e]	1040	1020	1120	1150	1165	1215	1220[w]	1180	1200	1200	1141	670
1953	1155	1120[e]	1040	1040	1110	1175	1180	1155	1240[w]	1210	1235	1205	1155	565
1954	1205	1085[e]	1090	1070	1140	1075	1145	1140	1170[w]	1180	1145	1120	1130	610
1955	1200	1250	1025[e]	1030	1125	1140	1225	1210	1140[w]	1135	1185	1160	1152	640
1956	1155	1120	1040[e]	1040	1100	1115	1130	1130	1170[w]	1110	1090	1060	1105	560
1957	990[e]	940	890	910	1030	1080	1050	1080	1130[w]	1130	1135	1035	1033	485
Av.[1]	995	973	913	888	939	990	1023	1040	1048	1061	1070	1048	999	525
Cow No. 3—½ Brahman x ½ Hereford—13 calves in 14 breedings, 12 raised														
1941							Born	105	130	180	200	225		
1942	245	270	295	330	400	460	500	540	600	620	630	625	460	
1943	610	595	600	615	720	780	815	830	880	945	945	895	796	
1944	955	980	935	935[e]	880	850	905	900	910[w]	920	940	940	921	460
1945	905	940	950	920[e]	940	960	920	950	970[w]	970	980	1005	951	380
1946	990	950	930	1010[e]	865	925	925	950	1035[w]	1010	995	1010	966	425
1947	995	1005	1000	890	980	1055	1075	1170	1200	1290	1290	1270	1100	
1948	1250	1270	1315[e]	1040	1160	1090	1140	1155	1115[w]	1125	1165	1060	1157	495
1949	1150	1205[e]	1070	985	1090	1165	1235	1210	1200[w]	1190	1275	1295	1173	555
1950	1325	1340[e]	1210	1200	1210	1260	1280	1290	1275[w]	1310	1340	1340	1282	595
1951	1320[e]	1145	1200	1090	1145	1195	1235	1235	1220[w]	1235	1260	1205	1207	645
1952	1280[e]	1180	1170	1225	1320	1375	1445	1495	1550	1595	1570	1530	1395	[3]
1953	1490[e]	1390	1340	1295	1320	1365	1400	1410	1435[w]	1420	1405	1400	1389	540
1954	1400[e]	1300	1210	1210	1310	1290	1380	1360	1385[w]	1385	1400	1360	1299	450
1955	1410	1345[e]	1220	1255	1315	1315	1370	1390	1390[w]	1380	1415	1400	1350	695
1956	1405[e]	1265	1240	1240	1290	1330	1365	1395	1435[w]	1390	1385	1350	1341	635
1957	1310	1140[e]	1150	1175	1260	1295	1305	1285	1290[w]	1300	1300	1290	1258	500
Av.[1]	1128	1083	1052	1026	1075	1107	1143	1160	1181	1193	1206	1186	1128	531

TABLE 8. INDIVIDUAL COW WEIGHTS IN POUNDS, BY MONTHS, CALVING AND WEANING (continued)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Av.	Calf weight at weaning
Cow No. 4—½ Brahman x ½ Hereford—12 calves in 14 breedings, 10 raised														
1941							Born	80	130	195	225	260		
1942	295	325	340	380	420	490	525	560	590	625	650	625	485	
1943	610	560	555	595	705	735	770	790	810	900	900	865	733	
1944	915	925	900c	700	805	760	835	825	840w	865	890	850	842	490
1945	865	790	800	820	930	980	1035	1085	1095	1155	1170	1150	990	
1946	970c	1020	1080	1070	1130	1100	1070	1130w	1125	1125	1135	1105	1088	505
1947	1175	1005c	955	860	960	950	985	1050	1040w	1085	1015	1015	1008	505
1948	1030	1070	1110c	1050	1040	1085	1135	1155	1100w	1150	1150	1035	1093	430
1949	1140	1230c	1145	965	1075	1185	1255	1270	1315	1365	1360	1390	1225	[3]
1950	1355	1375c	1290	1295	1270	1330	1330	1350	1325w	1285	1320	1325	1321	570
1951	1315	1190c	1140	1055	1145	1160	1205	1200	1220w	1170	1230	1165	1183	525
1952	1190c	1100	1085	1150	1145	1245	1295	1365	1380w	1370	1365	1340	1253	540
1953	1320	1325c	1270	1180	1230	1285	1270	1260	1275w	1265	1320	1305	1275	625
1954	1365	1365	1365	1405c	1300	1250	1320	1330	1330	1255	1195	1185	1305	465
1955	1240	1310	1320	1385	1460	1555c	1460	1410	1395	1375	1380	1205	1375	565
1956	1210	1010w	1160	1195	1285	1340	1410	1490	1460	1510	1480c	1330	1323	[3]
1957	1300	1260	1260	1270	1320	1385	1430	1470	1495	1510	1545	1465	1393	
Av.[1]	1081	1054	1048	1023	1076	1115	1146	1171	1175	1188	1194	1147	1118	522
Cow No. 5—Hereford—9 calves in 11 breedings, 9 raised														
1942										Born	115	135		
1943	185	205	240	285	345	395	455	480	500	540	510	495	386	
1944	520	530	500	500	540	585	585	655	675	710	750	765	610	
1945	760	770	745	745	810	840	885	970	1005	1020	990	980	876	
1946	985	915c	845	985	915	845	775	860	855w	830	905	915	886	415
1947	890	855	850	810c	790	725	785	835	830w	845	805	800	818	330
1948	800	815	840	755	875	920	995	1025	1015	1010	1075	1010	928	
1949	1050	1105	970c	850	845	995	1000	1025	1010w	1025	1010	1045	1003	480
1950	1035	1060	1065	1110c	1010	1050	1080	1055	1015w	1005	960	1010	1038	395
1951	1000	965	985	975	1040	1100	1130	1180	1200	1205	1215	1155	1096	
1952	1145	1075c	990	1025	1070	1100	1090	1110	1150w	1140	1145	1115	1096	625
1953	1080	1040	930c	1005	1100	1005	1040	1085	1090w	1130	1110	1110	1060	515
1954	1100	1085	1000c	1000	1020	1035	035	1000	990w	1000	940	975	1015	480
1955	1000	980	1020	1100	1245	1300	1315c	1190	1230	1180	1160	1120	1153	360
1956	1095w	1020	1060	1145	1195c	1105	1040	1060	1060	1075w	1070	1030	1079	340
1957	990	980	920	1015	1095	Sold - Pregnant								
Av.[2]	903	887	860	878	921	929	944	966	973	980	975	966	932	438
Cow No. 6—Hereford—9 calves in 11 breedings, 8 raised														
1942											Born	150		
1943	205	235	260	305	370	410	460	495	525	570	550	555	412	
1944	570	570	545	535	570	605	605	665	675	730	735	775	632	
1945	765	745	705	755	845	870	910	945	980	995	1000	1000	876	
1946	980	950	850c	895	940	950	1015	1030	1070	1110	1110	1070	998	[3]
1947	1030	1010c	850	770	855	865	860	890	900w	900	890	880	892	355
1948	840	850	885	835	950	1015	1060	1090	1065	1060	1095	1020	980	
1949	1050	1080	1080	1000	1100	1160	1200	1225	1250	1310	1325	1355	1178	
1950	1355c	1245	1175	1105	1140	1185	1175	1160	1160w	1155	1185	1225	1189	490
1951	1220	1215c	1090	1030	1055	1065	1110	1080	1070w	1060	1180	1185	1113	420
1952	1160c	1080	1005	1030	1045	1115	1115	1150	1185w	1170	1240	1265	1130	460
1953	1190	1170c	1085	1110	1155	1140	1160	1145	1190w	1240	1265	1235c	1174	450
1954	1135	1115	1045	1045	1090	1105	1120	1110w	1115	1135	1105	1125	1104	505
1955	1160	1170	1205c	1160	1140	1200	1225	1210	1210	1225w	1260	1230	1200	340
1956	1265	1220	1230c	1110	1110	1145	1145	1155	1090	1090w	1050	1030	1137	405
1957	1020	995	1010	1050	1120	1210	Sold—Pregnant							
Av.[2]	995	975	929	906	955	988	1011	1025	1035	1054	1071	1068	1001	428
Cow No. 7—Hereford—9 calves in 10 breedings, lost 2 calves and raised foster calf														
1942							Born	100	145	205	265	330		
1943	405	410	460	495	535	575	610	615	625	675	630	610	554	
1944	640	670	655	660	680	760	690	800	840	875	890	975	761	
1945	980	970	985c	870	915	940	915	940	930w	950	935	975	942	340
1946	930	920	900c	910	925	965	950	980	965w	1005	995	965	944	315
1947	1000	1005	980	800c	905	925	935	980	965w	975	960	940	948	350
1948	945	1000	1040c	950	1035	1140	1040	1030	1035w	1030	1075	1010	1028	325
1949	1080	1120	1150c	1055	1180	1090	1090	1110	1115w	1150	1080	1075	1108	355
1950	1085	1110	1110	1165	1165	1270	1270	1380	1370	1355	1400	1370	1254	
1951	1365	1135c	1230	1110	1180	1210	1230	1240	1215w	1175	1250	1285	1219	520
1952	1270	1275	1140c	1170	1280	1345	1325	1345	1395w	1320	1415	1340	1301	520
1953	1345	1115c	1185	1245	1335	1365	1345	1345	1395w	1335	1415	1415	1315	465[3 4]
1954	1510	1240c	1205	1235	1235	1235	1270	1260	1240	1240	1195	1200	Sold	[3]
Av.[2]	1046	998	1003	972	1031	1068	1056	1082	1082	1090	1103	1097	1052	399

