

An Overview of Structural Soundness in Beef Cattle



By:

At the recent CSA Annual meeting, one of the discussion groups recommended that there should be some articles presented in this breed journal in regards to structural soundness and related issues in beef cattle. I have been asked to write some of this and this article will be the first in a series of articles in upcoming issues.

In the January 2000 issue, I wrote an article entitled, Visual Appraisal of Cattle, and I have used parts of it to re-introduce this discussion. In order to fully understand a topic as vast as structural soundness, first, we have to understand a few basic facts about how all cattle are constructed. These simple facts are often forgotten, and they apply to all cattle, whether they be a Shorthorn, a Charolais, or a Jersey. Consider these facts:

Fact #1 - all cattle are composed of the same three tissues - bone, muscle and fat.

Fact # 2 - all cattle have the same number of bones and they are located in the same relation to each other. They are almost identical in shape and on a percentage basis, represent almost the same portion of all carcasses. On the other hand, the other two tissues - muscle and fat - vary greatly.

Fact # 3 - all cattle have the same number of muscles. They are attached to the skeleton in the same location in all cattle. What varies is the shape and size of these muscles.

Fact # 4 - the correlation between the weight of a single muscle with the total muscle in the carcass is extremely high. (.95-.98) This means that when you select for increased muscle in one area(for example, rib eye area), you will also increase the muscle in other areas by nearly the same amount.

Fact # 5 - muscle moves when the animal walks. Fat is inanimate. Fat hangs and shakes while muscles move and bulge. Muscles are round. Therefore a well muscled animal will have a round shape to its top, not a flat shape.

Fact # 6 - it costs much more to put on a pound of fat than a pound of muscle. Most research indicates that it is 6 to 7 times more expensive. We all know that a certain amount of fat is required on the carcass and it is very desirable for it to be well marbled.

Marbling is the small seams of fat in the muscle tissue and it is an important factor in the taste and tenderness of the meat.

Fact # 7 - there is a negative correlation between muscling and maternal traits, as well as with fertility.

USE OF THE SKELETON AS A REFERENCE POINT.

A. Freedom from Waste

The knowledge that the muscles are attached to the skeleton at the same points and in the same relation to each other in all cattle makes the skeleton an excellent reference point for determining muscle development. Likewise, the fat is deposited on the skeleton and musculature in certain definite areas and so again we can use the skeleton as a point from which to measure the amount of fat.

Most cattlemen know that if they handle cattle over the point of the shoulder, over the back ribs and along the tips of the backbone or spinous processes, they can measure the fatness of the animal because no muscle is ever found in these areas. Any tissue found in these areas has to be

either the hide or fat. Oftentimes, it is not possible to handle every animal, so you have to learn to visually appraise the amount of fat by looking at the areas where only fat is deposited. Fat is deposited in cattle first in areas where there isn't very much muscle movement such as the brisket, flank and twist areas. These areas can be used to visually appraise how much fat the animal is carrying. The animal will deposit a layer of fat over most of the body once these areas start to fill up. Almost all of the fat that is deposited in the above mentioned areas, not only costs you a lot to put there, but, it costs the packer money to trim it off. The marbling fat is usually put on the animal last. There are some breed differences as to how quickly this happens and this is extremely important for us as Shorthorn breeders to realize. All cattle will develop some degree of marbling providing they are fed for long enough periods of time. Shorthorn cattle have the genetic ability to put on the marbling fat faster than some other breeds. This is what impressed the people at Cargill when the results of the Alberta feeding trial were completed. There are some within breed differences for the marbling trait, just like there are for any other trait. The packers know this and they also know that this breed has an undeveloped market advantage on its hands.

They can't figure out why we aren't identifying the lines that have the genetic advantage to marble, as this is an extremely important economic trait. The packers are very cautious to not promote one breed over another, and they are right to think this. This is each breed's job to do.

Take a look at figures 1,2 and 3 to get a better idea of how the skeleton can be used to analyse the amount of fat and muscle an animal has. Draw a horizontal line approximately 3/4 of the distance from the knee joint to the top of the elbow (AB in the

diagram). This line can be used to evaluate the waste (ie: fat) that an animal carries. Any tissue found below this line, when viewed from the side or front, is either loose hide or fat. No muscle is found in the brisket or flank area below this line. Therefore these become great places for fat to be deposited. The abdominal wall consists of thin layers of connective tissue and muscle, and contrary to the belief of some, does not extend into the flank area, but, curves upward and attaches to skeleton above the stifle joint. Some will argue that high flanked cattle are “poor doing” cattle, however, I have never seen any research that indicates this. My own thought on this, with nothing but personal experience to go on, is that going to the extreme in any direction, is usually not the best. What I do know, is that a deep flank can make an animal look prettier, but that’s about all it does. It is just another great place for the animal to deposit fat.

Let us now examine Figures 4,5,6 and 7. Notice that they are scored identically for all traits except for freedom from waste. The bull in figure 4 appears to be longer, taller and shallower. If you take a ruler you will find that the bulls in all four diagrams have identical skeletons. They measure the same from nose to tail, height at the withers, and knee to the ground. There is progressively more depth of body as we go down the page, but this is not due to greater capacity of rib cage or abdominal cavity, but rather due to loose hide that is filled or will fill with fat. Note also that the bull in Figure 4 appears to be longer necked than the bull in Figure 8. This is an illusion as they are identical in the length of their necks. As you move down the diagrams, the only thing that changes in the neck areas is the amount of loose skin in the dewlaps. Also notice that as the cattle become wastier, they appear to be smoother topped, squarer in their rumps, and straighter in their underlines. Each of these bulls are identical in their muscular development so this smoothness and straightness comes from fat deposits.

