TYPE AND SIZE AS FACTORS IN ECONOMICAL BEEF PRODUCTION

by

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INTRODUCTION

Changes in type and size of beef cattle are largely the result of consumer demands for smaller cuts of beef. In earlier days, cattle were not marketed until they were three, four or even five years old. They were big, tall, rangy cattle and required longer to reach maturity and desirable market condition than the shorter legged, more compact cattle of today.

The trend to smaller, more compact cattle that mature early and fatten in a relatively shorter time was somewhat slow at first, but increased in the late 1930's and early 1940's. Some breeders changed rapidly to extremely small, compact cattle. These cattle were referred to "Comprest" in Herefords and "Compact" in Shorthorns. Many breeders used bulls of this extreme type to hasten the change in the type of their cattle. Thus, so-called "Comprest" cattle became popular and were in demand for some time.

The true "Comprest" is a small, extremely compact individual with certain distinguishing features that identify him as a "Comprest". These features are: large head and horn in proportion to body; bold or "bulldog" shoulders; and large bone and heavy forequarters in proportion to hindquarters.

Other breeders made the change to more compact cattle more gradually and did not use extremely compact bulls. They tried to breed for sound conformation, good constitution, substance and quality in their cattle, staying between the larger more rangy type and small, very compact cattle. As a result, three

subtypes of beef cattle are now being produced: small compact; intermediate; and large rangy. Which type and size is the best for economical beef production? The answer to this question is not easy. Fortunately, however, considerable research is being conducted in an attempt to answer the type and size question.

The Hereford breed is the largest source of commercial cattle, yet the three subtypes are quite numerous within the breed. Since uniformity is an asset to a breed, The American Hereford Association decided to sponsor research work with respect to type and size. The material for this thesis was taken from that portion of this project which was conducted by Kansas State College The Ohio and Oklahoma Experiment stations also cooperated in the study.

REVIEW OF LITERATURE

Type is a qualifying term which sometimes is misused and many times misunderstood by the research man as well as the stockman. It is very important in livestock production that type be understood in its true meaning. Vaughn (15) defines type as an ideal or standard of perfection, combining all the characters which contribute to the animal's value and efficiency for the purpose specified. Type provides the animal with the proper form and structure for the kind of work or production desired. In other words, beef type is the sum total of those features that should be included in the make-up of the shape or form of the commonly accepted ideal beef animal. Type, therefore, is not just length of leg, depth of body, thickness of

body, or any one feature of the animal. Beef type refers to all the parts that make up the structure of beef cattle. Considering true type, it is possible for a long-legged steer to show more beef type than a shorter legged steer, providing the taller steer shows more desirable conformation in his body. The beef steer possessing the most of the best has the most desirable beef type.

Size is not the same as type. Size is one of the components of type and refers principally to height, length, width and weight combined.

Wilson and Curtis (17) demonstrated that beef steers were no more efficient in making gains than dairy steers. Hence this study indicated that type had little effect on efficiency of gain.

Smith (10), in a feeding experiment with representatives from several breeds, observed that the beef breeds did not make larger gains than representatives of the dairy breeds. However, the profits made from feeding better bred beef cattle exceeded that made on the dairy-bred steers. His principal objection to Holsteins for the production of beef was the fact that they were very slow to fatten and had to be kept in the feed lots for a longer time than the beef breeds. They also had inferior carcasses.

Hawkins, Blizzard and Craft (1), in a study of breeding influences on type and gains in beef cattle, showed the advantages of improved breeding over inferior breeding with regard to feed lot performance. Observations over a six-year period from 1927 to 1932 were made on three lots of calves each year, which were bred as follows:

Lot 1, scrub sire, scrub dam
Lot 2, purebred sire, scrub dam
Lot 3, purebred sire, high grade dam

The better-bred calves in Lot 3 made larger and more rapid gains in weight, less feed was required per hundred pounds gain, and the gain was produced at a lower cost. These calves also brought a higher market price. Lot 2 approached Lot 3 closer in all of these factors than did Lot 1.

Woodward, Clark and Cummings (19), working with large and small type Herfords, found that calves from large type cows were heavier at birth and at weaning time than calves from small type cows.

Knapp et al. (6) concluded that sex, and sire and dam influence had a significant effect on birth weight of the calf. Age of dam had less significance, while the size of the cow had the most significance in determining birth weights of calves.

Some cows have larger calves than others, and it seemed that some cows are consistent in having either large or small calves at birth. Milk and other feed consumption, of course, as well as other environmental factors determine to a great extent the weaning weights of calves.

Gains in weight, winter and summer, on large and small type Herefords, have been investigated by Woodward, Clark, and Cummings (19). Their findings were made with nine crops of calves during the period 1929 to 1940. The animals were handled as two groups--limited-fed and full-fed. The limited-fed animals received only enough feed to maintain their weight. In the winter, the large type, full-fed group made a greater gain each year than

the small type. In the limited-fed groups, there was no significant difference in winter gains between the types. Steers of the large type averaged heavier in the feed lots each of the four years. They sold for more per head out of the feed lot, and returned greater margins per steer in two of the four years, with a slight but not significant advantage over the four-year period. Woodward states that extremes in either type are undesirable. Very rough, leggy and plain, large type steers are often unprofitable, particularly for the grower, and the same applies to the very small steers, even though they are desired in certain circles, according to these investigators.

Efficiency of gain is closely associated with rate of gain. This has been pointed out by Winters and McMahon (18) and observed by others. However, this is not always the case and where animals differ significantly in size or fatness, it does not hold true because of the increased maintenance requirements of the larger cattle.

Knapp and Baker (5) report as the result of a statistical study of records obtained from 66 steers, that a high correlation between efficiency and rate of gain is found only with animals of the same size.

Smith (11) conducted a feeding experiment in which he fed out three groups of steers. There were six steers in each group. Two of the steers in each group he graded as good, which he described as being low set and smooth; two that were heavy in bone, a little coarser throughout and more leggy, were graded fair. The two remaining were off type, angular, very leggy, and in some

instances narrow, and were graded as common. The results showed that, although the steers that graded good did not always make larger gains, they did fatten more readily and sold for a higher price per pound. The coarse, more rangy steers gained just as rapidly.

In another feeding trial with different types of cattle, Smith (10) concluded that the lower set, more blocky types, which usually have short wide heads and short necks, with few exceptions, fatten earlier than rangy cattle under like conditions and bring a higher price per pound when sold, because they are thicker in flesh and usually show larger proportion of higher priced cuts of beef. In the majority of instances, these lower set cattle were also somewhat better gainers up to the age when these groups were marketed; namely, 23 months. The cattle which had plenty of body capacity, large in barrel as indicated by depth of body and size of middle girth, made the largest gains.

Hultz (2), working with four types of calves; namely, very low set, low set, rangy, and very rangy, found that the very rangy calves made the fastest and cheapest gains and sold for the same price per hundredweight as the other calves. The very low set calves made the slowest gains at the highest cost per hundredweight gain.

Stanley and McCall (12), working with a large number of steers over a six-year period, concluded that the appearance of a steer is not a dependable criterion of its growth rate and gain efficiency. They suggested that an effort should be made to acquire a maximum of those feeder qualities associated with

carcass quality, such as, thickness of body, weight for height, quality, size of bone, and quiet disposition. They also reported that light-colored hair and weight for age may also be associated with rapid growth in feeder cattle.

Body conformation of the feeder steer was a better indication of its carcass grade than feed lot performance.

The amount of condition, rather than conformation, was more indicative of ultimate carcass grade, particularly with lightweight cattle. They also concluded that steers weighing, in relation to height, were greater gainers. In other words, the low set, thick, deep-bodied steers were the best gainers.

Knox and Koger (8), working with 350 head of steers over a nine-year period, found that rangy steers weighed more, gained more and yielded a higher dressing percent than compact steers. They found a slight-non-significant advantage for the compact steers when gain was expressed in percent of initial weight. This indicates that there was little or no advantage for the rangy type in economy of gain. They also concluded that greater gains made by the rangy cattle were due to size, associated feeding capacity, and growth rather than to body form. This is based on the fact that, regardless of type, for each pound of increase in initial weight, there was a corresponding increase in feed lot gain of .184 pound.

Stoddart (13) found that larger and older steers are less efficient in digesting range forage and that, for best production, smaller steers are desirable. They make more pounds of beef per given area of range than larger cattle. Stoddart also stated

that large cattle gain more in July, while in August there was little difference in gains by different sized cattle and in September and October the smaller cattle gained more than the larger cattle.

Willey et al. (16) found the percent of market weight, composed of untrimmed hide, untrimmed head, and shanks was greater in the case of "compress" than regular type Hereford steers. They found that regular type Herefords gained more in the feed lot, but there was no significant difference in efficiency of feed utilization. Of the percentages of wholesale cuts studied, only the shank was significantly different. The percentage of this cut from the regular type calves was greater. There was no difference in percentage of fat, lean and bone from the carcasses of the two types.

Stonaker et al. (14), working with small and conventional type Herefords, concluded that small-type calves graded significantly higher as feeders. They also stated that conventional-type calves had larger daily gains, ate more feed per day, and produced larger carcasses and wholesale cuts when finished than small-type calves. There were no consistent or significant differences in pounds of feed required per pound of gain, percent of different wholesale cuts in the carcass, or percent of fat, lean and bone in the 9-, 10-, 11-rib cut.

Kleiber (4), in discussing problems involved in breeding for efficiency of feed utilization, pointed out that there was no fundamental relationship between body size and efficiency of feed utilization. He further showed that absolute rate of gain could

be used as a measure of efficiency only when comparing animals of the same size.

Knapp and Clark (7), working on heritability of economic characteristics in beef cattle, concluded there was relatively high influence of heredity in determination of growth after weaning time. Growth measures were more highly influenced by heredity than were measures of quality and conformation.

According to measurements made by Lush (9), maximum gains are associated with a long body, tall at the withers, with a large paunch girth. He found that heart girth was of secondary importance in predicting gains and considered it on the borderline of statistical significance. There was also a tendency for large initial weight to be associated with large gains. Lush found steers of many shapes will gain well and steers which gain the same may be of many different shapes.

Hultz and Wheeler (3), experimenting with 30 two-year-old steers of three different types, found the dressing percent averages as follows: low set, 63.27; intermediate, 64.27; and rangy, 61.1. The intermediate steers showed an average of 1.2 higher dressing percentage than the low set steers.