c=calved; w=calf weaned.

[1]Averages do not include 1941 weights.

[2]Averages do not include 1942 and 1957 weights.

[3]Calf died at birth or soon after.

[4]Raised a foster calf.

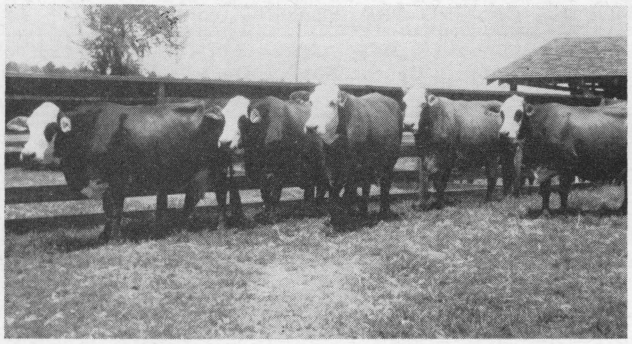


Figure 25. Desirable 1/2 Brahman x 1/2 Hereford cows.

What About the Adaptation of Cattle to the Area?

This discussion applies to the Brahman and Hereford breeds and crosses of the two under the management of the Laboratory. Hereford steers, bulls and heifers from the western part of Texas required a year or more to become acclimated. Some of the Hereford females failed to shed and continued to show distress in the hot, humid weather. These were culled. The Brahman and half-blood Brahman, Figure 25, show no distress in the heat of summer, but welcome shelter during the colder winter weather. Even one-fourth and one-eighth blood Brahman crosses appear to be tolerant to summer temperatures.

Observations suggest that British breeding stock should be brought to the area from the south and east rather than from the north and west; also, that short-haired ones should be selected instead of those with long, thick hair. The latter tend to eliminate themselves. Selection for thrift during 1934-58 has resulted in a small herd of Herefords reasonably well adapted to the environment.

What Are the Weights of Cows?

Table 8 shows the individual weights by months of 7 selected cows—4 first-crosses Brahman x Hereford, and 3 purebred Herefords, all of which were born and raised on the improved pastures. Since 1935, all cattle have been weighed about the first of each month. Weight records of many other individuals could have been shown, but the crossbreeds were selected because of their long breeding records. The individual Herefords were selected because of their nearness to the crossbreds in age and treatment.

The records show that the cows did not reach their greatest weight until after they were 10 years old. The cows produced their heaviest calves when they were 9 to 14 years old, Table 9. The production of heavy calves after 10 years of age, and the attainment of maximum weights at 11 or 12 years of age, varies from the general belief that cows attain maximum production and weight before they are 9 years old. A sample of high-producing cows was observed to be 45 percent heavier at 12 years of age than at 6 years. Further improvement of the pastures after 1950 no doubt contributed to the heavy weights of the old cows.

What Are the Monthly Weight Differences?

The lightest weight for a cow within the year usually follows calving in March or April and the heaviest weights are reached in the fall. If a cow calves late in the spring her heaviest weight for the year is likely to be just before calving. Table 8 shows differences of 19 to 34 percent between maximum and minimum weights within years.

As to when cows should be culled for age, these data and other records indicate that, as in-

TABLE 9. WEANING WEIGHTS, POUNDS, OF CALVES FROM COWS LISTED IN TABLE 8.

Year	1/2 Brahman x 1/2 Hereford cows born summer 1941				Hereford cows born fall 1942		
	No. 1	2	3	4	5	6	7
1944	510	355	460	490			
1945	390	400	380		Not bred	Not bred	340
1946	530	435	425	505	415	[1]	315
1947	530			505	330	355	350
1948	485	565	495	430			325
1949	520	520	555	[1]	480		355
1950	620	510	595	570	395	490	
1951	550	515	645	525		420	520
1952	645	670	[1]	540	625	460	520
1953	555	565	540	625	515	450	465[1,3]
1954	575	610	450	465	480	505	[1]
1955	730	640	695	565	360	340	[4]
1956	550	560	635	[1]	340	405	
1957	475	485	500		[2]	[2]	
Total	7665	6830	6375	5220	3940	3425	3190
Average	548	525	531	522	438	428	399

[1]Calf died at birth or soon after.
[2]Cow sold, pregnant.
[3]Foster calf.
[4]Cow sold.

dividuals, cows should be culled only when they cease to produce satisfactorily without undue extra care. Individual identification and records of production are required. This practice is followed and some extra feed is allowed the better calf producers as they get old. Under other conditions and with few records, it usually is a good practice to cull the dry fat cows. The cross-bred cows had solid mouths at 14 to 15 years, while the Hereford's mouths were worn to the gums at about 11 years.

A point to consider in culling is the gain which a dry cow makes in a grazing season. Cow no. 3 in Table 8, for example, gained from 1,170 to 1,570 pounds in 1952 after losing a calf in the spring. The 400 pounds of gain on the cow was worth less than 400 pounds of calf weight, but the failure to wean a calf would not have been a total loss had the cow been sold at 1,570 pounds.

The better-producing cows have tended to calve earlier each year, while the poorer and more erratic producers tended toward later calves. Earliness is believed to be important in selection.

Weight and production records give information on several questions. One concerns the weight a cow may lose without interfering with calf production. Weights of cow no. 1, Table 8, with 14 calves weaned in 14 years, are used as examples. In 1951, at 10 years of age, her weight varied from 1,015 to 1,305 pounds, or 290 pounds difference. The most common difference between highest and lowest weights of the year was 210 pounds. From this, it is assumed that mature cows at 1,200 pounds in strong flesh may temporarily lose to about 900 pounds without affecting regular calving.

What About Weight Losses at Calving?

