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Factors Affecting Carcass Grade  
Michigan State University Extension Service  
Michigan Beef Production  
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# MICHIGAN BEEF PRODUCTION

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

## Factors Affecting Carcass Grade

Dr. Dan G. Fox, Cornell University

The market value of a beef carcass is determined by the quality (palatability) and quantity of edible portion it contains. The difference in the qualities of meat are estimated by the USDA quality grades (prime, choice, good, standard). The differences in edible portion are estimated by the U.S.D.A. yield grades (yield grades 1, 2, 3, 4, 5). Table 1 shows the proportion of trimmed retail cuts from 600 lbs. of different yield graded carcasses.

The major factors used to determine quality grades are marbling and maturity. *Marbling, (the amount and distribution of small flecks of fat within a muscle), is the most important factor that influences quality grade of feedlot cattle.* Marbling contributes to the overall juiciness and flavor of beef but contributes very little to tenderness. Maturity is also an important factor in determining grades. Advanced maturity has been associated with decreased tenderness, particularly in those animals over 30 months of age. *The most important factor influencing yield grade is backfat thickness, because it is a good indication of the amount of fat trimmed in making retail cuts.* At present, carcasses that grade choice and have a yield grade of 2 or 3 bring the highest prices.

Extension Bulletin E-1743 discusses the quality and yield grades in detail. The next question is how to consistently produce carcasses with adequate quality and high yield grades. We do not have problems with maturity, as long as cattle are less than two years of age at slaughter. Research has shown that the shape of the carcass has little influence on the proportion of high priced cuts or the quality of the meat. *Thus, the problem is to produce cattle with low amounts of backfat and at the same time have at least a small degree of marbling.* Research has shown that large

Table 1. Percent Fat Trim, Bone and Shrink and Trimmed Retail Cuts in Carcasses with Various Yield Grades

	Yield Grade				
	1	2	3	4	5
	----- % in carcass -----				
Fat trim	7.6	12.7	17.8	22.9	28.0
Bone & shank	10.4	9.9	9.4	8.9	8.4
Trimmed retail cuts	82.0	77.4	72.8	68.2	63.6

amounts of marbling are not needed to obtain high quality beef, but a minimum degree of finish (fatness) is needed to attain desirable palatability. This fact sheet will discuss the various factors thought to influence both backfat thickness and marbling: weight, sex, age, feeding program and time on feed. The comparisons are based on the minimum amount of fat necessary to give a small degree of marbling, which is the amount needed to grade low choice.

Fact Sheets 4200, "Producing the Most Desirable Type of Feeders," and 4300, "When and How to Market Slaughter Cattle," also give discussions related to maximizing production of choice beef.

### Weight, Frame Size and Sex

Weight for the frame size is the most important factor influencing the proportion of muscle and fat in the carcass, and where the fat is deposited. Research has shown that fat and muscle develop at the same time as part of the normal growth process. Fat is deposited in the viscera and kidneys and between the muscles early in life. As cattle continue to grow and approach mature weight an increasing amount of fat is deposited over the outside of the body. Then at some

point, noticeable after there is at least 0.3 inch of backfat, fat is deposited in the muscle, and beyond this point the more backfat an animal has, the more marbling it is likely to have. Some backfat is desirable. Probably 0.2-0.3 inch of backfat are needed to prevent rapid chilling of the carcass and drying and discoloration of the meat. However, amounts above this are wasteful unless the trim fat is needed to blend with no-fat beef. Most cattle will have at least 0.3-0.4 inch of fat before their carcasses will contain ribeyes with a small degree of marbling.

Because of this normal growth pattern, the biggest help in determining when an animal will grade choice is the weight at which it can be expected to have 0.3-0.5 inch of backfat. Unfortunately, this is more than is generally needed for adequate palatability. Nevertheless, it is the amount needed to ensure that the cattle will grade choice. The weight at which this occurs will vary, depending on the sex and frame size. Heifers mature at lighter weights than steers and steers mature at lighter weights than bulls. Long bodied, long legged cattle mature at heavier weights than short bodied, short legged cattle. Thus, the earlier maturing cattle will have 0.3 to 0.5 inch of backfat at lighter weights than later maturing cattle. Table 2 gives weights at which cattle of various breeds and types can be expected to have 0.3 to 0.5 inch of backfat and a small degree of marbling, giving a yield grade of 2 to 3 and a low choice quality grade. The estimates in Table 2 are based on recent research at Cornell University, Ohio State University, Michigan State University, University of Wisconsin, and the U.S. Meat Animal Research Center at Clay Center, Nebraska.