Woodward et al. (19) found little difference in dressing percentage between large and small Hereford cattle.

Knox and Koger (8) found the rangy type ranking highest in dressing percent and the compact type last. They feel that this difference is probably due to higher condition or to less paunchiness of the rangy steers.

Weber (20), summarizing duplicate feeding tests conducted at

the Kansas, Ohio, and Oklahoma stations on steers sired by small, medium and large size Hereford bulls, concluded that steers sired by medium size bulls tend to combine the gaining ability of large cattle and the finishing ability of small cattle without sacrifice of efficiency of gain. There was no significant difference in economy of gain among the three groups. However, when the ration consisted largely of roughage or grass, the medium and large size steers produced gains at significantly lower costs than the small size group.

EXPERIMENTAL PROCEDURE

The purpose of this experiment was to determine the difference in grazing and feed lot performance of commercial cattle sired by small, compact; intermediate; and large rangy bulls.

It was difficult to locate enough steer calves of approximately the same age sired by small, compact, intermediate, and large, rangy bulls for the experiment. However, the steers were finally located and were selected from the following commercial Hereford herds: Bar 13 Ranch, P. K. Ranch, O. M. Wallop, Sheridan, Wyoming, and M. C. Simpson, Wolborg, Montana. These calves were bought at the going market price of choice, range-bred steer calves.

In October 1948, 288 head of steer calves were shipped from Sheridan, Wyoming, to the Kansas, Oklahoma and Ohio Experiment stations. Each cooperating station received 96 head of steer calves for the test. Each set of cattle contained 32 sired by small compact bulls, 32 sired by intermediate bulls and 32 sired

by large rangy bulls. The steer calves sired by small compact bulls were out of cows averaging about medium size and type, those sired by the intermediate bulls were out of medium size and type cows, but the dams of the calves sired by the large rangy bulls were larger framed and of a different type than the cows in the other herds. Weights were not available on the bulls and cows in the herds from which these steer calves were selected.

There was considerable variation within each group. The greatest variation was in the calves sired by small compact bulls. There was quite a number of distinctly small type calves in this group and a few were abnormally small, while some were as large as some of the bigger steers in the intermediate group.

While there were no unusually small or unusually large steers among those sired by the intermediate bulls, the calves in this group were somewhat variable in quality. A few of the calves sired by large rangy bulls could not be distinguished from the steers sired by intermediate bulls. Most of the calves sired by large rangy bulls were more upstanding, heavier boned and more rangy than those in the other two groups.

Strictly speaking, therefore, the comparison made in this experiment was not of steers of different size and type, but rather of steers sired by bulls of different size and type. Since this variation was present for the study reported herein, it was decided to select 3 steers from each lot that were typical of the different sizes and types. These representatives were handled exactly the same as the other steers in the lots and were compared to the lot they represented in order to determine differences in

grazing and feed lot performance. Carcass studies were also made for comparison.

The calves were lotted in 9 lots of 10 steers each. Three lots were made up of calves by small compact bulls, 3 of calves sired by intermediate size bulls and 3 of steers sired by large rangy bulls. These 9 lots were arranged in 3 series of 3 lots each, each series containing 1 lot of calves sired by small compact bulls, 1 lot by intermediate size bulls and 1 lot by large, rangy bulls.

The experiment called for handling the steers under 3 standard systems of beef production:

1. Immediate full feeding for 225 days.

2. A deferred full feeding program in which the steer calves were wintered well, grazed without grain from May 1 to August 1 and then full fed in dry lot for 100 days.

3. Production of two-year-old grass-fat steers without the feeding of grain. Phases under this system included: wintering as calves without grain, grazing as two-year-olds without supplemental feed and selling directly off grass.

One of the series of 3 lots was used under each of the above-mentioned systems of beef production.

After the steers were lotted as evenly as possible by weight, type and quality, they were branded to identify them with their lot. The calves were all given a type score as feeder steers, which ranged from 1 to 5--1 representing the very small, compact type, 3 representing the intermediate and 5 representing the very large, rangy steers. This was also done at the time of marketing

in order to have a slaughter steer type score. Pictures were taken of the 3 representatives selected from each lot at marketing time. Carcass studies were made on all carcasses and the beef rib was taken from the left or "open" side of each of the selected representatives for analysis.

The experiment started November 29, 1948. The steers in the immediate full fed lots received a ration consisting of silage, prairie hay, cracked corn, soybean meal, limestone and salt. The starting daily ration per steer was made up of 17 pounds silage, 1.9 pounds prairie hay, 3.52 pounds cracked corn and 2 pounds soybean meal. As the feeding period progressed, the amounts of prairie hay and cracked corn were increased, the amount of silage was decreased and the soybean meal remained the same. The steers were given all the feed they would eat for 225 days. They were marketed on July 12, 1949, at the Morrell Packing Company, Topeka, Kansas.

The calves under the deferred full feeding system were started on the wintering phase November 29, 1948, and were on this phase until May 1, 1949. The average daily ration per steer during the wintering period was approximately 20 pounds silage, 6 pounds prairie hay, 4 pounds corn and 1 pound soybean meal.

The yearlings were put on grass May 1, 1949, and grazed until August 1, 1949, a period of 92 days. They were grazed at the rate of 1 steer to 3 acres of pasture which was predominantly bluestem grass. This pasture was located in the northern Flint hills area of Kansas. The grazing season was very good in 1949, as a result of plenty of moisture, and the cattle did well.

August 1, 1949, the three lots of steers were moved to the dry lot and full fed until November 9, 1949, a period of 100 days. The approximate average daily ration per steer during this phase was, prairie hay, 6.5 pounds; alfalfa hay, 2 pounds; cracked corn, 14.5 pounds; soybean meal, 1.80 pounds and salt. Again, the steers were sold to Morrell Packing Company, Topeka, Kansas. Carcass studies were made on all the cattle and the beef rib from the left side of each of the selected size and type cattle was taken for analysis.

The calves, under the system of wintering and grazing two seasons, were also started on experiment, November 29, 1948. They were wintered on a ration of 1 pound soybean meal, 19.5 pounds silage and 5.5 pounds prairie hay. This phase lasted 153 days.

May 1, 1949, the steers were put on bluestem pasture and grazed 167 days, which left them on grass until October 15, 1949. The yearlings were grazed at the rate of 4 acres per steer and no supplemental feed was given.

October 15, 1949, to May 8, 1950, a period of 205 days, was the length of the second wintering phase. The yearlings were wintered on a ration of approximately 1.01 pounds soybean meal, 40 pounds silage, and 4 pounds prairie hay per head daily.

The steers were grazed as two-year-olds from May 8, 1950, to August 24, 1950, a period of 108 days. They were grazed at the rate of 5 acres per steer on bluestem pasture. During July of 1950, there was 16.5 inches of rainfall and the grass was in abundance. These cattle were sold through John Clay and Company

in Kansas City, and bought by Swift and Company. Carcass studies were made and the beef rib from the left side of each selected steer was taken for analysis. However, the rib from steer 92 was lost at the plant and never arrived in Manhattan for analysis. Steer 92 was one of the steers selected as being large rangy.

EXPERIMENTAL RESULTS

It should be pointed out in the beginning that the daily ration per steer, feed cost per 100 pounds gain and T. D. N. per 100 pounds gain are based on the entire lot of 10 steers and not the 3 steers selected from each lot as representing size and type. It is recognized that without individual feed records on the selected steers, no accurate measure can be made of efficiency in production. However, the feed data on the entire lot can be used as an indication of feed consumed by the 3 selected steers from each lot.

Immediate Full-Feeding System

Table 1 summarizes the results on the representative steers used in the immediate full-feeding system, which lasted 225 days. The large, rangy steers weighed more at the beginning, gained more total pounds and showed a larger daily gain than did the intermediate and small compact cattle. The small, compact cattle ranked last.

The intermediate type showed a higher percentage gain based on the initial weight than the large, rangy or small, compact cattle; with the small, compact cattle falling considerably behind

the other types. The T. D. N. required per 100 pounds gain was much higher for the small compact cattle than for the intermediate and large rangy.

The small compact steers graded 1/2 grade higher as feeder calves, but 1/3 of a grade lower than the intermediate and large rangy cattle as slaughter cattle. The intermediate type cattle graded 1/3 of a grade higher in the carcass than the small, compact and large, rangy steers, this difference being slight. The intermediate type steers dressed 1 percent higher than the small compact and large rangy cattle, but this difference is not great. There was a slight but not important difference in marketing shrinkage, in favor of the small compact cattle.

There was a marked increase in slaughter steer type score over the feeder steer type score for the large rangy and intermediate type steers, while the small compact calves showed practically the same type score as feeder calves and slaughter cattle. This would seem to indicate that there was more growth in the large rangy and intermediate type cattle.

The intermediate type sold for 25 cents per hundredweight more than the large rangy and small compact groups.

When comparing the representative steers to the lots from which they came, it is found that the three large rangy steers showed up better than the lot, while the three intermediate and small compact steers did not show up as well as the lots from which they came. The gain per steer and average daily gain for the three small compact steers was 351 and 1.56, while the lot averages were 408 and 1.81. The gain per steer and daily gain

Table 1. Immediate full-feeding system. November 29, 1948, to July 12, 1949--225 days.