The records of cow no, 1, Table 8, show an average at the last monthly weighing prior to calving of 1,118 pounds and 996 pounds for the first weighing after calving, an average loss of 122 pounds. In 14 calvings, the greatest difference between before and after-calving weight was 190 pounds. The average loss of 122 pounds is about 11 percent of the pre-calving weight. Calves may be expected to weigh 70 to 100 pounds.

In comparing the first seven calvings of this cow with the last seven, it appears that young cows will lose a higher percentage of body weight at calving than the old cows. For the first seven calvings, the loss was from 1,011 to 878 pounds, or 133 pounds. This loss was 13 percent of the body weight before calving. For the last seven calvings, the loss was from 1,222 to 1,114 pounds, or 108 pounds and 9 percent of body weight. The time required to regain the weight lost at calving varies. For the first seven calvings, an average of 8 months elapsed before the pre-calving weight was regained. The average time was 11 months for her last seven calvings and 9½ months for all 14 calvings. This shows that pre-calving weight was not regained until after weaning.

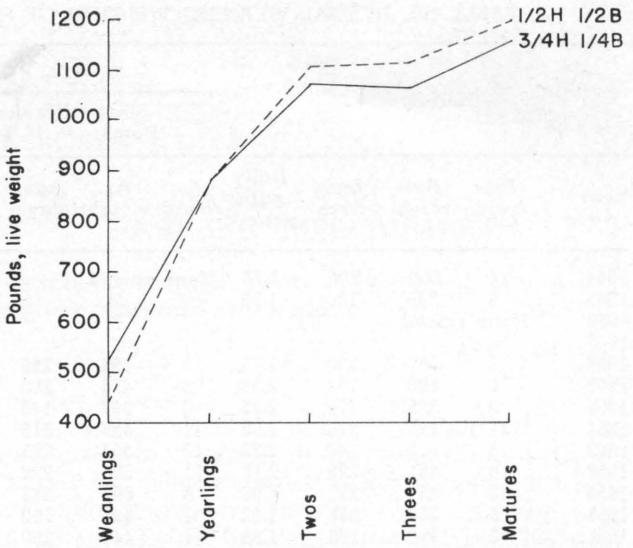


Figure 26. Growth of 10 ¾ Hereford-¼ Brahman females compared with that of 10 ½ Hereford-½ Brahman females in the Laboratory herd.

What Are the Comparative Weights of ¾ and ½ Blood Brahman-Hereford Crosses?

Half-breed heifers usually catch up with the ¾'s by October, their yearling year, Figure 26. Then as "twos," they move ahead of the ¾'s about 25 to 50 pounds, and tend to hold that advantage through their mature life.

The half-breeds for this comparison were out of Hereford cows by Brahman bulls. The Laboratory has never carried Brahman females, therefore, half-breeds have not been produced with Hereford sires and Brahman dams. A half-breed bull has been used recently on half-breed cows, Table 10, but the offspring were not included in the data for Figure 26. The ¾ Herefords for this comparison were out of half-breed cows and by Hereford bulls.

Although the ¾ Hereford cows remain good as individuals throughout their lives, though somewhat lighter in weight than the half-breeds, they do not raise as heavy calves when both are bred to Hereford bulls. The ⅞ Hereford calves out of the ¾ cows are not as heavy by some 45 pounds as the ¾ calves out of the half-breed cows, Table 10.

What Are the Weaning Weights of the Calves?

The weaning weights of the calves during 1944-57 are shown in Table 10. The table is presented with the knowledge that small numbers weaken the comparisons, but the results were consistent for calves of the same breeding over a period of years. From 1937, the first crop, through 1943, all were Herefords except the 1941 crop which largely was first-cross Brahman x Hereford. The Hereford is the only British breed

TABLE 10. ACTUAL WEANING WEIGHTS OF 527 CALVES, BULLS, STEERS AND HEIFERS COMBINED

Year	Herefords				7/8 H-1/8 B[1] Sires: Hereford Dams: 3/4 H-1/4 B				3/4 H-1/4 B Sires: Hereford Dams: 1/2 H-1/2 B				3/4 H-1/4 B Sires: 1/2 H-1/2 B Dams: Hereford			
	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds
1944	14	350	200	1.75	None raised				8	413	200	2.07	7	379	200	1.90
1945	6	286	180	1.59	"	"			1	400	200	2.00	5	318	200	1.59
1946	None raised				"	"			7	501	220	2.28	7	379	200	1.90
1947	"	"			"	"			5	509	220	2.31	14	320	200	1.60
1948	6	351	200	1.75	5	399	200	2.20	5	464	200	2.32	None raised			
1949	6	400	192	2.08	9	474	200	2.37	5	554	209	2.33	"	"		
1950	9	399	172	2.32	3	397	149	2.66	6	561	216	2.24	"	"		
1951	11	425	210	2.02	11	485	210	2.31	5	555	210	2.64	"	"		
1952	15	532	240	2.22	13	534	225	2.37	8	606	249	2.43	"	"		
1953	10	481	229	2.10	11	506	220	2.30	9	536	228	2.35	"	"		
1954	16	434	222	1.96	6	607	255	2.38	8	469	218	2.15	"	"		
1955	6	452	236	1.92	1	435	160	2.72	4	565	229	2.47	8	439	222	1.98
1956	3	355	189	1.88	1	440	200	2.20	7	519	234	2.22	1	550	243	2.26
1957	None raised				3	423	224	1.89	5	461	221	2.09	6	472	229	2.06
Total	102				63				83				48			
Average		421	206	1.97		470	204	2.30		513	220	2.33		381	208	1.83

Year	5/8 H-3/8 B Sires: Hereford Dams: 1/4 H-3/4 B				5/8 H-3/8 B Sires: 1/4 H-3/4 B Dams: Hereford				5/8 H-3/8 B Sires: 3/4 H-1/4 B Dams: 1/2 H-1/2 B				5/8 H-3/8 B Sires: 1/2 H-1/2 B Dams: 3/4 H-1/4 B			
	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds
1944	None raised				None raised				None raised				None raised			
1945	"	"			"	"			"	"			"	"		
1946	"	"			"	"			"	"			"	"		
1947	"	"			"	"			"	"			"	"		
1948	"	"			"	"			"	"			"	"		
1949	"	"			"	"			"	"			"	"		
1950	"	"			"	"			"	"			"	"		
1951	"	"			"	"			"	"			"	"		
1952	"	"			"	"			"	"			"	"		
1953	"	"			"	"			"	"			"	"		
1954	1	465	214	2.17	"	"			6	454	220	2.06	5	532	229	2.32
1955	None raised				"	"			13	487	226	2.15	11	523	230	2.27
1956	3	490	210	2.33	4	380	194	1.96	13	521	233	2.24	7	489	218	2.24
1957	2	458	214	2.14	1	415	198	2.10	9	437	204	2.14	8	491	218	2.25
Total	6				5				41				31			
Average		475	212	2.24		387	195	1.98		483	223	2.17		509	224	2.27

Year	1/2 H-1/2 B Sires: Brahman Dams: Hereford				1/2 H-1/2 B Sires: 1/2 H-1/2 B Dams: 1/2 H-1/2 B				3/8 H-5/8 B Sires: Brahman Dams: 3/4 H-1/4 B				1/4 H-3/4 B Sires: Brahman Dams: 1/2 H-1/2 B			
	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds	No. head	Av. weight	Age, days	Daily gain, pounds
1944	None raised				None raised				None raised				None raised			
1945	"	"			"	"			"	"			"	"		
1946	"	"			"	"			"	"			"	"		
1947	"	"			"	"			"	"			"	"		
1948	7	302	200	1.51	"	"			"	"			"	"		
1949	23	401	210	1.91	"	"			"	"			"	"		
1950	14	433	181	2.39	"	"			6	475	196	2.42	"	"		
1951	6	438	210	2.09	"	"			None raised				"	"		
1952	8	531	214	2.48	"	"			"	"			1	525	226	2.32
1953	11	515	207	2.49	"	"			"	"			9	510	230	2.22
1954	11	520	230	2.26	"	"			"	"			7	531	217	2.45
1955	10	466	211	2.21	7	586	237	2.48	"	"			None raised			
1956	11	467	203	2.30	3	582	241	2.42	"	"			"	"		
1957	None raised				14	511	226	2.26	"	"			"	"		
Total	101				24				6				17			
Average		450	207	2.17		542	231	2.35		475	196	2.42		520	224	2.32

[1]H for Hereford; B for Brahman.

that has been used and crosses have been made only with the Brahman. All Brahman blood has come from bulls.

