

### Summary

As a part of a series of studies on the effect of winter feed levels on the growth and productivity of beef females, results of two trials with young cows carried to 3.5 and 4.5 years of age are reported. The results to date clearly point out the danger of underfeeding which results in delayed skeletal growth, body weight, and late calving, with smaller calves at birth and weaning, and depressed milk production. Conversely, overfeeding may result in more calving difficulty, depressed milk production, and a tremendous increase in feed cost. Although feeding regimes similar to the Very High level, as practiced in this study are rarely encountered in the field, the possibility of damaging the young growing beef female by overfeeding, as in fitting show animals, should be guarded against.

A Medium to High level appears to be most desirable in this study in terms of growth of the dam, weaning weight, and number of offspring produced. When considered from the economic standpoint, the Medium level appears most desirable, wherein heifer calves are wintered to gain approximately 0.5 lb. daily throughout the first wintering period, and fed so as to lose less than 10 percent of their fall body weight each winter thereafter to maturity. It should be pointed out that these studies involve only spring-calving cows, and that this loss in body weight during the winter includes the loss due to calving in February and March.

## The Inheritance of Two Different Types of Dwarfism in Beef Cattle

*E. J. Turman, B. J. Watkins,*

*Doyle Chambers, and Dwight Stephens*

Few, if any, hereditary defects in farm animals have received the attention that was focused on dwarfism. Certainly the present optimism on the part of cattlemen that dwarfism is under control is in sharp contrast to the fear, doubt, and confusion that accompanied the onset and early history of this defect.

To most cattlemen the word "dwarf" and "snorter dwarf" are synonymous. Few are aware that there are several other types of hereditary dwarfism of cattle, because these other types were much less frequently encountered and were never an important problem to the industry. However, in a few individual herds these other dwarfism types were a problem as serious as snorter dwarfism.

One of the other forms of dwarfism in cattle is the longheaded dwarf. It was first described in a scientific publication at approximately the same time as the snorter dwarf. Therefore, it is not a new type of dwarfism, but rather a different type. For both types of dwarfism the mode of inheritance was reported to be due to an autosomal recessive gene. Subsequent research plus the experiences of breeders has confirmed this mode of inheritance for the snorter dwarf. Little research has been concerned with the longheaded dwarf, however, and nothing further has been reported in the literature since the original paper that described it.

The name, longheaded, is descriptive of the principal difference between mature animals of the two types (Figures 1 and 2). The long narrow head of the longheaded dwarf is in sharp contrast to the short, broad, distinctly dished head of the snorter dwarf which is characteristic of all dwarfs in the minds of most breeders. The two are very similar in other characteristics, being definitely dwarf in stature with short thick cannons and heavy middles.

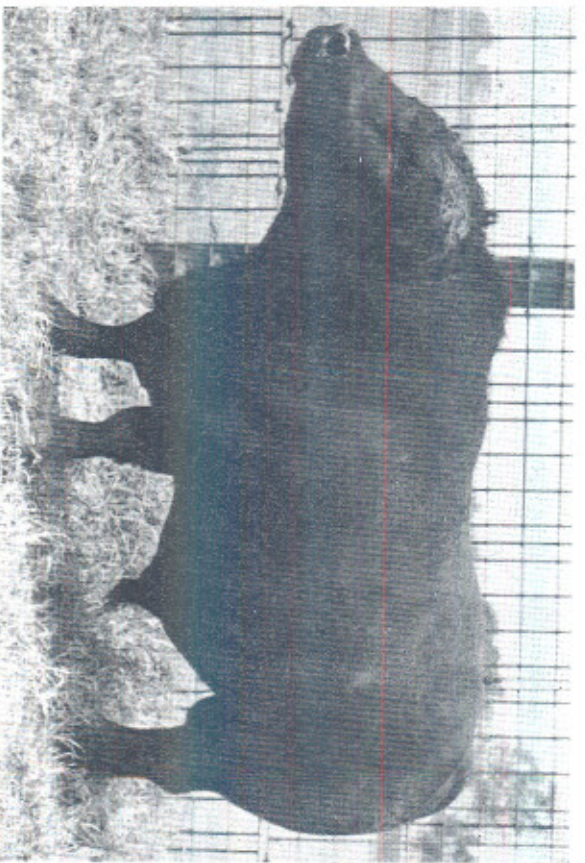
Unfortunately the long narrow head is not evident at birth in the longheaded dwarf calf. It usually begins to be noticeable after the calf is several months of age and appears to continue to grow longer throughout the lifetime of the dwarf. The typical longheaded calf at birth shows many dwarf symptoms. It is lowset and blocky with short thick cannons, but it also appears almost normal in the head. Because longheaded dwarf calves do not have the typical snorter dwarf symptoms in the head they are often overlooked at birth. This oversight is corrected later if the calf survives until weaning time. It is likely that a number of longheaded dwarf calves, which were either born dead or died soon after birth, have not been correctly identified.