Here’s another point to remember. When cattle approach maturity, they grow less muscle and increase the rate of fat deposition. This is why shorter bodied, shorter legged cattle mature and fatten faster. Some of the trends we see coming out of some of the major U.S. steer shows should be sounding the warning alarms within the industry. Again, I don’t think we want to “go there” as we’ve been there before and it really isn’t that pretty. It has taken this breed several decades to regain the confidence of beef producers after we got our Shorthorns too small and too wasty in the 50's and 60s.

B. Selecting for Muscling.

The same principle used to determine fat or waste can be used to identify muscling. Since the size and shape of the skeleton varies only slightly you simply look at the points of the skeleton where there is only muscle to compare the muscling between animals. The forearm and the stifle areas are good places to make these comparisons. Let’s look at the animals in Figures 8,9,10, and 11. In these animals all traits are the same except for muscling. Notice that as the muscling score decreases, the forearms become narrower, straighter, and flatter. There is less bulge in the muscles over the shoulder and in the stifle area. The loin becomes flatter and the round more concave or has less bulge. The heavier muscled animal has a more prominent shoulder and stands relatively wide. The poorer

muscled bull has a very flat smooth shoulder and stands narrow. The well muscled animal is thicker down low in his body than he is at the top. When standing behind a well muscled animal the widest part of its body will be through its stifle region. Poor muscled cattle will be wider on top than lower down. Remember that in live animals, you can see the muscles move when they are walking. When you are walking your animals in the show ring, the judge should be analyzing their muscling as well as structural soundness. This is also probably the best method of seeing how wide an animal walks and this is a good indication of muscling as well.

Leg placement is used as an evaluation tool for the amount of muscling an animal has. The legs should be set squarely under the animal. There should be width between both the front and back legs. When you understand how the muscles attach from the body to the legs, one understands more clearly how well muscled cattle will have width between their legs. If the legs are structurally sound, this is almost always the case. You have probably seen animals that are commonly called 'cow hocked'. This is a term used to describe animals that have legs that are very close when standing or while walking and in some cases the hocks almost touch. This is usually normally a sign used to identify animals that have poorer than desired muscling.

The shape of the legs is also an extremely important trait, that should never be dismissed when talking about structural soundness. An animal with good leg structure will have a slight curvature to the legs, so that the leg bones actually provide a shock absorbing effect for the animals weight and how it affects the joints. There has been a trend especially in what is commonly called the show steer or club calf parts of the industry, to select for legs that are very straight. Animals with very straight legs can be made to look very attractive in the show ring, but for all practical purposes, these animals have very limited use in the beef industry. Straight legged animals have very little shock absorbing ability and usually their joints will start to get arthritic before it gets very old. I would hate to have a pasture full of sisters of many of today's top show steers, simply because I would know that a major percentage of them would most likely have to be shipped to market before their normal life expectancy arrives, due to their becoming crippled. In this case, leg structure has contributed to the longevity of the animal. Having legs with too much set to their legs is also not desirable, as it also will affect how the animal moves and how its feet hold up with the animals weight on them. In my opinion, I do not believe that this trait is as serious as having legs that are too straight. Curved (sickle hocked) animals may not be very attractive to look at, however, they almost always last longer than the animals with the straight, posty legs. The animal's stride is also important. It should have a long smooth stride. The back feet should land in the prints of the front feet when it is walking. Front feet should point straight ahead.

The discussion of feet is one that deserves considerable attention, and I will leave this topic for an upcoming edition, as it is a topic that I feel we really have to study as many of today's cattle are lacking in such things as hoof shape, heel depth and pastern slope.

Shorthorn cattle have commonly been called a maternal breed. In recent times, Shorthorns have been gaining some recognition as having good carcasses. When you consider that there is a definite negative correlation between muscling and maternal traits, one has to question if we as Shorthorn breeders are trying to be too many things in the beef industry. To my thinking, the key word in this discussion should be OPTIMUM. Like most things in life, too much of a good thing isn't always the best. It has been documented time and time again, that muscling and reproductive traits antagonize each other. This is why the real heavily muscled breeds are not known for their maternal traits and fertility. Age at puberty, which many consider to be one of the most important economic traits, increases as muscling increases. The important thing to remember is that it is important to find that optimum level where muscling and reproductive traits can live together, so to speak. We have proven time and time again that we can improve the muscling in our Shorthorn cattle and still keep our fertility and maternal traits. There are probably limits to this and we must be careful not to jeopardize our strong maternal and reproductive traits in pursuit of muscling. We have in this breed an opportunity to produce cattle that combine most of the things the beef industry is wanting. It is our job to identify the superior cattle, and then produce them in quantities that will make them useful to the industry.

The entire topic of structural soundness can be a very complex topic to cover, as it involves all parts of the animal. The animal's structure can have immense effects on things like longevity and fertility, and reproductive efficiency. Structural soundness can play a huge role in determining the environment best suited for certain animals. It seems to me that people in the dairy industry have a much better understanding about structural soundness issues in cattle, than most beef producers do. This may be due to the fact that structural soundness is an extremely important economic factor as it has direct effects on fertility, calving ease, and longevity. It also has the same importance in beef cattle, however, it is sometimes overlooked.

In the next article on these topics, I will discuss structural soundness in regards to fertility and reproductive capacity in both bulls and females. This is a very large area to cover in one article, however, it is a very important one and it is also an area that all cattlemen should have a good understanding about.