When the crossing work began, funds did not permit the use of registered females, and non-registered Brahman females could not be bought of a quality and uniformity comparable with commercial Herefords.

The total number of calves raised each year is shown by breeding, with the average weaning weights, the average in days at weaning and the daily gain. In calculating the daily gain, the birth weights were not subtracted, and no allowance was made for the age of the dams. The calves were creep-fed about 5 of the 14 years.

Bull, steer and heifer calves were combined in Table 10. The top-looking male calves were saved for possible sale as bulls to commercial cattle raisers in the region. On the average, the heifer calves were 25 to 50 pounds lighter than the bull and steer calves at weaning.

All cross-bred calves continue to wean heavier than full-blood Herefords, provided the mothers have Brahman blood, (4, 5, 6, 8 and 9). These weight records indicate that, under the conditions of improved pastures and intensive operations that existed, the optimum percentage of Brahman blood for the cow is 25 to 50 percent. It appears more reliable to use purebred Hereford bulls on these cross-bred cows than to use Hereford-Brahman cross bulls. In the table, calves by the ½ Hereford x Brahman bull and out of ½ Hereford x Brahman cows were the heaviest at weaning, but only 3 years were involved and both the bull and the cows were far above average in calf-producing ability.

The trend the past few years seems to be the set of calves that always has been the lightest, the Herefords, are getting heavier at weaning and the set that always has been the heaviest, the ¾ Herefords-¼ Brahmans, are getting lighter; thereby, tending to close the gap between these two sets. Until a few years ago, the gap was about 120 pounds; now it has narrowed to about 92 pounds. Two factors could be influencing this trend: on the cow side, the best calf-raisers among the Herefords have been bred to Hereford bulls and the poorer calf-raisers used for crossing, and the best calf-raisers among the ½ Hereford x Brahman (the original set born in 1941) were bred during 1952-53 to a Brahman instead of a Hereford, and since have been bred to the outstanding ½ Hereford x Brahman bull mentioned.

Actual weaning weight is what counts in a program of slaughter calf production where the calves are sold by the pound. Where the cows have a 3 or 4-month period in which to calve, and the calves are weaned and sold once or twice per year, it matters little how high is the adjusted weight of the late calves, if the mothers consistently produce such calves because of slow breeding.

Figures 27 and 28 picture the system of breeding used by the Laboratory to get the principal crosses. Calves not pictured are the ⅞ Hereford-⅛ Brahman and the ⅜ Hereford-⅝ Brahman.

ECONOMIC ASPECTS OF PASTURE IMPROVEMENT

What Is the Relation Between Pasture Improvement and Production?

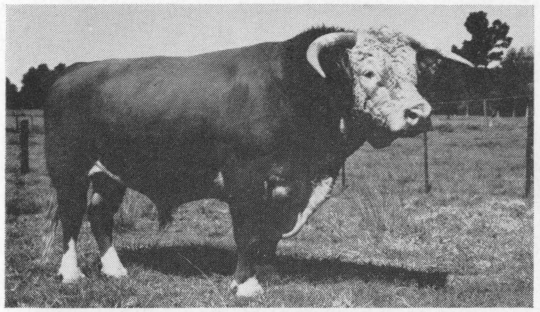
This is a principal problem. The complexities of grassland management, cattle production and the prices of cattle, feed and fertilizers are all involved in the problem. Related data are presented in the form of an inventory in Tables 11 and 12. These data are for 7 years, 1950-56, and involve the maintenance of a breeding herd on 150 acres of improved pasture. The term "cow herd," as used here, includes all cattle, cows, calves, bulls, replacement heifers, young bulls and steers. The herd is inventoried by weight and by the number in each class. An inventory by weight is used to describe the progressive growth of the breeding herd during the development of pasture resources.

Part I of Table 11 is primarily the weight inventory of the cow herd in pounds by years; part 2 concerns the prices and returns from cattle, the costs of feeds and fertilizer and the differences between the value of pounds produced and feed and fertilizer costs. It has not been possible to maintain the cow herd without supplementary concentrates and roughage.

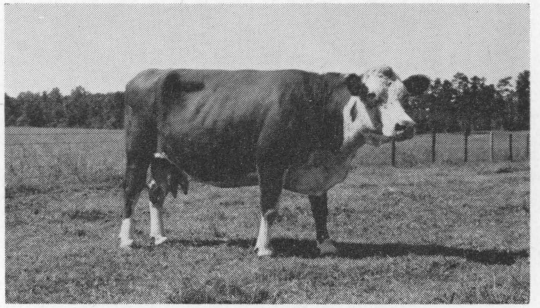
Column 1, part 1, Table 11, shows the total weight of the herd on January 1. The weights for December 31, column 10, correspond with the January 1 weights of the succeeding years. The total pounds produced, column 3, includes the weaning or sale weight of the current crop of calves and the weight increase or decrease of all other cattle. Weight made within the year, whether from calves or other cattle, constitutes production from the acreage used.

The total pounds grazed, column 6, for the year is the sum of the pounds on January 1 plus production and purchases. The gain in inventory, column 11, is the difference between pounds on January 1 and December 31 of the same year. Likewise, it is the difference between pounds produced and pounds sold plus any death loss. The average annual death loss approximates 1 percent of the total weight handled. Column 7, pounds grazed per acre, is an expression of carrying capacity in terms of live weight rather than in number of head. More accurately, it is the pounds of cattle maintained by a combination of the pasture and the supplementary feed used. The production per acre, column 4, is similarly based.

Part 2, Table 11, concerns prices of cattle and costs of feed and fertilizer. Price per hundredweight, column 1, is the average price receiv-