## Material and Methods

The data reported in this paper were largely obtained from breeding records of the experimental cow herd of Project 873 at Ft. Reno from 1955 through 1961. This cow herd includes a group of Angus and Hereford cows that are known to be carriers of snorter dwarfism. In addition to the carrier cows, a herd of snorter and longheaded dwarfs are also maintained for physiological studies. The bulk of the information on inheritance of the longheaded type came from another experimental herd of Angus cows.



**Figure 1. Mature Snorter Dwarf Angus Bull.**



**Figure 2. Mature Longheaded Dwarf Angus Bull**

The inheritance of snorter dwarfism was studied by considering all matings of a carrier bull to carrier cows. Since all cows were known to be carriers, any calf dropped to the service of a carrier bull could be counted. However, since none of the bulls were known to be carriers at the time they were bred to the cows, it was necessary to use a post probant analysis. The first dwarf sired by a bull was used to prove him a carrier, and that dwarf and all earlier calves that had been born were discarded. Thus, the only calves credited to a sire in this analysis were those dropped after the dwarf calf that proved him to be a carrier.

Additional information on the inheritance of snorter dwarfism was obtained from a limited number of matings of snorter dwarf bulls to snorter dwarf heifers. This mating was made to produce a number of dwarf calves for a hematological study. Such matings are difficult to make because only a small percentage of dwarf calves live to reach breeding age and are fertile and will conceive. It was also necessary to deliver all calves from dwarf heifers by caesarian.

The inheritance of longheaded dwarfism was studied by considering all matings of sons of known carriers to daughters of known carriers of the longheaded gene. This approach was necessary because only a limited number of cows were known to be carriers.

The genetic relationship of the two forms of dwarfism was also studied. A number of matings of longheaded carrier bulls to snorter carrier cows were made. The critical matings, however, were six snorter dwarf heifers bred to a longheaded dwarf bull.

## Results and Discussion

The results of this study are presented in Table 1. For each mating the observed numbers of each type of offspring are presented. An expected ratio has also been calculated on the assumption that the two forms of dwarfism are inherited as an autosomal recessive as has been reported in earlier reports by other research workers. The inheritance of snorter dwarfism was described in a previous Feeders Day report (Okla. Agr. Exp. Sta. MP-34). It was further assumed that the two types of dwarfism are inherited independently.

The data reported in this study strongly supports the assumption that snorter dwarfism is inherited as a simple autosomal recessive. The observed and expected ratios obtained from carrier matings are almost identical. The most critical mating was that of snorter dwarf x snorter dwarf, and, as was expected, only snorter dwarf calves resulted.

In the case of the longheaded form, the data are not as clear cut although there is no reason to believe that it is not also inherited as a simple autosomal recessive. The deviations between observed and expected approach statistical significance ( $P < .10$ ). However, it should be

pointed out that the calculated expected number of six dwarfs is a minimum estimate. It was assumed that all test animals were offspring of only one dwarf carrier parent and the other parent was free of dwarfism. It is probable that a number of the animals included in this study were offspring of two carrier parents. In such cases the probability of dwarfs resulting is greater than one chance in eight which was the fraction used in calculating the expected. It should also be pointed out that, while there was essentially no selection of heifers that went back into the line, selection was practiced on the bulls to be used. There is, therefore, the possibility that selection favored the carrier bulls over the clean bulls, and more than one half of the sons of the carrier were actually themselves carriers. Had the true frequency of the longheaded gene in this herd been known, it is likely that the calculated expected number of dwarfs would have been nearer to the number actually observed than is reported in Table 1.

The results obtained in this study proves that the longheaded and snorter genes are non-allelic. The critical test was the fact that only normal calves resulted from six matings of a longheaded dwarf bull to

**Table 1. Results of Matings of Animals Whose Genotype for Snorter and Longheaded Types of Dwarfism Either Was Known or Could be Predicted.**

Matings	Total Number Calves	Numbers of Each Type of Calf		
		Normal- Non-Dwarf	Snorter Dwarf	Longheaded Dwarf
Snorter dwarf carriers X Snorter dwarf carriers:				
Observed	43	33	10	0
Expected <sup>1</sup>	43	32	11	0
Snorter dwarf X Snorter dwarf:				
Observed	7	0	7	0
Expected <sup>1</sup>	7	0	7	0
Longheaded dwarf X Snorter dwarf:				
Observed	6	6	0	0
Expected <sup>2</sup>	6	6	0	0
Longheaded dwarf carriers X Snorter dwarf carriers:				
Observed	27	27	0	0
Expected <sup>2</sup>	27	27	0	0
Sons of Longheaded dwarf carriers X Daughters of Longheaded dwarf carriers:				
Observed	96	86	0	10
Expected <sup>1</sup>	96	90	0	6

<sup>1</sup> Expected ratios calculated on the assumption that the dwarf gene is a simple autosomal recessive.