Size and type	Small, compact				Intermediate				Large, rangy			
Steer number	2	7	8	Average	23	24	28	Average	30	32	33	Average
Feeder steer grade	Choice	Choice-	Choice	Choice	Choice-	Good+	Good+	Good+	Choice-	Good+	Good	Good+
*Feeder steer type score	1	1.8	1	1.2	2	2.5	2.3	2.4	2.5	3.8	3.5	3.3
Initial weight per steer	115	400	415	410	450	450	420	440	540	510	495	515
Final weight per steer	785	775	723	761	900	895	830	875	1110	1043	902	1018
Gain per steer	370	375	308	351	450	495	410	435	570	533	407	503
Daily gain per steer	1.64	1.67-	1.37	1.56	2.00	1.98	1.52	1.93	2.53	2.37	1.81	2.24
**Daily ration per steer												
Ground shelled corn		8.43				9.70				9.66		
Soybean meal		2.00				2.00				2.00		
Silage		6.61				6.61				6.58		
Prairie hay		1.70				1.51				1.69		
Alfalfa hay		1.28				1.30				1.26		
Ground limestone		.07				.07				.07		
Salt		.01				.02				.01		
**Feed required per 100 lbs. gain:												
Ground shelled corn		492.5				475.5				469.4		
Soybean meal		110.3				98.0				97.4		
Silage		364.6				324.1				320.9		
Prairie hay		93.9				84.7				82.1		
Alfalfa hay		70.4				63.5				61.6		
Ground limestone		3.75				3.27				3.54		
**Feed cost per 100 lbs. gain		$18.79				$17.47				$17.24		
I.D.N. per 100 lbs. gain		626.64				587.85				579.75		
Percent shrink in marketing	3.1	2.5	3.1	2.9	2.7	3.9	4.2	3.6	3.1	4.1	2.4	3.2
*Slaughter steer type score	1	2	1	1.3	3	3	3	3	3.8	4.4	4.5	4.2
Live grade	Choice+	Choice	Choice	Choice	Choice+	Prime	Choice	Choice+	Choice+	Choice+	Choice-	Choice+
Carcass grade	Good	Good	Good-	Good	Choice-	Good+	Good+	Good+	Good+	Good	Good	Good
Dressing percent	61.1	61.5	60.9	61.2	63.5	61.8	61.4	62.2	61.7	60.8	61.4	61.3
**Selling price per cwt.	$27.00	$27.00	$27.00	$27.00	27.25	27.25	27.25	27.25	27.00	27.00	27.00	27.00

*Numbers 1 to 5 represent type. 1 represents small, compact, 3 intermediate and 5 large, rangy.

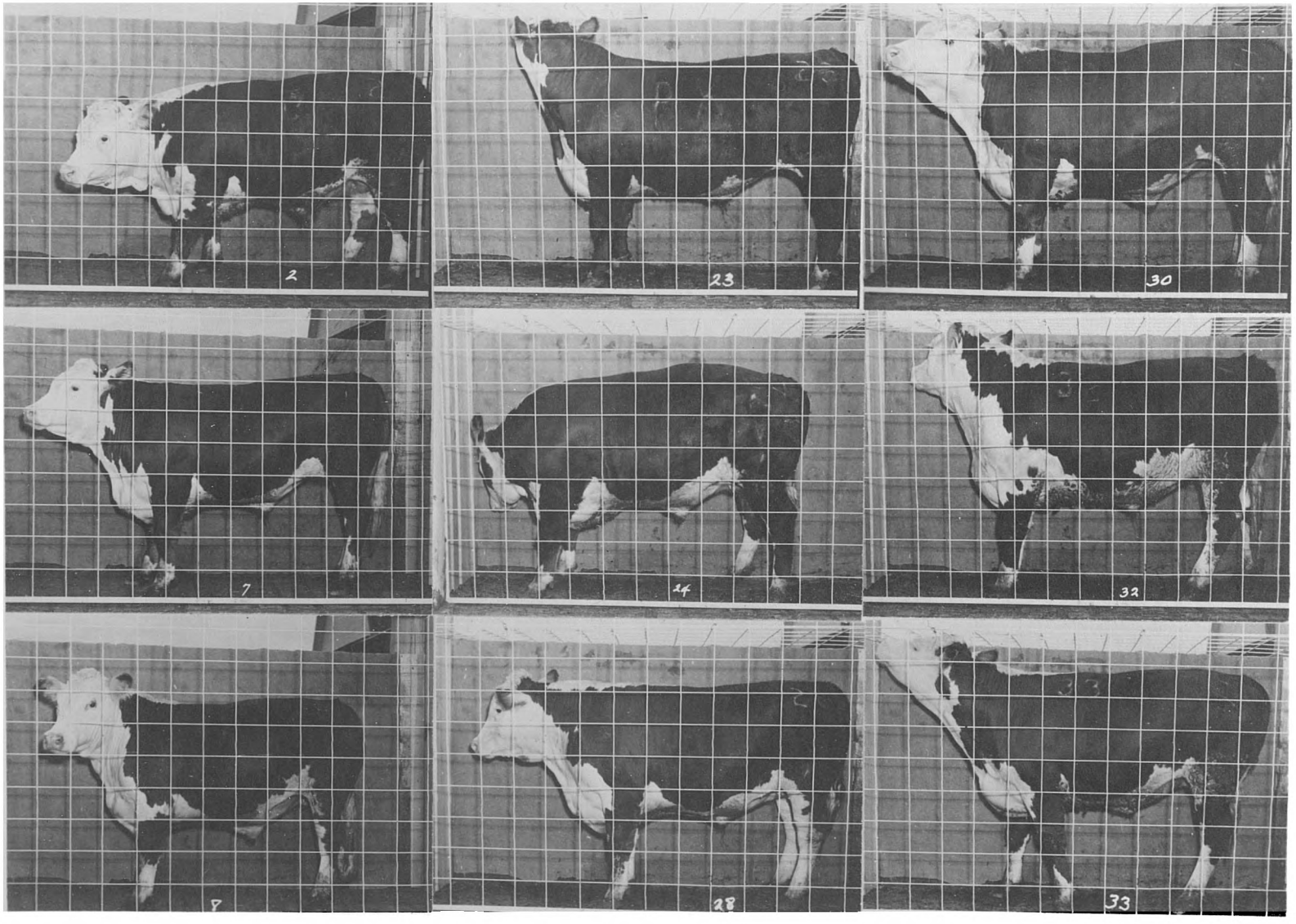
**Daily ration per steer, feed per 100 lbs. gain, cost per 100 lbs. gain, T.D.N. per 100 lbs. gain, and selling price, are based on the entire lot of 10 steers rather than the 3 steers representing each lot. This is done for comparison, since we do not have individual feeding records on the steers, and they sold as lots.

EXPLANATION OF PLATE I

The steers shown in this plate were handled under the immediate full-feeding system. Steers 2, 7, and 8 represent small compact type; steers 23, 24, and 28 represent intermediate type and steers 30, 32, and 33 represent large, rangy type.

The pictures were taken just before marketing.

PLATE I



for the three intermediate cattle were 435 and 1.93, while the lot averages were 459 and 2.04. For three large rangy steers the gain per steer and average daily gain were 503 and 2.24, while the lot averages were 463 and 2.06. The initial weights of the three large, rangy steers were heavier than the lot by 63 pounds and the initial weights of the three small, compact steers were lighter than the lot by 20 pounds. The three intermediate calves were within 4 pounds of the initial weight of the parent lot. Otherwise, the three selected steers compared very close to the parent lot.

According to the results shown in Table 1, the poorest performing cattle were of the small, compact type, while the intermediate type performed the best.

Plate I shows the steers representing small compact, intermediate and large rangy type which were handled under the immediate full-feeding system.

Deferred Full-Feeding System

Table 2 summarizes the results on the selected steers handled under the deferred full-feeding system. The large, rangy steers weighed more at the beginning, gained more total pounds and had a larger daily gain per steer than either the small, compact or the intermediate type cattle. The total gain and average daily gain per steer of the small, compact, intermediate and large, rangy type during the 345-day period were 503 and 1.47, 531 and 1.54, and 625 and 1.81 pounds, respectively. The difference in total gain between the slowest and fastest gaining

groups was 122 pounds, and it was 0.35 pound in average daily gain per steer.

The cost per 100 pounds gain, based on the entire lot, was $14.06, $14.20, and $13.46, respectively, for the small, compact, intermediate and large rangy type cattle.

The small compact steers graded 1/2 grade higher as feeder calves than the intermediate and large rangy types, but all three groups graded the same as slaughter cattle. The small compact and intermediate cattle graded 1/3 grade higher in the carcass than the large rangy type.

The dressing percent of the small compact, intermediate and large rangy cattle was 60.51, 61.18 and 59.57, respectively. This shows an advantage for the intermediate type over the large rangy of 1.61% and .67% over the small compact type.

The selling price per hundredweight of the small compact, intermediate and large rangy type was $26.75, $27.50 and $24.75, respectively. This shows an advantage for the intermediate type over the large rangy of $2.75 per hundredweight and 75 cents per hundredweight over the small compact type.

The large rangy cattle shrank 1 percent less in marketing than the intermediate and small compact types.

There was a distinct increase in the slaughter steer type score over the feeder steer type score in the large rangy cattle, which indicates that during the feeding period they became more rangy. The type scores on the other two types remain practically the same.

When comparing the representative steers to their parent

Table 2. Summary of deferred full-feeding system. November 29, 1948, to November 9, 1949--345 days.

Size and type	Small, compact				Intermediate				Large, rangy			
Steer number	40	43	47	Average	52	57	59	Average	60	61	64	Average
Feeder steer grade	Choice	Choice-	Choice	Choice	Good+	Good+	Good+	Good+	Choice-	Good+	Good	Good+
*Feeder steer type score	1.3	1.5	1.8	1.5	2.5	2.8	3.0	2.8	3.5	3.5	3.8	3.6
Initial weight per steer	375	365	480	407	400	400	400	413	520	490	440	483
Final weight per steer	850	900	980	910	948	818	968	945	1148	1095	1083	1108
Gain per steer	475	535	500	503	508	518	568	531	628	605	643	625
Daily gain per steer	1.38	1.55	1.46	1.47	1.47	1.50	1.65	1.54	1.82	1.75	1.86	1.81
**Average daily ration per steer												
Atlas sorgo silage		8.70				8.75				8.80		
Prairie hay		3.30				3.66				3.96		
Alfalfa hay		.60				.58				.57		
Ground shelled corn		5.81				6.06				5.83		
Soybean meal		.96				.97				.97		
Ground limestone		.01				.01				.01		
Salt		.03				.04				.04		
**Feed required per 100 lbs. gain												
Atlas sorgo silage		545.91				434.07				516.55		
Prairie hay		207.22				223.31				232.26		
Alfalfa hay		36.36				35.40				33.67		
Ground shelled corn		364.67				369.77				341.82		
Soybean meal		60.27				58.94				56.63		
Ground limestone		.75				.73				.70		
Salt		2.08				2.73				2.15		
**Feed cost per 100 lbs. gain		$14.06				$14.20				$13.46		
Percent shrink in marketing	5.29	4.12	4.08	4.5	3.48	4.68	5.48	4.54	2.44	3.20	5.09	3.57
*Slaughter steer type score	1.0	1.3	1.0	1.1	2.7	2.7	2.7	2.7	4.6	4.3	4.3	4.4
Live grade	Med.	Good-	Good	Med.+	Med.+	Med.+	Med.+	Med.+	Med.+	Med.+	Med.+	Med.+
Carcass grade	Com.	Good-	Good	Good-	Good-	Good	Com.+	Good-	Com.+	Com.+	Good-	Com.+
Dressing percent	57.83	59.14	60.5	60.51	60.51	62.52	60.51	61.18	59.6	57.78	61.33	59.57
**Selling price per cwt.	$26.75	$26.75	$26.75	$26.75	$27.50	$27.50	$27.50	$27.50	$24.75	$24.75	$24.75	$24.75

*Numbers 1 to 5 represent type. 1 represents small, compact, 3 intermediate, and 5 large, rangy.