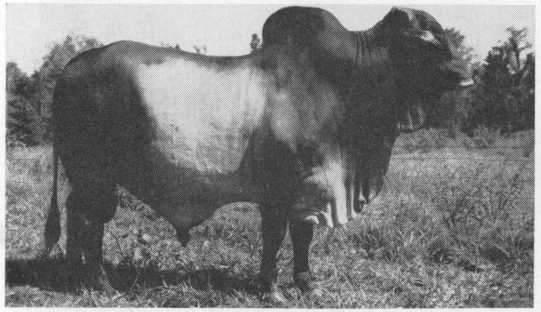


Hereford Bull



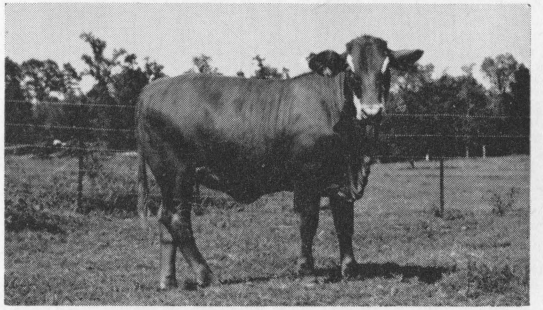
Hereford Cow

Hereford Calf

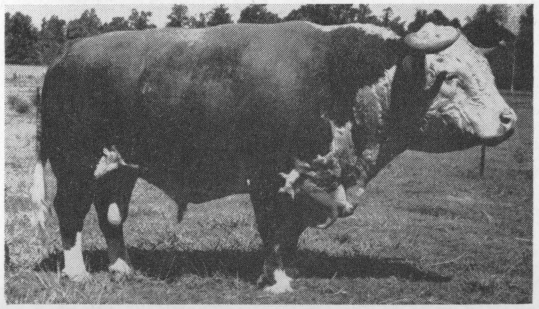


Brahman Bull

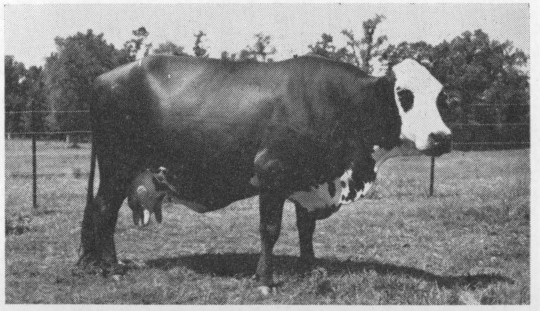
Hereford Cow



½ Brahman — ½ Hereford Calf



Hereford Bull



½ Brahman — ½ Hereford Cow

¾ Hereford — ¼ Brahman Calf

Figure 27. Breeding systems used to get the first ½ Hereford-½ Brahman and ¾ Hereford-¼ Brahman crosses.

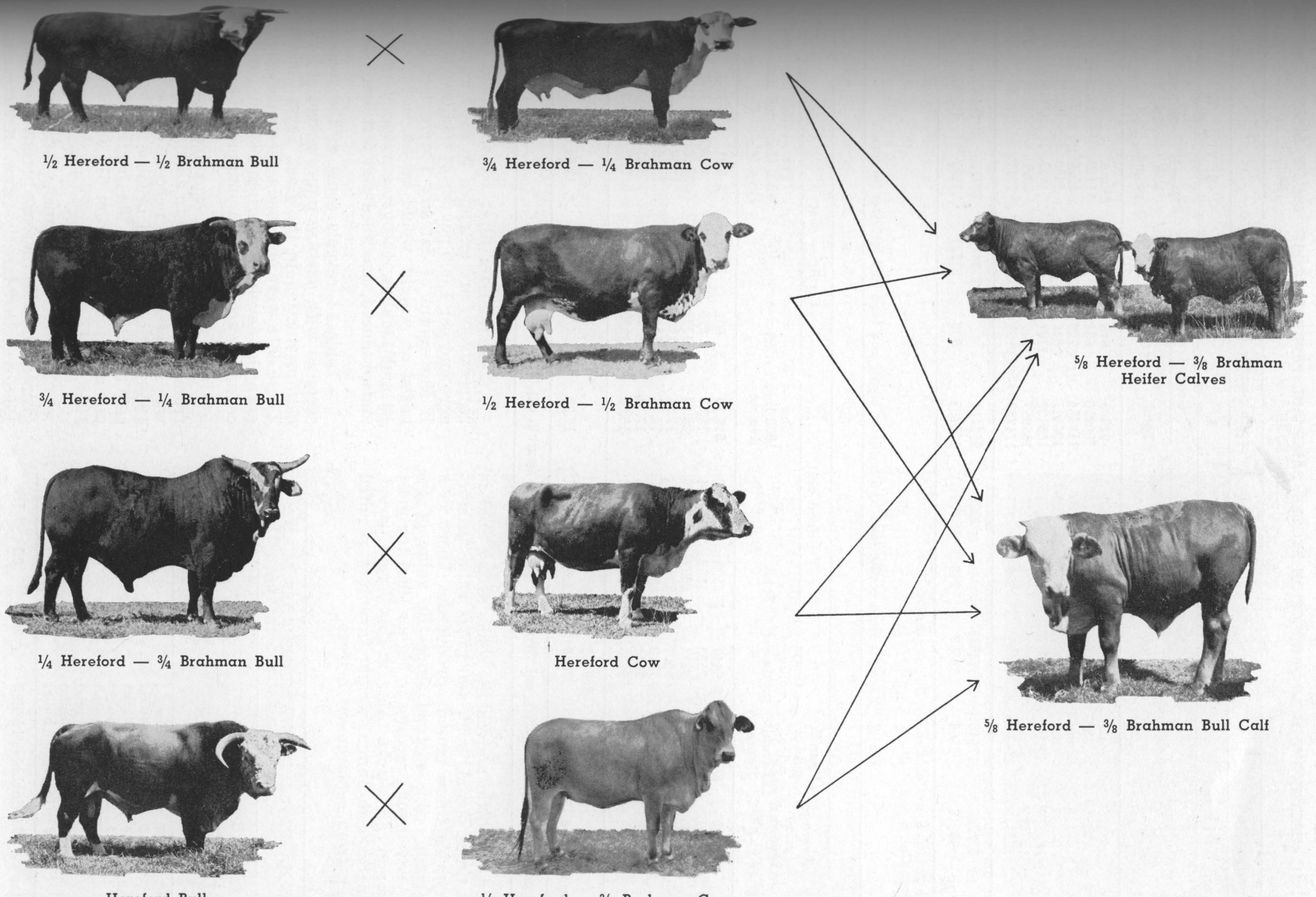


Figure 28. The four systems of breeding used to get 5/8 Hereford-3/8 Brahman crosses.

TABLE 11. CATTLE AND CALF PRODUCTION RECORD, SALES AND PRINCIPAL COSTS ON 150 ACRES OF IMPROVED PASTURE

Part 1. Weight inventory in pounds by years.

Column	1	2	3	4	5	6	7	8	9	10	11
Year	On hand Jan. 1	Purchased	Yearly increase			Grazed		Sold, pounds	Death loss, pounds	On hand Dec. 31	Gain in inventory
			Total[1]	Per acre	Per 1000-lb. wt.	Total[2]	Per acre				
1950	67565	None	24715	165	366	92280	615	16975	None	75305	7740
1951	75305	725	24200	161	318	100230	668	15965	1150	83115	7810
1952	83115	None	35369	236	426	118484	790	24594	1165	92725	9610
1953	92725	4215	39671	264	409	136611	911	26921	1380	108310	15585
1954	108310	12600	44072	294	365	165132	1101	45487	1825	117820	9510
1955	117870	None	48137	321	410	165957	1106	30052	3395	132885	15065
1956	132885	None	41835	279	315	174720	1165	58625	1790	114305	—18580
Total	677725	17540	257999		2609	953414		218619	10715	724465	46740
Average	96818	2506	36857	246	373	136202	908	31231	1529	103495	6677

[1]Col. 3 = Col. 6 — Col. 1 + 2.
[2]Col. 6 = Col. 8 + 9 + 10.

Part 2. Receipts from cattle; feed and fertilizer costs; and feed and fertilizer income.