<sup>2</sup> Expected ratios calculated on the assumption that the two dwarf genes are not allelic.

snorter dwarf heifers. Additional proof was obtained by considering all matings of known longheaded carriers with known snorter carriers. There were 27 such matings, representing two sires, and all calves were normal.

The calves that resulted from the mating of the two types of dwarfs were completely normal in appearance. Despite the fact that they were carriers of both types of dwarfism, they were grossly indistinguishable from calves that were believed to be free of dwarfism. These results mean that a bull must be progeny tested on cows that are known to be carriers of the specific type of dwarfism in which he is interested. A progeny test for one type tells a breeder nothing about the genotype of the animal for the other type of dwarfism.

Some additional observations were made that are not reported in Table 1. The longheaded dwarf has occurred only in Angus cattle in our study. It has not been observed in any Hereford lines. While there are one or two reports in the literature of longheaded dwarfs of other breeds, it has largely been reported in the Angus breed. It is also relatively rare in occurrence. However, as mentioned previously, it can be a serious problem in individual herds. There is also the possibility that many longheaded dwarf calves may have been produced and not recognized.

This study confirmed earlier reported observations that the snorter dwarf gene in the Hereford breed is identical to the snorter dwarf gene in the Angus breed. A total of 16 Hereford x Angus crossbred snorter dwarfs have been produced. Therefore, in progeny testing bulls for snorter dwarfism, it is valid to test bulls of one breed on carrier cows of the other breed.

The characteristic abnormalities seen in the lumbar vertebrae of most snorter dwarf calves\* were present in all longheaded dwarfs studied. Radiographs of the lumbar spine appear to be an accurate method for identifying either type of dwarf since no non-dwarf has ever shown these typical vertebral abnormalities. It is recommended that dead calves whose dwarfism status is questionable be x-rayed. The results of the dwarfism research to date indicates that any calf that has the typical dwarf vertebrae may safely be considered to be a dwarf. Whether it is a snorter or longheaded dwarf must be determined from the other symptoms.

### Summary

The inheritance of two different types of dwarfism in beef cattle, the snorter and longheaded types, were studied from the 1955-1961 breeding records of the Project 873 cow herd at Fort Reno. The data indicate that each is inherited as a simple autosomal recessive gene. The same gene produces the snorter dwarf in both the Hereford and Angus

\*Described in Okla. Agri. Exp. Sta. MP-57.

breeds. The longheaded dwarf gene is a different gene from the snorter dwarf gene. Bulls may be progeny tested for snorter dwarfism on snorter carrier cows of either the Hereford or Angus breeds. However, bulls may be tested for snorter dwarfism only on snorter carrier cows, and for longheaded dwarfism only on longheaded carrier cows. Longheaded dwarf calves may be identified at birth on the basis of characteristic abnormalities of the lumbar vertebrae. Since these abnormalities are similar to those that have been observed in snorter dwarfs, and have never been seen in non-dwarfs, they offer an accurate method for identifying dwarf calves of either type.

## Lifetime Performance of Beef Cows Wintered Each Year on Three Different Levels

*D. O. Pinney, L. S. Pope,*

*Dwight Stephens, and L. M. Henderson*

Few studies with beef cows have been continued over an interval of time necessary to show the accumulative effects of different feed levels on lifetime production. This is an important issue since (1) most producers have a tendency to be either "good" or "poor" feeders, i.e., following high or low feeding regimes year after year; (2) beef cattle have remarkable ability to recover from one or, perhaps, several years of poor winter feeding by compensatory gains on lush summer grass; and (3) some of the effects of good or bad feeding practices may be accumulative, affecting the life span and productivity of the beef cow, which one year's data may not reveal.

Surprisingly, our knowledge of the exact requirements of the beef cow is still fragmentary. It is important to the Oklahoma cattle industry, however, as nearly 60 percent of our total beef cattle population is classified as breeding females over two years of age. To study the effects of continuous low, medium, or high levels of supplemental feed on the performance of the range beef cow during her life span in the herd, a project was initiated in the fall of 1948 with a group of weaner, heifer calves. The results of individual years have been reported in this series of publications.<sup>1</sup> This report summarizes the results from this experiment to the fall of 1961, at which time most of the cows have passed out of production and only a remnant of the original herd remain on test.

As background for this study, let us first consider the yearly picture for native range grass since this is the basic foundation for a profitable herd and for our methods of feeding beef cows in the Southwest. Results

<sup>1</sup>See Okla. Agr. Expt. Sta. MP-22,27,31,34,43,45,48,51,55 and 57.