**Average daily ration, feed required per 100 lbs. gain, feed cost per 100 lbs. gain, and selling price are based on the entire lot of 10 steers rather than the 3 steers representing each lot. This is done for comparison, since we do not have individual feeding records on the steers, and they sold as lots.

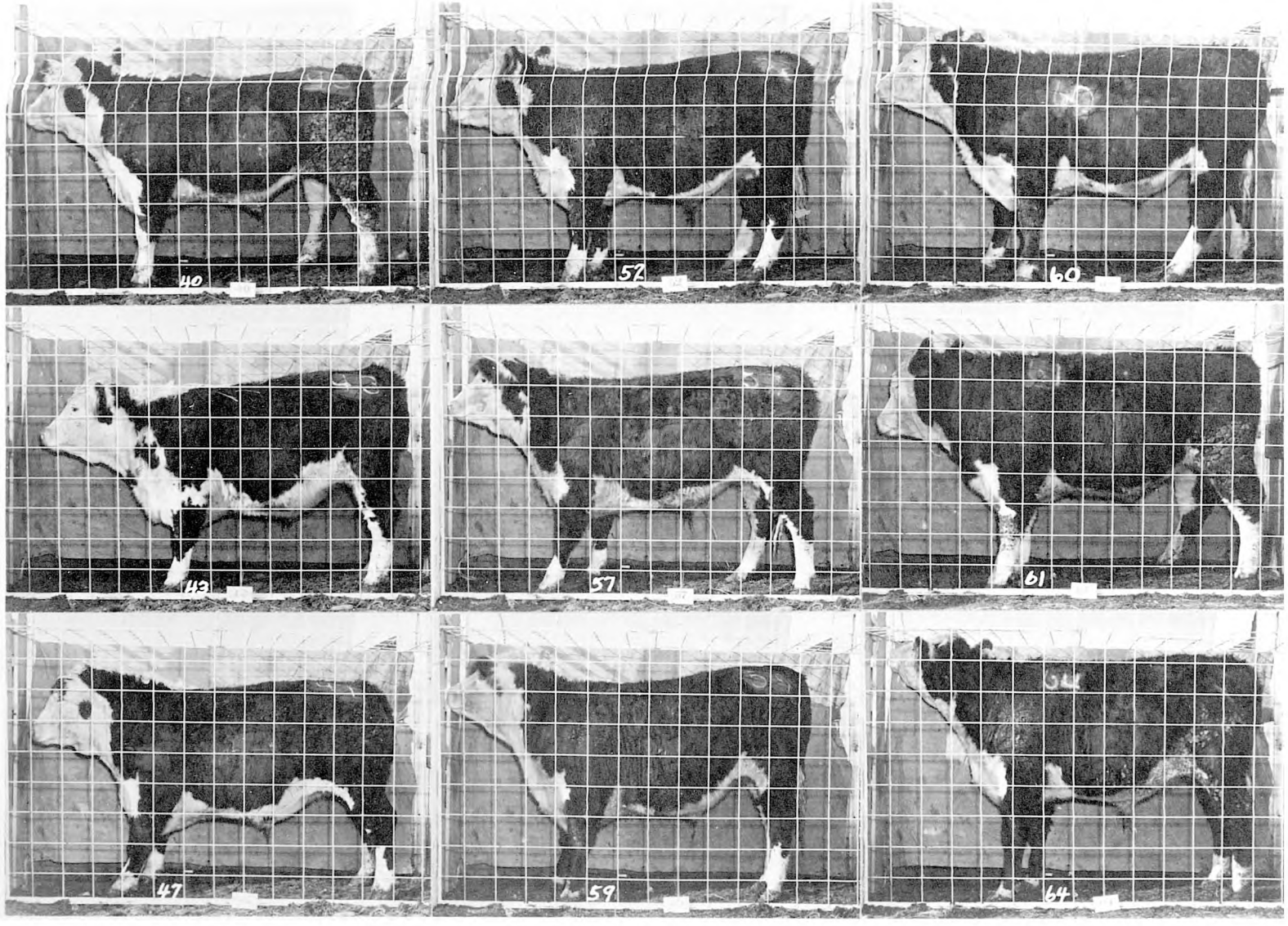
Table 3. Deferred full-feeding system by phases.

Size and type	Small, compact	Intermediate	Large, rangy
Number of steers per group	3	3	3
Wintering phase (153 days)			
Initial weight per steer	407	413	483
Final weight per steer	622	615	756
Total gain per steer	215	202	273
Average daily gain per steer	1.36	1.32	1.78
Summer grazing phase (92 days)			
Initial weight per steer	622	615	756
Final weight per steer	700	716	854
Total gain per steer	78	101	98
Average daily gain per steer	.85	1.06	1.06
Full-feeding phase (100 days)			
Initial weight per steer	700	716	854
Final weight per steer	910	945	1108
Total gain per steer	210	229	254
Average daily gain per steer	2.10	2.29	2.54
Summary (345 days)			
Initial weight per steer	407	413	483
Final weight per steer	910	945	1108
Total gain per steer	503	531	625
Average daily gain per steer	1.46	1.54	1.81

EXPLANATION OF PLATE II

The steers shown in this plate were handled under the deferred full-feeding system. Steers 40, 43, and 47 represent small compact type; steers 52, 57, and 59 represent intermediate type and steers 60, 61, and 64 represent large rangy type. The pictures were taken just before marketing.

PLATE II



lots, we find that the 3 large rangy steers made more total gain per steer than the parent lot, while the small compact and intermediate groups did not show up as well as their parent lots. The total gain and average daily gain for the 3 small compact steers was 503 and 1.47, while the parent lot was 550 and 1.59, respectively. The total gain and average daily gain for the 3 intermediate steers was 531 and 1.54, while the parent lot was 556 and 1.64, respectively; for the 3 large rangy steers it was 625 and 1.81, while their parent lot was 588 and 1.70, respectively.

In most other respects, the 3 representative steers did not differ significantly from their parent lots. The type scores of the small compact cattle were lower than the parent lot, and higher in the case of the large rangy type.

Plate II shows the steers representing small compact, intermediate and large rangy typeswhich were handled under the deferred full-feeding system.

Wintering and Grazing Two Seasons System

Table 4 summarizes the data on the selected type steers handled under the system of wintering and grazing two seasons. The total gain and average daily gain per steer was 570 and .90 pound, 706 and 1.11 pounds and 804 and 1.27 pounds respectively for the small compact, intermediate and large rangy steers. This shows that the large rangy type gained 234 more pounds than the small compact type. The intermediate steers gained 136 pounds more than the small compact type. The average initial weight is 383,

422, and 428 for the small compact, intermediate and large rangy type, respectively, the greatest difference in initial weight among the types being 45 pounds and the final weight difference being 234 pounds.

Total gain and average daily gain are greatly in favor of the large rangy cattle while the small compact type were much slower gainers than the other types under test.

Feed cost per 100 pounds gain was $13.52 for the small compact type, $12.82 for the intermediate and $12.17 for the large rangy type. This figure is based on the entire lot, rather than the 3 representative steers. The cost of 100 pounds gain was $1.45 cheaper for the large rangy type as compared to the small compact type.

The small compact type graded 1/3 of a grade higher as feeder calves than the intermediate and 1/2 of a grade higher than the large rangy. The small compact type also graded 1/3 of a grade higher as slaughter steers and in the carcass than the other two types.

The shrinkage in marketing was 4.8 percent for the small compact, 5.3 percent for the intermediate, and 5.2 percent for the large rangy, showing a slight advantage for the small compact cattle.

The intermediate type dressed 1/2 percent higher than the large rangy cattle and they in turn dressed 1 percent higher than the small compact type.

The small compact steers outsold the large rangy steers 15 cents per 100 pounds, while the intermediate type outsold the

small compact steers 35 cents per 100 pounds. They sold as follows: $27.65 per hundredweight for the small compact, $28.00 for the intermediate and $27.50 for the large rangy type.

The feeder steer and slaughter steer type score remains nearly the same for the small compact and intermediate types, while the large rangy type showed a difference of 1.6. The large, rangy cattle were scored 3.3 as feeder calves, or slightly rangy, and as two-year-old slaughter cattle they scored 4.9, or very rangy. This seems to indicate that the large, rangy cattle grew much more than the other two types.

In all respects, the 3 intermediate type steers performed practically the same as the parent lot. The 3 small compact steers did not make as much total gain or average daily gain as the parent lot. The parent lots gained 649 pounds and had an average daily gain per steer of 1.03 pounds, while the 3 representative steers gained 570 pounds and had a daily gain of .90 pound. This indicates the parent lot lacked uniformity and that probably some of the larger steers in the small lot were responsible for the better average performance of the entire lot.

The type score for the 3 representative small compact steers was lower than the parent lot. The 3 large rangy steers had a higher type score than the parent lot and the intermediate steers had the same score as their parent lot.

The total gain and average daily gain of the 3 representative large rangy steers was 804 and 1.27 pounds, while the parent lot was 749 and 1.18 pounds. The 3 selected steers gained an

average of 55 pounds more than the average of the parent lot.

Table 5 summarizes the total gain and average daily gain per steer by phases in the system of wintering and grazing two seasons. The three steers of each type are averaged together as a group.

During the first wintering period which was 153 days, the total gain was 104, 161, and 182 pounds, respectively, for the small compact, intermediate, and large rangy types. The large rangy cattle gained 21 pounds more than the intermediate and 78 pounds more than the small compact type. The average daily gains during the first wintering were .61 pound for the small compact, 1.06 pounds for the intermediate, and 1.18 pounds for the large, rangy type.