Column	1	2	3	4	5	6	7	8	9	10	11
Year	Average price received per cwt.	Pounds sold x price. Actual figure	Gross value of produced[1]	Feed cost			Fertilizer cost			Gross sold less feed and fert.	Gross value of produced less feed and fert.
				Total	Per acre	Per 1000 lbs. live wt.	Total	Per acre	Per 1000 lbs. live wt.		
1950	$26.09	$ 4428	$ 6448	$ 1503	$10.02	$16.29	$ 601	$ 4.01	$ 6.51	$ 2324	$ 4344
1951	31.21	4982	7553	1562	10.41	15.58	975	6.50	9.73	2545	5016
1952	26.25	6456	9284	2967	19.78	25.04	1793	11.95	15.13	1696	4524
1953	14.89	4010	5907	2398	15.99	17.55	1909	12.73	13.97	—297	1600
1954	16.36	7443	7210	2356	15.71	14.27	1744	11.63	10.56	3343	3110
1955	15.90	4773	7654	2902	19.35	17.49	1628	10.85	9.81	243	3124
1956	12.98	7610	5430	2841	18.94	16.53	1680	11.20	9.62	3089	909
Total		$39702	$49486	$16529			$10330			$12843	$22627
Average	19.18	5672	7069	2361	15.74	17.33	1476	9.84	10.84	1835	3232

[1]Total pounds produced (part 1, col. 3) x price per cwt. sold (part 2, col. 1)

ed for all cattle and calves sold. Gross sold is price times pounds sold, and gross value produced is price times pounds produced. There is a question on this method since the value of females saved for breeding is higher than for most cattle and calves sold. Also, in this 7-year period, the increase in annual weight inventory resulted largely from replacement heifers.

TABLE 12. CATTLE INVENTORY BY CLASS GRAZED ON 150 ACRES OF IMPROVED PASTURE.

January 1	Cows, bulls, steers and heifers, 2-years-old and up	Yearlings	Calves	Total
1950	58 (includes 2 bulls)	14		72
1951	63 (includes 3 bulls)	16		79
1952	73 (includes 3 bulls)	13	6	92
1953	83 (includes 3 bulls)	10	3	96
1954	83 (includes 5 bulls)	23	6	112
1955	94 (includes 6 bulls)	33	11	138
1956	111 (includes 6 bulls)	32	2	155
1957	98 (includes 6 bulls)	21	37	156
Average	83.2 (includes 4 bulls)	20.2	8.1	112

Feed and fertilizer costs, columns 4 and 7, respectively, are extended to show expenses per acre and per 1,000 pounds of total weight grazed. If the weight of January 1 were used, the costs based on weight would be increased. Columns 10 and 11 show the gross value of pounds sold and produced, less feed and fertilizer expense.

Table 11 reveals some of the problems associated with pasture improvement and cow and calf production in the East Texas Timberlands. These data were obtained under a pattern of management developed during 1935-50, but the procedures were based on judgment factors.

The herd weight was increased 49 percent from January 1, 1950 to January 1, 1956. There was a decrease of 14 percent in the inventory in 1956. This occurred because of drouth and the sale of culled cows. The pounds of cattle grazed per acre increased from 615 in 1950 to 1,165 in 1956, or 47 percent.

The annual increase in pounds of cattle grazed and the increase in inventory, except in 1956, resulted largely from an increased use of

fertilizer after 1951. The fertilizer cost per 1,000 pounds of cattle grazed tended to level off as maximum carrying capacity was approached in 1954. Total feed costs tended to parallel increases in the inventory and, on the basis of cost per 1,000 pounds grazed, remained near the same level. Similarly, feed costs per acre tended to increase as the carrying capacity was increased.

Feed and fertilizer prices varied, but not as much as the price of cattle. Cattle prices were approximately 45 percent lower and production 35 percent higher in the last 4 years than in the first 3 years of this record. There was an increase of 28 percent in total cost of feed and fertilizer in the last 4 years. Despite the increase in production, the gross value of production was lower in the last 4 years.

The inventory record permits a measurement of production efficiency. Columns 4 and 5, part 1, production per acre (or yearly increase) and per 1,000 pounds of live weight, respectively, relate to efficiency. The efficiency of the herd may be expressed in pounds of production per 1,000 pounds of the inventory weight of January 1. As the inventory becomes stabilized, the pounds sold as related to inventory weight may be a more reliable measurement. The January 1 inventory weight sold each year was 21 to 44 percent, with an average of 32 percent. The production per 1,000 pounds live weight was 32 to 43 percent, with an average of 37 percent.

Cows developed on fertilized pasture averaged 200 to 300 pounds heavier than cows developed on unfertilized pasture. Per-head maintenance requirements are increased for both winter and summer as weights are increased. There is, perhaps, a most efficent weight. The management attempts to avoid the extremes and to select for medium-size cows.

The percentage calf crop, weight of weaned calves and the gains produced determine the efficiency of the cow herd and the pasture. Pasture management is directed to the production of per-head and per-acre gains.

Pastures may be stocked for maximum per-head gain or for maximum per-acre gain. Maximum gains per-head occur when the pastures are lightly stocked. At medium stocking rates, optimum gains per-acre and per-head may be realized, but maximum per-head gains do not produce maximum per-acre gains. There are periods also when only maintenance or sub-maintenance is possible.

What Returns Are Expected from Improved Pastures?

Table 11 shows a gross annual return of $7,069 from 150 acres, or $47 per acre annually, during 1950-56.

Do Improved Pastures for Beef Cattle Pay?

Table 11 indicates annual beef cattle returns of $20 to $22 per acre from the pastures above the costs of feeds, fertilizer, seed and seeding.

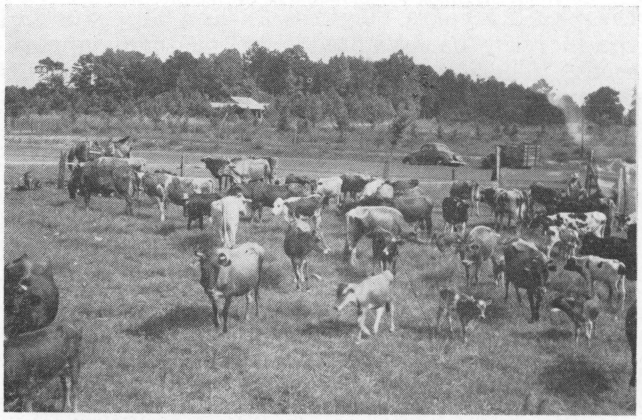


Figure 29. Cattle in a dipping vat pen near the Laboratory, summer 1937. Compare the quality and size with those in Figure 30.

When other expenses, except labor, are subtracted from the $20 to $22 per acre, little is left for labor-management income.

Beef cattle production records on adjacent unimproved land are not available, but the labor income per acre is low. Some cattlemen allow 50 acres of unimproved timberland per cow. Estimates of calf production vary from 5 to 15 pounds per acre, or a gross of $.96 to $2.88 per acre, based on average selling price of $19.18 per hundredweight. This is in contrast with the gross of $47 per acre from the improved pastures, but the former may be more profitable because of the difference in cost of production.

The 7-year production record is not conclusive as to the amount of pasture improvement that should be done. Supplemental irrigation and more fertilizer should enable further increase, but there is evidence of a loss in efficiency from overstocking. More years are needed to determine a point of diminishing returns. Currently, it seems that 1,000 to 1,200 pounds of herd weight per acre is near maximum for calf production.

How Much Pasture Improvement Should Be Done?

The East Texas Timberlands have made rapid advancement in beef cattle production in

Figure 30. Cattle on an improved pasture near the Laboratory, May 1954. Compare the quality and size with those in Figure 29.

the past 25 years, Figures 29 and 30. Much of the increase has resulted from pasture improvement. There are many small acreages of cleared, mowable pasture varying in degrees of improvement.

Pastures have been developed to a carrying capacity of approximately 1,000 pounds of live weight per acre during the growing season, and have the quality necessary to the full growth and development of adapted cattle. Milk and grass-fat calves of the quality in demand by slaughterers are almost impossible to produce without improved pastures.

The returns from varying degrees of pasture improvement are determined largely by individual management. Pastures in this area continue to be improved. This indicates that improved pastures are of economic benefit; however, the improved pasture is only part of beef cattle production. A practice profitable under one system of management could be unprofitable under another; also, prices may be such as to make profits impossible. That situation prevailed in 1953, Table 11.

What Was the Effect of the Recent Cost-Price Squeeze?

