

Bull Power
Purebred Bull Specifications: Carcass and Retail Products

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The cattle industry was sailing along in the 1970's, thinking the world would never end--beef was the "perfect product"; everyone wanted to buy it; everyone wanted to eat it. In 1976, 94.4 pounds of beef was being sold at retail outlets per person in the U.S.A. But, the wheels fell off the wagon. All of a sudden something was wrong with beef as a food. Between 1976 and 1983, retail weight per capita declined nearly 16 pounds (from 94.4 lb. in 1976, to 78.7 lb. in 1983); before the decline could be halted 9 more pounds would be lost (70.0 lb. in 1987).

What happened? First, a boycott by consumers protested its high cost; then, a flurry of reports claimed that beef was unhealthy--to high in calories, cholesterol and fatty acids. Beef consumption was implied to be causative of heart disease and cancer, and its percentage of calories from fat was blamed--in part-- for widespread obesity in the U.S. populace. It became clear that beef must be repositioned in the diet and that its chemical composition had to be changed, if its consumption in desired quantity was to be reconciled with recommendations by health professionals.

Too little was done until 1982 when began the first phase of the National Household Beef Consumer Study (NHBCS) and its sequel--the National Retail Beef Consumer Study (NRBCS). Results of those studies (funded by the beef industry and conducted by the Texas Agricultural Experiment Station) were released in January, 1986 at the annual convention of the National Cattlemen's Association (NCA) and consisted of two primary conclusions: (a) Two "qualities" of beef were needed to satisfy desires for the two segments of the retail-beef consuming public--Choice, for those most interested in "taste appeal" and Good (identified as "Select" in that study), for those most interested in "lean appeal", and (b) Fat must be removed, especially around the external borders, from beef, if sales increases were to occur.

The news was a bombshell; two weeks after release of the results of the NRBCS, the Kroger Company announced plans to leave no more than 1/4 inch of external fat on its retail beef cuts. In quick succession, Safeway Stores, Inc. declared its "war on fat"; Excel Corporation began its Perfect Trim program (saying to retailers "You can't sell fat, so we won't ship fat") and need was recognized to remove external fat from carcasses on the slaughter/dressing floor (the so-called "hot-fat trimming" procedure). The beauty of the latter procedure was that no longer would dressing percentage (which increases almost directly with increasing animal/carcass fatness) drive the logic at the price-discovery interface between feedlot operators and packers since--in its eventual chronology--all subcutaneous fat in excess of 1/4-inch on the carcass would be removed physically before payweight was determined.

Research was conducted (again funded by the beef industry and performed by the Texas Agricultural Experiment Station) that proved the technical feasibility of the procedure and NCA and American Meat Institute (AMI) petitioned the United States Department of Agriculture (USDA) to "uncouple" beef yield and quality grades to make hot-fat trimming possible from the regulatory standpoint. In 1988, USDA proposed such "uncoupling" and--at this writing--that proposal remains in its public-hearing phase.

Meanwhile, 81% of U.S. citizens (according to studies conducted by the Beef Industry Council) were trimming away all or some of the border fat from cooked beef before consuming it, 86% of U.S. food retailers (according to studies by St. Joseph University, funded by AMI) were leaving no more than 1/4-inch of external fat on beef cuts, and health professionals were admitting that drastic reductions in consumption of calories (from 480 to 134) and milligrams of cholesterol (from 120, to 60) occurred if none of the 1/2-inch of the border fat surrounding a beef steak weighing 5.3 ounces (before trimming and cooking) was ingested (based on studies by the Texas Agricultural Experiment Station).

Attempts by the beef industry to convince the U.S. Departments of Agriculture (USDA) and of Health and Human Services (USDHHS) that their food consumption data (and recommendations to the public there from) were in error because beef cuts at retail now had 1/4-inch, rather than 1/2-inch, of border fat were not successful. To determine whether the St. Joseph University data (which said that the national average for fat thickness on retail beef was now 1/4-inch) could be substantiated, the USDA, NCA and BIC sponsored the National Retail Market Basket Study (NRMBS).

Conducted by the Texas Agricultural Experiment Station, the latter investigation involved purchase of a prescribed list of retail beef items from 8 or more supermarkets in each of 12 cities (Seattle, Denver, Los Angeles, Dallas, Houston, Chicago, Detroit, Atlanta, Tampa, New York, Philadelphia, Washington, DC) and subsequent measurements of physical and chemical fatness. Results of the NRMBS revealed that the average border-fat thickness of beef cuts in the U.S. was .11 inch (closer to 1/8-inch than to the presumed 1/4-inch) and that there was, in 1988, 27% less trimmable fat in the nation's collective retail case than had been there in 1986. It is clear that beef has "lost most of its ugly fat"--unfortunately, though, all of the loss has been occasioned by use of a knife (trimming away the excess portions).