During the 167-day initial grazing period, the total gain was 186, 184, and 222 pounds for the small compact, intermediate and large, rangy types. The small, compact type outgained the intermediate type 2 pounds and the large, rangy type outgained the intermediate type 38 pounds. The average daily gains for the small compact, intermediate and large, rangy cattle were 1.12, 1.10, and 1.66, respectively.

The second wintering period was 205 days. The intermediate type outgained the large rangy type 4 pounds and the small compact cattle 101 pounds. The average daily gain was .65, 1.14, and 1.13 pounds, respectively, for the small compact, intermediate and large, rangy cattle.

When grazed 108 days as two-year-old steers, the gain was 146, 126, and 169 pounds for the small compact, intermediate and

Table 4. Summary of wintering and grazing two seasons. November 29, 1948, to August 24, 1950--633 days.

Size and type	Small, compact				Intermediate				Large, rangy			
Steer number	71	76	79	Average	83	86	88	Average	92	95	97	Average
Feeder steer grade	Good+	Choice+	Choice	Choice-	Choice-	Good	Good	Good+	Good	Good+	Good	Good
*Feeder steer type score	1.3	1.5	1.0	1.3	2.3	3.0	2.8	2.7	3.8	2.8	3.3	3.3
Initial weight per steer	475	350	325	383	460	375	430	422	465	430	390	428
Final weight per steer	1077	908	875	953	1112	1170	1102	1128	1210	1227	1258	1232
Gain per steer	602	558	550	570	652	795	672	706	745	797	868	804
Daily gain per steer	.95	.88	.87	.90	1.03	1.25	1.06	1.11	1.18	1.26	1.37	1.27
**Average daily ration per steer												
Soybean meal		1.0				1.0				1.0		
Atlas sorgo silage		28.86				31.71				30.74		
Prairie hay		4.68				4.44				4.97		
**Feed required per 100 lbs. gain												
Soybean meal		72.58				65.57				61.02		
Atlas sorgo silage		2181.05				2178.91				1961.83		
Prairie hay		303.95				285.34				298.95		
Pasture--two seasons												
**Feed cost per 100 lbs. gain		$13.52				$12.82				$12.17		
Percent shrink in marketing	5.7	4.7	4.0	4.8	5.1	6.8	4.2	5.3	4.9	5.2	4.6	5.2
*Slaughter steer type score	2.0	1.0	1.0	1.3	3.2	3.2	3.0	3.1	5.0	4.7	5.0	4.9
Live grade	Med.+	Med.	Med.+	Med.+	Med.+	Med.	Med.	Med.	Med.	Med.+	Med.	Med.
Carcass grade	Com.+	Com.-	Com.+	Com.+	Com.	Com.	Com.	Com.	Com.	Com.+	Com.	Com.
Dressing percent	59.7	56.1	59.4	58.4	60.2	60.9	58.6	59.9	60.1	59.7	58.4	59.4
**Selling price per cwt.	$27.65	$27.65	$27.65	$27.65	$28.00	$28.00	$28.00	$28.00	$27.50	$27.50	$27.50	$27.50

*Numbers 1 to 5 represent type. 1 represents small, compact, 3 intermediate, and 5 large, rangy.

**Average daily ration, feed required per 100 lbs. gain, feed cost per 100 lbs. gain, and selling price are based on the entire lot of 10 steers rather than the 3 steers representing each lot. This is done for comparison, since we do not have individual records on the steers, and they sold as lots. Cost per 100 lbs. gain includes pasture charges.

Table 5. Wintering and grazing two seasons by phases.

Size and type	Small, compact	Intermediate	Large, rangy
Number of steers per group	3	3	3
Wintering phase (153 days)			
Initial weight per steer	383	422	428
Final weight per steer	487	583	610
Total gain per steer	104	161	182
Average daily gain per steer	.61	1.06	1.18
Summer grazing phase (167 days)			
Initial weight per steer	487	583	610
Final weight per steer	673	717	832
Total gain per steer	186	184	222
Average daily gain per steer	1.12	1.10	1.66
Wintering as yearlings (205 days)			
Initial weight per steer	673	767	832
Final weight per steer	807	1002	1063
Total gain per steer	134	235	231
Average daily gain per steer	.65	1.14	1.13
Grazing as two-year-olds (108 days)			
Initial weight per steer	807	1002	1063
Final weight per steer	953	1128	1232
Total gain per steer	146	126	169
Average daily gain per steer	1.35	1.15	1.54
Summary of phases I,II,III, and IV			
Initial weight per steer	383	422	428
Final weight per steer	953	1128	1232
Total gain per steer	570	706	804
Average daily gain per steer	.90	1.11	1.27

large, rangy type steers. The small, compact steers outgained the intermediate type 20 pounds, while the large, rangy type outgained the intermediate steers 36 pounds. The average daily gain for the small compact type was 1.35 pounds, the intermediate type 1.15 and the large, rangy type 1.54 pounds.

The large rangy steers outgained the other types in every phase except the second wintering period; here the intermediate type outgained them 4 pounds. The small compact type outgained the intermediate type during both grazing seasons by a small margin, but the intermediate type made much larger winter gains than the small compact cattle.

Plate III shows the small compact, intermediate, and large rangy type cattle handled under the system of wintering and grazing two seasons. The pictures were taken at marketing time.

Carcass and Slaughter Investigations

The purpose of the meat investigation in this project was to determine differences, if any, in carcass value and composition among the three types of cattle selected for this special study.

The 9th, 10th, and 11th ribs have long been used as a representative cut from the carcass for analysis. The ribs were cut as 10-inch ribs and were taken from the left side. There was one exception to this, however; due to a mistake at the packing plant the rib from the right side was taken from the cattle handled under the deferred full-feeding system. Experiments have proven that there is no difference between the right and left rib from the same carcass.

EXPLANATION OF PLATE III

The steers shown in this plate were handled under the system of wintering and grazing two seasons. Steers 71, 76, and 79 represent small compact type; steers 83, 86, and 88 represent intermediate type and steers 92, 95, and 97 represent large rangy type.

The pictures were taken just before marketing.

PLATE III

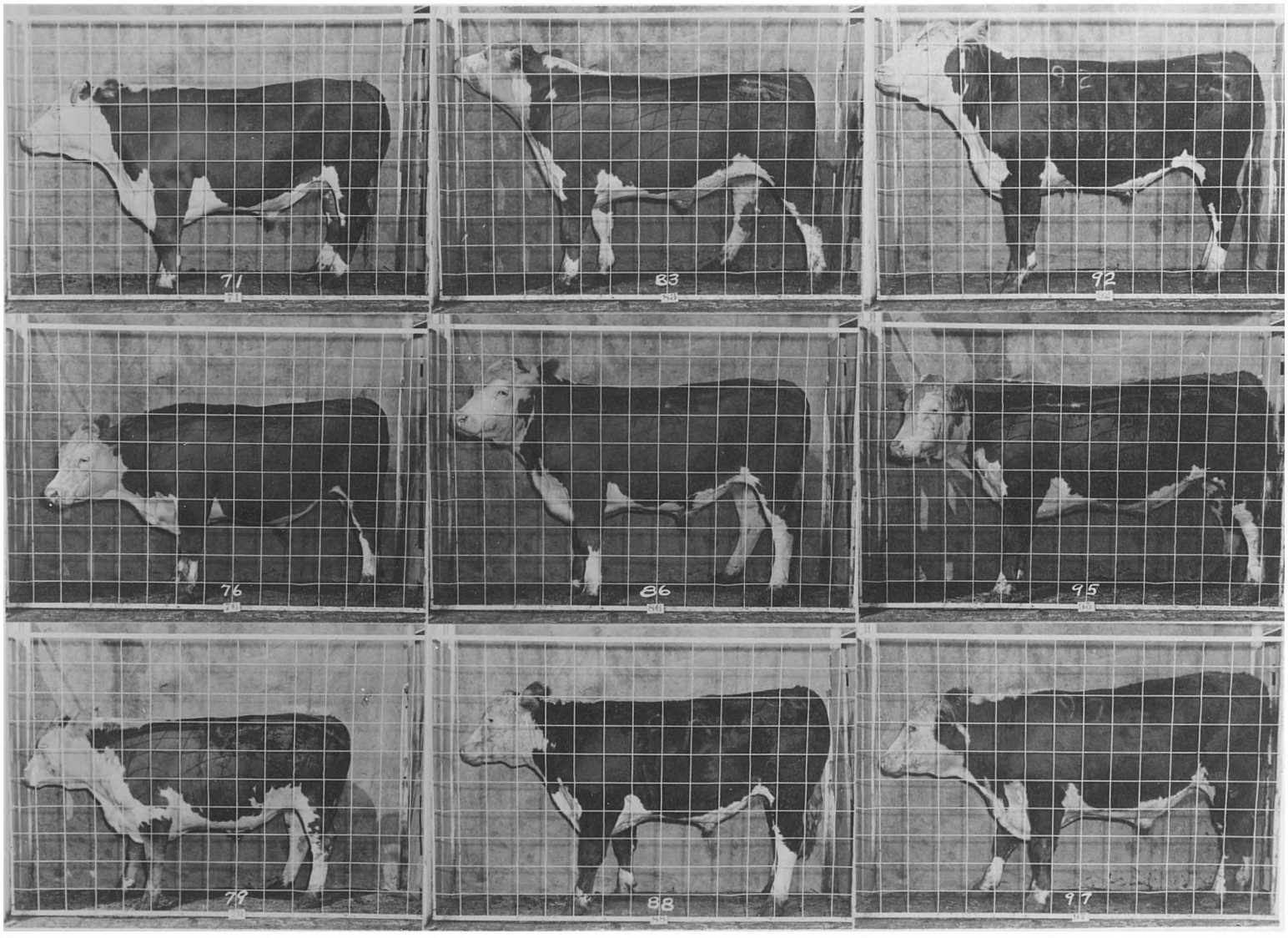


Table 6 shows a summary of the mechanical separation of fat, lean and bone on each of the ribs from the representative cattle handled under the three different systems of beef production. The rib eye is figured in the total lean and all figures are on the percentage basis.

There was no consistent or significant difference among the different types of cattle with respect to percent of lean or fat and bone in the 9th, 10th, and 11th ribs. There was a difference in the percent of fat and lean between the cattle which were immediate full-fed and those which were wintered and grazed two seasons. This is due to the difference in finish. The immediate full-fed cattle had a higher percentage of fat. This did not decrease the volume of lean but it did decrease the percentage of lean. On the other hand, the steers that were wintered and grazed two seasons had a lower percentage of fat and a higher percentage of lean.