As cattle prices declined in 1953, the recourse was to lower unit costs by increasing production. A comparison of the fiscal year, ending in August 1951 and 1955, Table 13, presents the results of such effort. Numbers were increased and the pounds produced were doubled. An 85 percent increase in numbers and a 99 percent increase in pounds of calves nearly maintained dollar income with a 50 percent loss in the price of calves. The increase in numbers reduced the inventory per cow from $740 in 1951 to $516 in 1955. The inventory increase for the 51 added cattle, twos-and up, was $251 per head. The dollar inventory per cow would be less if facilities necessary to research, but not essential to commercial operations, were deducted.

The questions: "Do improved pastures pay for beef cattle?" and "How much pasture improvement should be done?" are further examined under the heading, "A Sample Beef Cattle Operation."

A SAMPLE BEEF CATTLE OPERATION

An attempt is made to apply the preceding research data and experience to an analysis of assumed slaughter-calf production operations on improved pastures. A unit of 100 cows as a part-time operation was selected for analysis. A smaller unit would be handicapped by overhead and there are few units in the area which are much larger.

The average size farmstead in the area is about 200 acres. In many cases, adjoining land may be leased. The owner or operator usually has income independent of the land, but few would be likely to expand to a full-time cattle operation.

Table 14 lists the estimated annual income and expense for two 100-cow units. The unit of 200 acres with 100 cows is patterned from the Laboratory's operation and carrying capacity. The other unit for 100 cows and 400 acres is the situation of more land and a less intensive operation. The allowance of 4 acres per cow permits greater freedom, since the carrying capacity can be increased quickly by adding more fertilizer. There is less opportunity for expanding numbers with an allowance of only 2 acres per cow. With more room, less trouble is to be expected from disease, and drouth effects are delayed. This is because high carrying capacity is possible only through heavy fertilization which requires ample moisture for high production.

In the evaluation of the two situations, Table 14, the following conditions are assumed to simplify calculations:

1. The land is to be leased on a long-term basis.

2. All work requiring large implements and equipment other than a pickup, trailer and horse, will be hired on a custom basis.

3. All replacement cattle, cows and bulls, will be purchased and all calves will be sold at weaning age.

4. Gross income will be based on the June 15, 1958 parity price of $25.60 per hundredweight for Good and Choice grade slaughter calves. Culled cows and bulls will be priced in relation to

TABLE 13. ADJUSTMENT OF CATTLE OPERATION 1951-55

Item	Year ending		Changes in 4 years	
	August 1951	August 1955	Amount	Percent
Cattle on hand, 2 yrs. and older	60	111	Up 51 head	85
Pounds calves produced	15,925	31,643	Up 15,718 lb.	99
Price calves per pound, approx.	30¢	15¢	Down 15¢	50
Sales, actual	$4,782	$4,415	Down $367	8
Expenditure, including labor	$4,443	$3,309	Down $1,124	25
Total inventory	$44,418	$57,240	Up $12,822	29

the parity price of calves, since parity is not quoted for them.

5. The lease operator's original investment is estimated at $24,650 and consists of:

100 3 and 4-year-old cross-bred cows	$20,000
Five 2 and 3-year-old bulls	2,500
A used pickup truck and tandem trailer	1,300
Saddle horse and equipment	450
Squeeze chute and miscellaneous tools	400
Total	$24,650

Explanation of Items in Table 14

The separate items listed under Income, Expenses and Return in Table 14 are discussed in detail:

Item 1—Calf Sales: The return from calves is based on an 85 percent calf crop averaging 500 pounds at $25.60 per hundredweight. An 85 percent calf crop weaned at 500 pounds is within reason, considering the stipulations as to kind of cows and bulls used, culling, breeding season, feeding and pasture fertilization. In each crop of calves, some will not reach the grade of Good, but they should be offset by others in the grade of Choice. Any sale price set may not apply at a future date, but, in this case, the USDA effective parity price of June 15, 1958 is used. Parity should be flexible and will adjust. Another course is to use a breakeven price by dividing pounds of calves sold into total expense, but this must be recalculated as expense items change.

Items 2 and 3—Cows and Bulls Culled: The return from cows and bulls culled is based on a price of $12 per hundredweight for 10 cows averaging 1,100 pounds and 1 bull weighing 1,600 pounds at $15 per hundredweight.

Item 4—Land Charge: The assumed lease rate is $4 per acre on a 10-year basis for land with improvements. It is assumed that the land will be clear of timber, have a fair grass sod and that grassland-farming implements may be used on most of the acreage. Also, that the land will be well-fenced into about four pastures, with pens for working cattle, and that a shed for hay storage and shelter plus a feed room will be provided. The use of surface tanks for watering is assumed.

The operator must have a long-term lease to protect this investment in seed and fertilizer. The landowner's incentive to grant a long-term lease is that the operator must proceed to seed and fertilize to increase volume and quality production. The land should be more valuable at the end of the lease. It was calculated that the

TABLE 14. ESTIMATED ANNUAL INCOME AND EXPENSE

	Item	200 acres 100 cows	400 acres 100 cows
	Income		
1.	85 500-lb. Good to Choice slaughter calves; 42,500 lb. @ $25.60 cwt. (effective parity 6/15/58)	$10,880	$10,880
2.	10 1,100-lb. cows culled—11,000 lb. @ $12.00 cwt.	1,320	1,320
3.	1 1,600-lb. bull culled—1,600 lb. @ $15.00 cwt.	240	240
	Total gross income	$12,440	$12,440
	Expenses		
4.	Land charge @ $4 per acre per year (10-year lease)	800	1,600
5.	Cow replacement; 11 good young ½ Brahman cows annually @ $200	2,200	2,200
6.	Bull replacement; one good British-breed bull annually @ $500	500	500
7.	Feed purchased; 41 percent protein concentrate	1,250	1,250
8.	Salt and bone meal	60	60
9.	Stored roughage cost (custom baling hay off pastures, 75 tons @ $12); one-half this where cows have 4 acres	900	450
10.	Vaccines, medicine and veterinary service	100	100
11.	Fertilizer, including lime, $10 per acre applied @ 2 acres per cow; $2.50 per acre (applied) @ 4 acres per cow	2,000	1,000
12.	Interest on cattle investment; $24,650 @ 6%	1,479	1,479
13.	Taxes (county, state, school) $1,000 valuation x rate of $3 per $100	30	30
14.	Pickup truck expense per year (3000 miles @ 10¢)	300	300
15.	Marketing expense (hauling, yardage, commission, 60¢ cwt.)	331	331
16.	Maintenance of fences, waterings, corrals and shed	300	400
17.	Horse feed, saddle and equipment, upkeep and depreciation	95	95
18.	Labor hired	300	300
19.	Seed planted	100	100
20.	Mowing; twice yearly on average @ $1 per acre per mowing	400	800
21.	Spray for external parasite control. Three @ 10¢ per head	30	30
22.	Miscellaneous; telephone calls, livestock newspapers and magazines, liability insurance on cattle, etc.	65	65
	Total expense	11,240	11,090
	Return		
23.	Operator's income for his labor and management	1,200	1,350
24.	Interest earned on investment	1,479	1,479

landowner would have $100 per acre invested in land to meet the lease requirements, and that the $4 per acre rental would care for the depreciation of the original improvements and pay a fair rate of interest on his investment.

Item 5, Cow Replacement: An average of 11 cows, 10 to replace those culled and 1 to replace death loss, would be purchased annually. Assuming the purchase of 3 and 4-year-olds with calf at side, and the immediate sale of the calves, the cows are shown at $200 per head. The cows will be Brahman x British crosses. Their productive life is assumed to be 10 years after purchase. It is recognized that many operators will prefer to produce their own replacement females, but, to maintain half-breed cows, it is necessary to keep either Brahman or British cows with British and Brahman bulls, or to use half-breed bulls on the half-breed cows.