The beef industry must now consider "the pros vs. the cons" of further reductions in the fatness of its products; to do that correctly necessitates consideration of the primary industry targets in terms of quality-levels in beef. Inasmuch as "quality" in cooked beef steaks/roasts is best defined in terms of their flavor, juiciness and tenderness when eaten, U.S.D.A. quality grade--and especially its component, marbling (percent of muscle as intramuscular fat)--usefully predicts degree and repeatability of palatability performance. There are three primary targets for qualities of beef: (a) Very High Quality--Average Choice or higher-grade beef best fits the need for high and

consistent palatability performance for sale to the hotel/restaurant/institution (HRI) and food-service (FS) trades, (b) Intermediate Quality--Low Choice or higher-grade beef fulfills demand for parts of the HRI and FS trades and fits almost perfectly the desires of retail supermarket customers who emphasizes palatability ("taste", in their vernacular), and (c) Acceptable Quality--Low Select or higher-grade beef appeals to retail supermarket customers who emphasize cutability ("leanness", in their vernacular) and who are willing to sacrifice something in taste to achieve a reduction in calories.

Importance of "taste" (actually--flavor, juiciness, tenderness or overall palatability) in beef-purchase decisions has been amply demonstrated by studies of the Texas Department of Agriculture (TDAO and the Safeway Nutrition awareness program (SNAP). TDA determined relative importance of numerous factors as they were used by restaurant patrons in deciding which food to purchase and eat; "taste" was the deciding factor in 58.8% of such decisions, far surpassing calories (4.4%), cost (5.5%), convenience (11.6%) or diet health (20.0%) concerns. Retail consumers, also, emphasize "taste" over diet/health/nutrition concerns in making food purchasing decisions, based on analyses of impact of components in the SNAP by supermarket officials.

Obviously, the desire is for the beef offered for sale to please nearly all of the HRI and FS patrons and to "woo 'em, wow 'em and win 'em" in the supermarket trade. To achieve these aims while progressively leaning-up the product, requires that special attention be paid to not proceeding too far in the fat-reduction process. Drs. Savell and Cross (of the Texas Agricultural Experiment Station) spoke eloquently to that issue in their 1988 report commissioned by the National Academy of Sciences: their extensive evaluation of the scientific literature on the subject of intramuscular fatness relationships to palatability (the so-called "Window of Acceptability") revealed that beef dare not dip below the level of 3% intramuscular fat (equivalent to "minimum Slight" marbling--which is the bottom of the U.S. Select Grade), if consumer expectations are to be met. It is the "Waste Fat" (fat along borders and in the seams between muscles) and not the "Taste Fat" (fat inside the muscle), that must be reduced/removed.

Further clarity regarding quality grades for beef issued from analyses of the NRBCS. Though many in industry and the scientific community argued forcefully for the combining into one grade of the Choice and Good grades of beef--as recently as 1985--the NRBCS demonstrated need for two separate grades--one grade ("Choice") for consumers emphasizing "taste appeal" and another grade ("Good"--but preferably renamed "Select") for consumers emphasizing "lean appeal". To blend together the two kinds of beef would be analogous to bottling and offering Classic Coke only as a mixture with Diet Coke--neither sub-population of consumers could fine the exact target of their personal-purchase preference. On November 23, 1987 the USDA officially changed the name of the Good grade to Select, thereby making possible the merchandising and promotion of a "new kind" of beef for health-conscious consumers. Resulting then, for cattle producers to strive for, are three production and/or carcass targets, identified, for example, by the Texas Agricultural Experiment Station as (I) Very High Quality Beef

(Average Choice to High Prime), (II) Intermediate Quality Beef (Low Choice) and (III) Acceptable Quality Beef (Low Select to High Select), by the Excel Corporation as (a) "Quality Beef" (Average Choice to High Prime), (b) "Retail Store Beef" (Low Choice) and (c) "Lean/Lite Beef" (Low Select to High Select) or by the NCA as (1) "Very High Quality Beef" (High Choice to Low Prime), (2) "Retail Store Beef" (High Select to Low Choice) and (3) "Lean/Lite Beef" (Low Standard to Low Select).

Those are the targets; now comes the hard part. The consensus is that the fat must go; now, how do we do it. The old--and the current--way is to trim the fat away with a knife; the new way must be to breed it or feed it away (that is, don't put it on in the first place).

The genetics of leanness is such that it is a heritable trait which can be selected for both within and between breeds, and that actually leanness of a given animal is some product of a feed X animal X leanness interaction. Important, too, is the fact that leanness in beef cattle is related to critical animal productivity characters--cow size, calving ease and ability to rebreed. Obviously, then, the best bet in using genetics of the commercial cow-herd to achieve desired carcass targets lies in the principle "Match the cow to the environment, match the bull to the endpoint, so the offspring will dominate at the marketplace."