The large, rangy cattle showed a larger percentage of eye muscle than the other two types. The small compact type showed a larger percentage of eye muscle than the intermediate type. This difference is not significant.

Table 7 summarizes the chemical analysis of the eye muscle of the representative cattle handled under the three systems of beef production.

There was no significant difference in percent of total nitrogen, non-protein nitrogen, fat, moisture, ash, and ph among the different type and size cattle.

The differences in percent of glycogen of the rib eyes from

Table 6. Mechanical separation of fat, lean and bone on 9th, 10th, 11th rib of each representative cattle (small compact, intermediate and large rangy).

**Steer number	% total lean	% total fat	% total bone	% rib eye muscle
	Immediate full-fed group			
2	48.9	37.0	12.8	17.4
7	45.6	41.5	13.1	19.4
8	44.4	30.4	14.5	16.6
Average	*46.0	*36.3	*13.4	*17.8
23	45.1	37.0	10.7	16.5
24	41.4	40.0	13.0	15.2
28	49.6	34.8	15.2	18.4
Average	*45.3	*37.2	*13.3	*16.7
30	47.8	39.0	12.4	21.0
32	41.7	40.0	14.0	16.7
33	45.6	36.2	13.7	19.8
Average	*45.3	*38.4	*13.3	*19.1
	Deferred full-fed group			
40	48.8	31.8	16.2	18.7
43	44.5	39.1	14.3	15.1
47	45.6	38.3	13.8	17.6
Average	*46.3	*36.4	*14.8	*17.1
52	45.4	38.1	14.5	13.7
57	46.4	37.6	13.3	17.2
59	44.3	39.4	13.8	15.3
Average	*45.4	*38.4	*13.8	*15.4
60	49.8	32.0	16.1	20.4
61	56.6	27.5	15.6	21.1
64	49.6	32.9	16.0	17.0
Average	*52.0	*30.8	*15.9	*19.5
	Wintering and grazing two seasons group			
71	50.5	30.9	17.9	18.5
76	61.1	19.7	18.9	23.1
79	59.9	23.7	15.8	20.7
Average	*57.1	*24.7	*17.5	*20.7
83	55.7	24.2	18.2	20.3
86	48.2	31.8	16.1	16.1
88	54.0	27.0	18.6	21.0
Average	*52.6	*27.6	*17.6	*19.1
95	52.2	29.2	16.1	21.1
97	56.8	25.0	17.0	23.6
Average	*54.5	*27.1	*16.5	*22.3

*Indicates average.

**The steer number represents the rib analyzed from that steer. Small numbers under each system represent the small compact cattle, large numbers the largy rangy type and intermediate numbers the intermediate type.

Table 7. Chemical analysis of eye muscles taken from the 9th, 10th, 11th rib of each representative carcass.

Steer * no.	Total nitr. pct.	NPN pct. total N.	Fat pct.	Mois. pct.	Ash pct.	pH	Glyco-gen mg. %
		Immediate full-fed group					
2	3.36	12.3	5.5	72.5	0.83	5.40	144
7	3.46	12.3	3.6	73.9	0.96	5.40	139
8	3.54	13.4	3.8	73.5	1.10	5.48	16
23	3.39	13.0	5.8	72.1	0.93	5.40	137
24	3.43	13.6	5.7	72.8	1.07	5.49	83
28	3.41	12.7	4.9	72.8	1.06	5.37	117
30	3.46	12.3	5.8	73.0	1.06	5.47	44
32	3.42	12.6	4.8	72.7	1.11	5.40	43
33	3.45	12.4	5.7	71.9	1.10	5.52	6
		Deferred full-fed group					
40	3.52	12.4	2.1	74.7	1.08	5.31	34
43	3.48	12.0	3.8	73.0	1.04	5.32	16
47	3.43	12.4	5.1	71.0	1.00	5.30	75
52	3.55	12.2	3.8	72.8	1.04	5.31	130
57	3.42	12.6	4.3	71.9	1.01	5.31	64
59	3.53	12.6	2.2	74.4	1.00	5.37	134
60	3.61	12.5	3.1	71.9	1.04	5.33	120
61	3.52	12.0	2.9	73.8	1.03	5.32	80
64	3.50	11.3	4.7	72.9	1.03	5.42	0
		Wintering and grazing two seasons group					
71	3.64	12.1	4.6	71.0	0.97	5.54	193
76	3.66	12.1	1.4	74.6	1.06	5.64	108
79	3.59	12.3	2.6	73.3	0.99	5.65	144
83	3.61	12.2	2.4	73.4	0.99	5.62	88
86	3.58	12.5	3.6	72.6	0.98	5.62	44
88	3.66	12.3	2.2	73.3	1.05	5.65	50
95	3.62	12.2	3.2	72.9	1.02	5.68	6
97	3.64	12.4	2.0	74.0	1.01	5.62	46

*The steer number represents the eye muscle from that steer. Small numbers under each system represent the small compact type, large numbers the large rangy cattle and intermediate numbers the intermediate type.

the small compact, intermediate and large rangy types were not significant. There was a tendency for the large rangy type to have a lower percentage of glycogen than the other two types, but this difference was small.

After the 9th, 10th, and 11th ribs were removed, the remaining beef rib was taken to the Home Economics Department for cooking tests. These were roasted at 137 degrees Fahrenheit until done and losses were recorded. After the roasts were done, shear tests, press fluid volume, and tasting scores were recorded to determine differences in the roasts.

Table 8 summarizes the cooking losses of the standing rib roasts from the representative cattle handled under the three systems of beef production.

There was some variation in drip, volatile and total cooking loss but this variation was not consistent or significant among the different types. There was a slight advantage for the small compact type in total cooking loss, but this advantage was not significant.

Table 9 summarizes the tenderness and juiciness tests on the standing rib roasts from the selected cattle handled under the immediate full-feeding, deferred full-feeding and wintering and grazing two seasons systems of beef production. There was no consistent or significant difference in tenderness and juiciness between the different types. The ribs from cattle handled under the system of wintering and grazing two seasons were less tender and juicy than the ribs from cattle handled under the other two systems.

Table 8. Cooking losses of the standing rib roasts cooked at 137° F.

*Roast no.	Drip loss percent	Volatile loss percent	Total cooking loss percent
	Immediate full-fed group		
2	3.93	10.82	14.75
7	4.38	10.74	15.58
8	4.25	9.87	14.16
23	4.99	12.49	17.48
24	5.60	9.88	15.48
28	4.20	10.85	15.05
30	6.07	12.36	18.43
32	5.91	11.60	17.50
33	5.48	9.77	15.24
	Deferred full-fed group		
40	4.09	9.07	13.15
43	4.19	8.63	12.82
47	3.35	7.07	10.42
52	5.14	10.69	15.84
51	4.59	12.46	17.04
59	5.89	10.57	16.47
60	5.08	11.96	17.04
61	3.49	7.51	11.00
64	3.97	12.82	16.79
	Wintered and grazed two seasons group		
71	7.73	7.13	14.86
76	3.70	8.33	12.03
79	5.25	6.88	12.13
83	7.51	7.56	15.07
86	6.00	12.44	18.44
88	6.69	8.88	15.00
95	4.87	10.71	15.58
97	3.71	11.54	15.25

*Roast number corresponds to the steer number from which the roast came.

Table 9. Tenderness and juiciness of the standing rib roasts cooked at 137° F.

*Roast no.	Tenderness		Juiciness	
	Shear value (lbs.)	Judges' score	Press fluids	ML. judges' score
		Immediate full-fed group		
2	9.56	6.6	6.30	6.0
7	10.63	6.4	10.05	5.9
8	13.87	6.0	10.25	5.6
23	8.06	6.9	10.95	6.0
24	14.69	5.9	10.05	5.9
28	10.25	6.4	10.00	5.9
30	10.00	6.4	12.25	6.4
32	14.12	6.4	10.35	6.0
33	11.87	6.4	10.80	6.0
		Deferred full-fed group		
40	13.00	5.9	12.45	6.4
43	19.87	6.4	12.50	6.6
47	17.69	6.1	8.75	6.6
52	13.75	6.4	10.70	6.1
57	11.06	6.8	9.60	6.1
59	15.13	5.6	10.55	5.8
60	13.69	6.5	11.80	6.1
61	14.56	6.6	12.25	6.3
64	11.37	6.6	12.05	6.3
		Wintered and grazed two seasons group		
71	15.13	5.7	7.50	5.8
76	17.40	6.0	9.50	5.9
79	13.56	5.6	7.50	5.7
83	16.00	5.8	9.20	5.8
86	18.75	5.8	9.50	5.5
88	16.94	5.4	6.80	5.1
95	11.90	5.6	10.50	5.9
97	15.69	5.6	8.80	5.4

*Roast number corresponds to the steer number from which the roast came.

Plate IV shows the beef ribs of the selected steers which were handled under the immediate full-feeding systems. The ribs from the intermediate type show more desirable conformation, marbling and quality. The ribs from the small compact cattle lacked thickness at the rib ends and also lacked marbling.

Plate V shows the beef ribs of the selected steers which were handled under the deferred full-feeding system. There is very little difference in the marbling among the different types. The rib eyes from the large, rangy cattle appear to be larger than the rib eyes of the other two types.