Item 6—Bull Replacement: One young bull, of Hereford or other British beef breeding, will be purchased annually to replace the bull culled. The cost is not expected to exceed $500. Five bulls are to be kept for 100 cows, with the breeding season to extend from January 1 to August 31. The death loss among bulls is part of the 1 percent annually figured against the cows.

Item 7—Feed Purchased: The allowance of $1,250 provides for 250 pounds of 41 percent protein feed for the cows and 350 pounds for the bulls. This is based on information in Table 5. The estimated cost of protein supplement is $70 per ton. Approximately $4 per head is allowed for a limited amount of calf creep-feeding.

Item 8—Salt and Bone Meal: The standard mineral lick used is 2 parts bone meal and 1 part salt. Records show an average annual consumption of 8 pounds of bone meal and 4 pounds of salt. Allowing for waste and costs of $100 per ton for bone meal and $22 per ton for salt, the allowance of $60 annually is adequate.

Item 9—Stored Roughage: Table 5 shows a consumption of 750 pounds of hay per cow during mild winters and in the case of sod-seeding small grain in the fall. The allowance of 1,500 pounds per cow, including bulls, is adequate for hard winters. No charge is made for standing hay and $12 per ton are allowed for custom baling and storing. Only half as much hay is allowed for the 400-acre unit. It is assumed that more forage will remain on this unit for winter grazing than on the 200-acre unit.

Item 10—Vaccines, Medicines and Veterinary Service: The allowance of $100 is based on actual costs during recent years.

Item 11—Fertilizers, Including Lime: The estimate of $2,000 annually is about equal to the cost of feed, minerals and stored roughage. This estimate is based on Tables 3 and 11, which indicate a fertilizer cost of approximately $10 per acre per year. In allowing 4 acres per cow, it is assumed that the operator will economize on fertilizer. Perhaps 1,000 pounds of rock phosphate and 1 ton of lime will be applied at the beginning and again 7 years later. This is estimated to cost $2.50 per acre annually.

With $10 worth of fertilizer per acre and 2 acres per cow, 425 pounds of calves have been produced annually. The expense was $28 per cow, with land rent at $8 and fertilizer at $20. With 4 acres per cow and at the same annual rental, only $3 per acre could be allowed for fertilizer. It has not been determined whether 4 acres of land and $12 in fertilizer will produce as much as 2 acres of the same priced land with $20 of fertilizer. It is evident, however, that in allowing more acres per head, the tendency will be toward lower rates of fertilization.

Item 12—Interest on Cattle Investment: The items and cost of the original investment, totaling $24,650, or $246.50 per cow, have been listed. It is assumed that the money can be borrowed at 6 percent. The collateral the operator puts into the deal is considered risk capital and is entitled to the same rate of interest.

Item 13—Taxes: County, state and school taxes on the cattle are included and are based on 100 head of cows valued at $10 per head and a combined rate of $3 per $100 valuation. No other taxes are considered.

Item 14—Pickup Truck: The truck expense is figured at 10 cents per mile and is calculated to include costs of gasoline, oil, repairs, tires, tax, insurance and depreciation. It is assumed that 250 miles per month will take care of the travel directly chargeable to the cattle.

Item 15—Marketing Expense: The 60 cents per hundredweight cost is based on records. Items 1, 2 and 3 show 55,100 pounds to be sold annually. Some selling will be at nearby auctions with the cattle hauled by the operator. Such marketing will offset some of the expense of longer hauls by hired trucks.

Item 16—Maintenance of Fences, Waterings, Corrals and Sheds: This expense is calculated on 3½ miles of 4-strand barbed wire fence on the 200 acres at $500 per mile, and $1,250 worth of corrals and sheds. The total is $3,000 and, with the upkeep estimated at 10 percent, the yearly cost is $300 for the smaller acreage. The cost is increased by one-third for the 400-acre unit because of more fencing.

Item 17 — Saddlehorse, Feed and Depreciation: The horse cost $300. Assuming 10 years of useful life, the depreciation is $30 per year. About $50 worth of feed will be required per year. The riding equipment, costing $150, will require about $15 annually for upkeep and depreciation.

Item 18—Labor Hired: It is assumed that about 300 hours yearly at $1.00 per hour will meet the needs for additional labor.

Item 19 — Planting Seed: Approximately $1,000 worth of seed will be planted over the 10-

year lease period. Most of this will be spent in the first 2 or 3 years.

Item 20—Mowing: An average of two mowings per year at $1 per acre per mowing is assumed. In the early stages of pasture development, three mowings may be necessary, but in later years, one mowing may be sufficient.

Item 21 — Spraying to Control Flies and Ticks: The estimate is for three sprayings per year at 10 cents per head. The operator can, if he desires, do the work for a small investment; treated rubs may be used to reduce the frequency of spraying.

Item 22—Miscellaneous: Included are expenses such as phone calls, subscriptions to livestock publications and liability insurance.

Item 23 — Operator's Income: The respective returns for the 200 and the 400-acre operations are $12.00 and $13.50 per cow and 4.9 and 5.5 percent interest on the investment. Although estimated returns from assumed conditions are subject to question, the returns shown are considered possible by local cattlemen under parity prices for slaughter calves.

Item 24—Interest Earned: With the operator charging his capital at 6 percent, the interest would be in addition to the labor income. It is likely that the operator will have to borrow 50 to 60 percent of the capital required.

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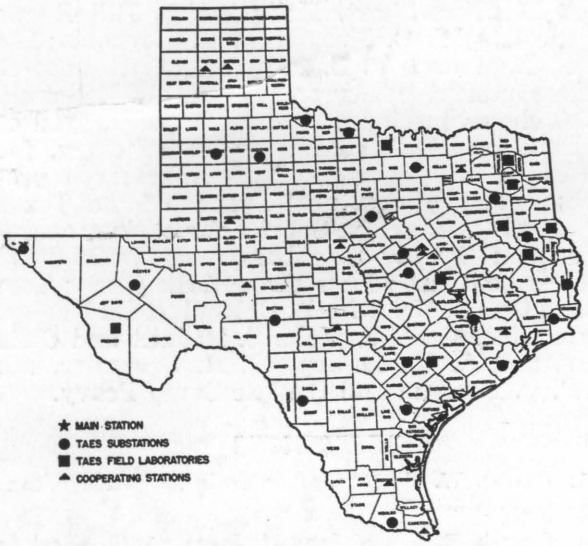

Location of field research units of the Texas Agricultural Experiment Station and cooperating agencies

State-wide Research

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The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of ten parts of the Texas A&M College System

ORGANIZATION

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies. Cooperating agencies include the Texas Forest Service, Game and Fish Commission of Texas, Texas Prison System, U. S. Department of Agriculture, University of Texas, Texas Technological College, Texas College of Arts and Industries and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

OPERATION

THE TEXAS STATION is conducting about 400 active research projects, grouped in 25 programs, which include all phases of agriculture in Texas. Among these are:

- Conservation and improvement of soil
- Conservation and use of water
- Grasses and legumes
- Grain crops
- Cotton and other fiber crops
- Vegetable crops
- Citrus and other subtropical fruits
- Fruits and nuts
- Oil seed crops
- Ornamental plants
- Brush and weeds
- Insects
- Beef cattle
- Dairy cattle
- Sheep and goats
- Swine
- Chickens and turkeys
- Animal diseases and parasites
- Fish and game
- Farm and ranch engineering
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- Marketing agricultural products
- Rural home economics
- Rural agricultural economics
- Plant diseases

Two additional programs are maintenance and upkeep, and central services.

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