Visual appraisal and these weights used in combination give a good estimate of the point where the carcass is likely to have a yield grade of 2 or 3 and a small degree of marbling. Animals beginning to show signs of fullness in the brisket and in the flanks and patches around the tailhead are likely near this point. If the brisket and flanks become completely full, heavy

patches appear around the tailhead and the underline sags, the animal is likely to have a yield grade of 4 or 5 and more than a small degree of marbling.

## Age

Most cattle feeders feel that yearlings must be fed to heavier weights than calves to grade choice. Research results have not provided a clear answer to the weight at which a yearling placed in the feedlot off grass will grade choice (have a small degree of marbling) as compared to a calf of similar body type placed in the feedlot at weaning. It probably depends on their age or length of time they have been on a low level of nutrition before being placed in the feedlot. A few research trials and observation suggest that most yearlings need to be about 50 to 75 lbs. heavier than comparable calves to have a 0.3 to 0.5 inch of backfat and a small degree of marbling.

## Feeding Programs and Time on Feed

The influence of feeding programs on carcass grade has been the subject of many research trials and discussions with cattle feeders for a long time. The results of recent studies at University of California, Colorado State University, Ohio State University, University of Minnesota, University of Missouri, Michigan State University and University of Wisconsin have shown only small differences in carcass grade due to the feeding program used. Included in these studies have been rations based on all corn silage to slaughter; various lengths of time on high silage followed by high grain; or continuous high grain rations from weaning to slaughter.

Two experiments at MSU, in which eight different types of cattle were fed either an all silage (properly supplemented with protein and minerals) or high grain ration from weaning to slaughter, may provide some answers to this question. In one of these studies, cattle fed high grain rations were slaughtered when on the average they were barely fat enough to grade choice (0.3 to 0.4 inch of backfat). Then similar cattle finished on high silage rations were slaughtered when they reached the same estimated carcass weight. In this case, more graded choice when fed high grain than when fed high silage.

In the second experiment, the high grain fed cattle were fed until the *thinnest ones in the pen* were fat enough to grade choice; then the high silage cattle were slaughtered at approximately the same weight. In this case, there was no difference between rations in the proportion of the cattle that graded choice.

These results suggest that if you have been feeding a high grain ration the last part of the feeding period

**Table 2. Slaughter weights at which cattle of various frame sizes, sexes and breeds can be expected to have 0.3 to 0.5 inch of backfat and a small degree of marbling.**

Breed and Type	Slaughter weight, lb.	
	Steers	Heifers
Small type Angus or Shorthorn	900	700
Large type Angus or Shorthorn	1050	850
Small type Hereford	1000	800
Large type Hereford	1150	950
Brahman and Limousin crosses	1200	1000
Holstein	1200	1000
Charolais, Simmental and Maine-Anjou crosses	1250	1050
Chianina crosses	1350	1150

and were selling cattle just when they were barely fat enough to grade low choice, and then you switch to feeding a high silage ration all the way to slaughter, you may need to feed to 50-75 lbs. heavier weights than when you fed the high grain ration. Some studies have shown that feeding large amounts of grain (90-100% concentrates) early in the growth period tends to increase marbling. Other than for these exceptions, the level and timing of grain feeding has not been shown to have much influence on the carcass grade *as long as the total ration contains at least as much energy as is in high quality corn silage.*

Many cattle feeders use the time cattle have been on their ration as an indication of readiness for slaughter. This is useful when a certain weight and size of cattle are always fed and the environment and ration composition do not vary. However, weight for the frame size, and visual appraisal are the best guides under most conditions.

## **Breed**

On the average, most breeds of cattle will tend to have the desirable amount of outside fat and marbling when they reach the appropriate weight for their frame size and sex as shown in Table 2. However, there are some differences between breeds in ability to deposit intramuscular (marbling) fat. Some observations can be made, based on experience and research. Angus tend to deposit more intramuscular and less backfat than most other breeds at the same stage of growth. Holsteins tend to have less backfat and more internal fat (kidney, heart and pelvic fat) than British breeds, (Angus, Herefords, and Shorthorns) at the same stage of growth. Charolais, Simmental, and Chianina breeds appear to be intermediate between the British breeds and Holsteins in fat distribution.



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