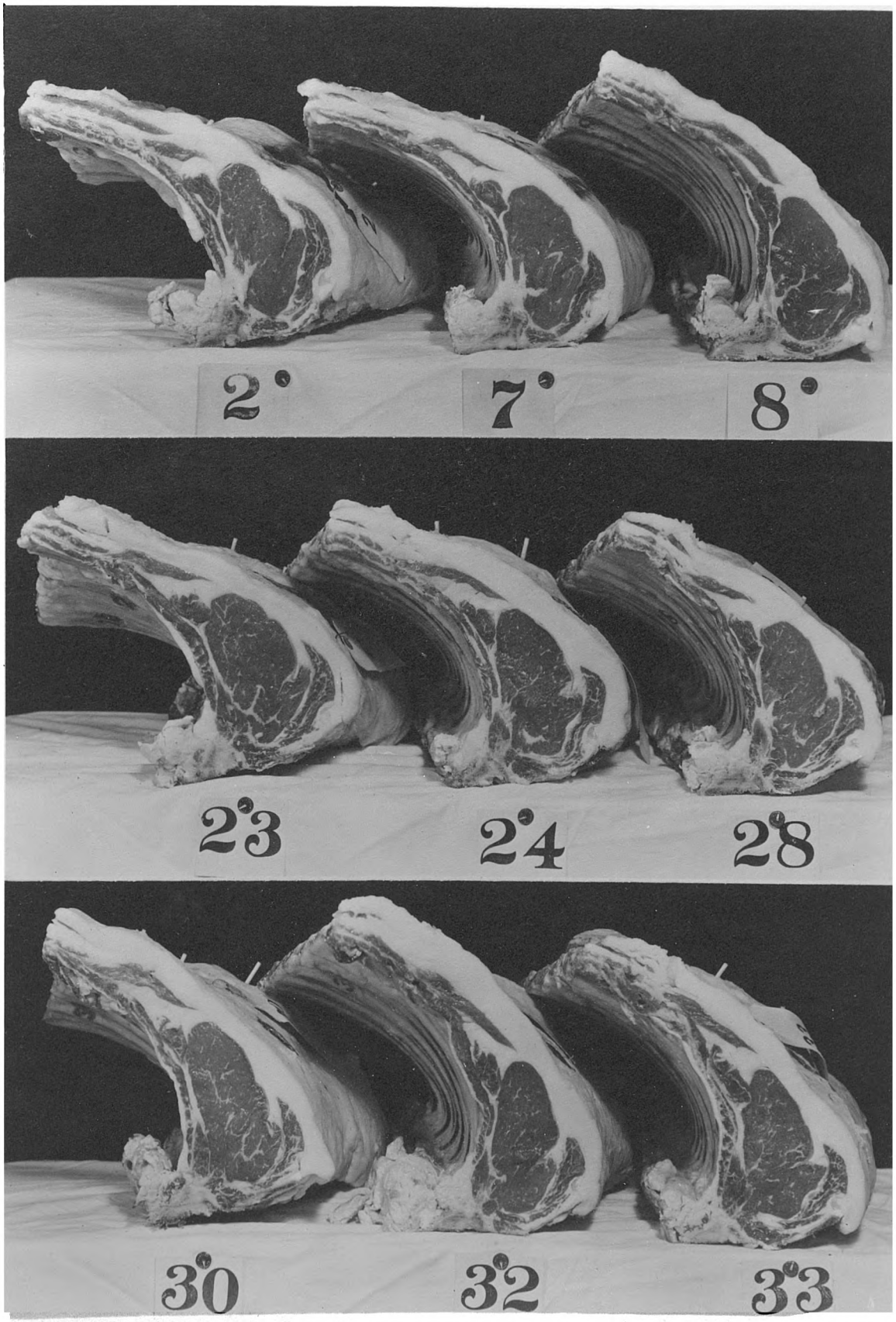
Plate VI shows the beef ribs of the selected cattle which were handled under the system of wintering and grazing two seasons. The rib from steer number 92 was misplaced at the packing plant and is not shown in this plate. Number 92 was one of the large, rangy steers. These ribs were coarse and appear soft. They also show a lot of moisture.

EXPLANATION OF PLATE IV

Pictured in this plate are the beef ribs of the selected steers which were handled under the immediate full-feeding system. The number on the rib corresponds to the number of the steer from which the rib came. The top row of ribs are from small compact cattle; the middle row from intermediate and the bottom row are from large rangy cattle.

The cattle from which these ribs came are shown in Plate I.

PLATE IV

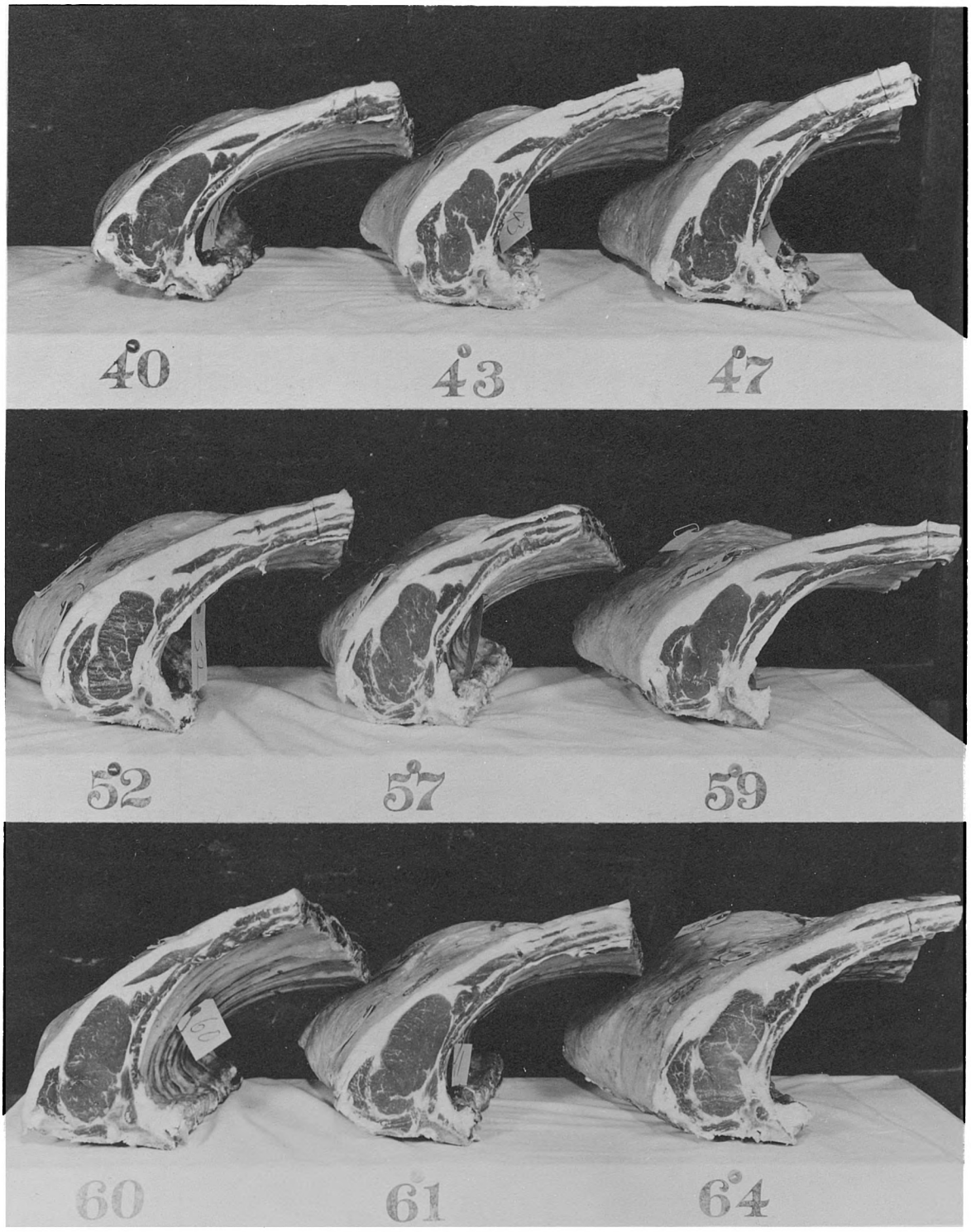


EXPLANATION OF PLATE V

Pictured in this plate are the beef ribs of the selected steers which were handled under the deferred full-feeding system. The number on the rib corresponds to the number of the steer from which the rib came. The top row of ribs are from small compact cattle; the middle row from intermediate, and the bottom row are from large rangy cattle.

The cattle from which these ribs came are shown in Plate II.

PLATE V



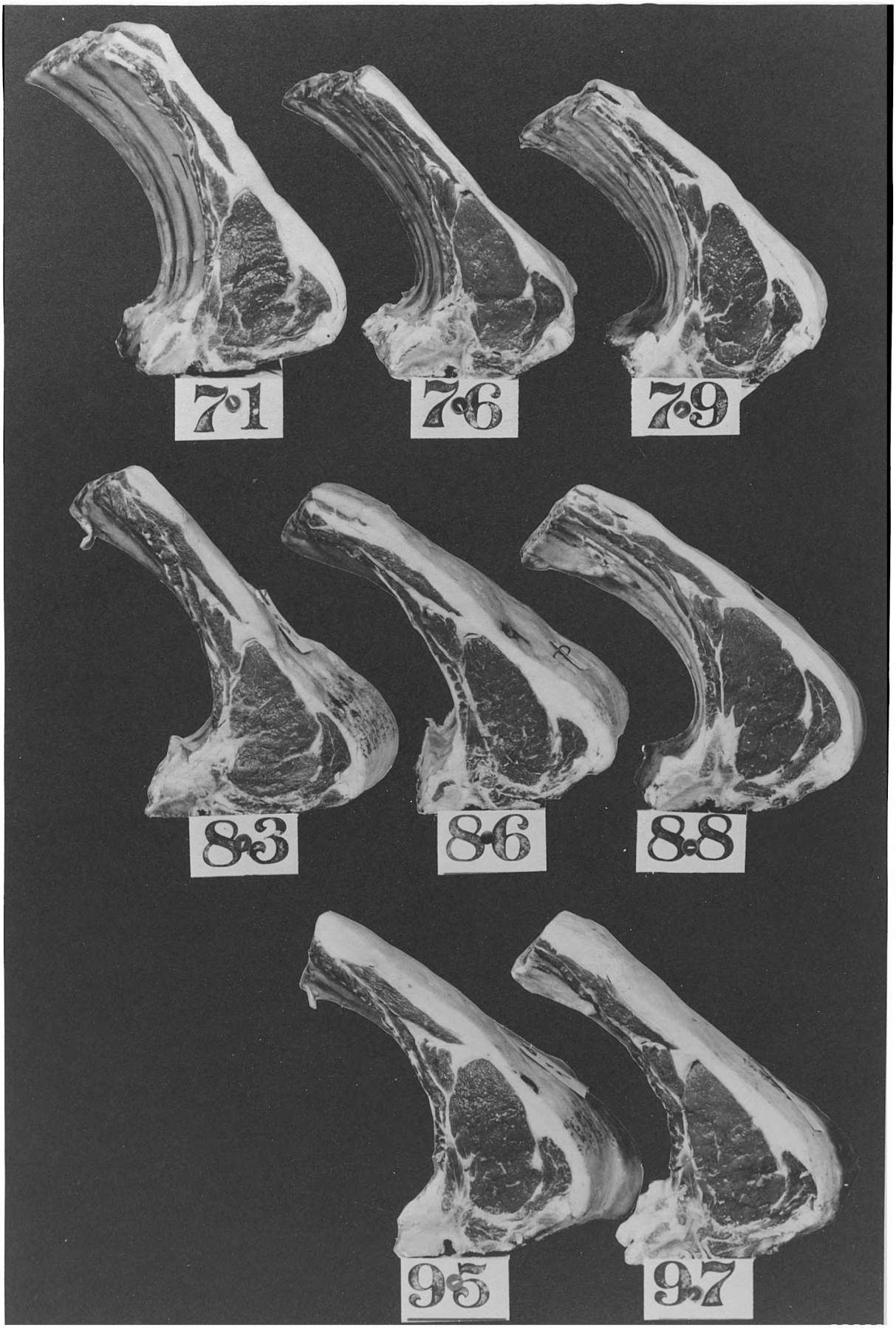
EXPLANATION OF PLATE VI

Pictured in this plate are the beef ribs of the selected steers which were handled under the wintering and grazing two seasons system. The number on the rib corresponds to the number of the steer from which the rib came. The top row of ribs are from small compact cattle; the middle row from intermediate; and the bottom row are from large rangy cattle.

The cattle from which these ribs came are shown in Plate III.

Rib 92 was lost at the packing plant, which made it impossible for us to use it for analysis.

PLATE VI



SUMMARY AND CONCLUSIONS

Range-bred Hereford steer calves from Wyoming and Montana were purchased and used in a study of grazing and feed-lot performance with respect to type and size. The calves were lotted in 9 lots of 10 steers each. Three lots were made up of calves sired by small compact bulls, 3 of calves sired by intermediate type bulls and 3 of steers sired by large rangy bulls. The 9 lots were arranged in 3 series of 3 lots each, each series containing 1 lot sired by small compact bulls, 1 lot by intermediate type bulls and 1 lot by large rangy bulls. Three steers from each lot were selected for special study. These steers were selected as being typical of small compact type, intermediate type and large rangy type. Three lots containing the three types were handled under the immediate full-feeding system, another series was handled under the deferred full-feeding system and the third series was handled under the system of wintering and grazing two seasons. Carcass studies were made of each selected type and size cattle.

From the data obtained, the following conclusions seem justified:

1. The small compact type (resembling "compress") were significantly slower gainers than intermediate and large rangy types. They made less total gain and average daily gain per steer under each beef production system than the other two types.

2. In this study, the large rangy cattle utilized roughage and pasture significantly more efficiently than the other two types.

3. The feeder calves scored as very compact did not possess the ability to make good growth. The cattle that were scored intermediate to large rangy, as feeders, made exceptionally good growth. This seems to indicate that feeder calves that are extremely blocky, very compact, and appear somewhat mature, may lack the ability to make good growth.

4. There was no significant difference in marketing shrinkage among the different sizes and types.

5. There was a slight advantage in dressing percent for the intermediate type over the other two types. This advantage was not significant.

6. The live cattle grade for the full-fed group was much higher than the carcass grade. This apparently was due to an inflated appraisal by the graders.

7. Type and size did not significantly influence carcass composition. There was no significant difference in percent of lean, fat, and bone among the type and size groups. The chemical composition of the rib eye was practically the same for the different types and the cooking and palatability tests showed no difference among the types. The 9th, 10th, and 11th ribs were used for analysis.

8. Even though individual feeding records were not available to determine economy of gain among the different type and size groups, it seems logical to conclude that, for economical beef production, extremely small compact cattle (resembling "comprest") are not desirable.

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LITERATURE CITED

(1) Hawkins, L. E., W. L. Blizzard and W. A. Craft.
Influence of breeding on type and gains in beef cattle. Okla. Sta Rpt. 1933-34.

(2) Hultz, Fred S.
Type of beef calves. Wyo. Agr. Expt. Sta. Bul. 153 p. 1927.

(3) Hultz, Fred S. and S. S. Wheeler.
Type in two year old beef steers. Wyo. Agr. Expt. Sta. Bul. 155 p. 1927.

(4) Kleiber, M.
Problems involved in breeding efficiency of food utilization. Amer. Soc. Anim. Prod. Proc. 1936 p. 247-258.

(5) Knapp, Bradford Jr. and A. L. Baker.
Correlations between rate and efficiency of gain in steers. Jour. Anim. Sci. 3:219-223. 1944.

(6) Knapp, Bradford Jr., A. L. Baker and J. R. Quisenberry.
Growth and production factors in range cattle. Mont. Expt. Sta. Bul. 400. 1942.

(7) Knapp, Bradford Jr. and R. T. Clark.
Revised estimates of heritability of economic characteristics in beef cattle. Jour. Anim. Sci. 9(4). Nov. 1950.

(8) Knox, J. H. and Marvin Koger.
A comparison of gains and carcasses produced by three types of feeder steers. Jour. Anim. Sci. 5(4). 1946.

(9) Lush, J. L.
Relation of body shape of feeder steers to rate of gain, to dressing percent and to value of dressed carcass. Texas Agr. Expt. Sta. Bul. 471. 1932.

(10) Smith, H. R.
Beef production. Nebr. Expt. Sta. Bul. 132. 1912.

(11) Smith, H. R.
Economical beef production. Nebr. Expt. Sta. Bul. 116. 1910.

(12) Stanley, E. B. and Ralph McCall.
A study of performance in Hereford cattle. Ariz. Agr. Expt. Sta. Bul. 109. 1945.

(13) Stoddart, L. A.
Gains made by cattle on summer range in northern Utah. Utah Agr. Expt. Sta. Bul. 314. 1944.

(14) Stonaker, H. H., S. S. Wheeler, M. H. Hazaleus, J. E. Ingalls, and E. W. Schleicher.
Progress report on feedlot and carcass characteristics of small and conventional type steer calves. Colo. Agr. Expt. Sta. March 22, 1950.

(15) Vaughn, Henry W.
Types and market classes of livestock. Columbus, Ohio: College Book Company. p. 23. 1945.

(16) Willey, N. B., O. D. Butler, J. K. Riggs, J. H. Jones, and P. J. Lyerly.
The influence of type and feedlot performance and killing qualities of Hereford steers. Jour. Anim. Sci. 10(1). 1951.

(17) Wilson, J. and C. F. Curtis.
Steer feeding. Iowa Bul. 20. 1893.

(18) Winters, L. M. and H. McMahon.
Efficiency variations in steers: Proposed record of performance. Minn. Agr. Expt. Sta. Tech. Bul. 94. 1934.

(19) Woodward, R. R., R. T. Clark and J. N. Cummings.
Studies on large and small type Hereford cattle. Mont. Agr. Expt. Sta. Bul. 401. 1942.

(20) Weber, A. D.
Medium is the size. The American Hereford Journal. 41(22):20-25. March 15, 1951.

TYPE AND SIZE AS FACTORS IN ECONOMICAL BEEF PRODUCTION

by

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TYPE AND SIZE AS FACTORS IN ECONOMICAL BEEF PRODUCTION

Largely as a result of demand for smaller cuts of beef by consumers, the type of beef cattle has changed from larger more rangy cattle to the smaller more compact type. Some breeders changed rapidly to extremely small compact cattle. These cattle were called "comprest" in Herefords and "compacts" in Shorthorns. Many breeders used bulls of this extreme type to hasten the change in the type of their cattle. Other breeders made this change gradually and bred for sound conformation, good constitution, substance and quality in their cattle, staying between the large rangy and small very compact cattle.

Since uniformity is an asset to a breed and since the Hereford breed produces different types and size cattle, The American Hereford Association decided to sponsor research work with respect to size and type in order to gain more information as to which size and type is the best for economic beef production.

These tests were conducted by the Kansas, Oklahoma and Ohio stations. The study herein reported is taken from the project conducted at Kansas State College.

The purpose of this experiment was to determine the difference in grazing and feed-lot performance between commercial cattle sired by small compact, intermediate and large rangy type bulls. The calves used in this test were range-bred steers from Wyoming and Montana.

The cattle were lotted in 3 series of 3 lots each, making 9 lots in all. One lot in each series was sired by small compact

bulls, 1 by intermediate and 1 by large rangy type bulls.

There was considerable variation within each group. The greatest variation was in the calves sired by small compact bulls. Because of this variation, 3 steers from each lot were selected as being typical in size and type of their respective lot and were used for special study. The selected steers were handled exactly the same as the parent lots and were compared to the lot they represented in order to determine differences in grazing and feedlot performance. Carcass studies were also made for comparison.

One series of 3 lots was handled under the immediate full-feeding system, which lasted 225 days. Another series of 3 lots was handled under the deferred full-feeding system, which included 3 phases; wintering well, grazing May 1 to August 1 and full-feeding in the dry lot 100 days. The third series of 3 lots was handled under the system of wintering and grazing two seasons. This was done without grain, and the cattle were marketed off grass.

The data obtained indicated that the small compact type (resembling "comprest") were significantly slower gainers than intermediate and large rangy types. They made less total gain and average daily gain per steer under each system of beef production than the other two types.

In this study, the large rangy cattle utilized roughage and pasture significantly better than small compact and intermediate type cattle.

In this test, type scores were given each steer as a feeder and also as a slaughter steer. The scores ranged from 1 to 5.

One represented small very compact, 3 intermediate and 5 large very rangy. It was found that feeder calves scored as very compact did not possess the ability to make good growth. The cattle that were scored intermediate to large rangy, as feeders made exceptionally good growth. This seems to indicate that feeder calves that are extremely blocky, very compact and appear somewhat mature, may lack ability to make good growth.

Type and size did not influence the amount of shrinkage in marketing. There was a slight advantage in dressing percent for the intermediate type over the other two types, but this advantage was not significant.

Type and size did not significantly influence carcass composition. There was no significant difference in percent of lean, fat, and bone among the type and size groups. The chemical composition of the rib eye was practically the same for the different types and cooking and palatability tests showed no difference among the types. The 9th, 10th, and 11th rib were used for analysis.

Even though individual feeding records were not available to determine economy of gain among the different type and size groups, it seems logical to conclude that, for economical beef production, extremely small compact cattle (resembling "comprest") are not desirable.