Mamas are important! Cows are expected to produce a calf, every year, irrespective of ambient temperature, relative humidity and supply of feedstuffs. Experience and intuition assure producers that the ideal cow for South Texas is not identical (in genotype or phenotype) to that considered best in Alaska, California, Wyoming, Indiana or Massachusetts--or, for that matter, even in North Texas or East Texas. In South Texas, ability to tolerate high humidity/temperature conditions and ability to match milk production to incumbent feed supplies so as not to excessively deplete body fat-stores are needed to assure that the cow will cycle, breed, ovulate, carry--to term--and wean one calf every 365 days. On Colorado's Western Slope, the ideal cow must--too--do these same things while simultaneously retaining enough "condition" (fat stores, especially in the subcutaneous depots) to keep her alive in even the harshest of winters. In regions of Kentucky, a bigger, heavier milking cow may be ideal because shortages of feed and extremes of weather are less likely to impinge upon her environment. An oft-quoted phrase "all the cattlemen has to market is his grass" denies that in places like Southern Arizona conditions (drought, for example) may be such that he has nothing to market--not even grass.

Targets, of production and of carcass types, are now (in 1988) easy to identify; to reach the target market with a bullseye--every time-- is not quite so simple. To assure that the target is visible and the bullseye apparent, research is presently underway at TAES to determine value differences among live cattle (in studies supported by the Con-Agra Corporation and the USDA) and among carcasses (in studies supported by BIC and NCA). Additional TAES studies seek to improve the price-discovery processes so that cow-calf producers, stocker operators, cattle feeders, beef packers and meat retailers have equal access to supply/demand/value/price information prior to the time "a trade" is

consummated. To do that, it appears necessary that the Chicago Mercantile Exchange institute trading in contracts for boxed beef to augment price-discovery mechanisms presently partially supplied by trading of contracts for feeder cattle and for fed cattle.

Because of the present (in 1988) short-supplies of feeder cattle and of slaughter cattle there will be little price/value differentiation among live animals or carcasses until the supply situation is corrected. Knowledgeable market analysts project that three to five years (at or about the year 1992) will be needed to rectify supply/demand imbalances. That period provides an enormous "window of opportunity" for those in the beef cattle industry to clean up their act; that is, to change the genotype/phenotype of feeder and fed cattle so they more closely coincide with carcass and retail product targets. By approximately 1992, it is likely that systems of premiums/discounts (actually of value differences and determinations) will exist and be employed by both feedlot operators and meat packers; the Excel Corporation has them now, Con-Agra Corporation will have them shortly.

That being the case, "bull power" will be needed. Required to accomplish such need will be purebred bull specifications to meet industry needs in terms of carcasses and retail products. "Bull power" exists presently among breeds. Examples of "targeted breeds for targeted needs" include the "Certified Angus Beef" program (for high quality beef) and the "Lean on Limousin" program (for lean beef). Heritability estimates are moderate to high for most of the quality/palatability/cutability traits of beef (USDA quality grade, .55; marbling score, .45; tenderness, .65; ribeye area, .70; carcass fat thickness, .40; USDA yield grade, .45). For at least one of these traits--marbling score--there is a working hypothesis regarding the physiological mechanisms by which differences exist between cattle of different breeds. Inasmuch as cattle differ in the predominant-type of fibers--red vs. white--in their ribeye muscles and in that red fibers use fatty acids as a primary source of muscle contraction/relaxation energy while white fibers do not (their source of energy, cattle (e.g., Jersey, Longhorn, Angus, Shorthorn) with predominantly red muscle fibers store fatty acids in intramuscular depots (as marbling) dispersed among their muscle fibers while other breeds of cattle (e.g., Charolais, Maine-Anjou, Limousin, Gelbvieh) with predominantly white muscle fibers have much less need for a nearby supply of fatty acids to serve as a source of energy for muscle work and, thus, deposit very little marbling in their ribeyes. Because white muscle fibers are substantially larger in diameter than are red muscle fibers, those breeds of cattle with predominantly white muscle fibers have larger ribeye areas (all other traits held constant) leading to the well-known apparent genetic antagonism between muscling and marbling in beef cattle.

Although announcement by the Excel Corporation in 1987 that they would "name names" (identify specific breeds) of cattle that would versus would not work in their block-beef programs created fear that a "breed beauty contest" might ensue, it should be obvious that there is tremendous variability in all endpoint-product traits among cattle of the same breed. Changes in the Angus breed--from large and fat (in 1912), to short and fat (in 1953), to large and lean (in 1988)--provides

ample evidence of the effectiveness of within-breed selection pressure to make the breed's market animals fit real or perceived demands of then-existent buyers of cattle, carcasses or meat. Within reason, similar success can be realized within other cattle breeds but progress would be slow and long periods of time might be required. Research conducted in 1988 at the U.S. Meat Animal Research Center (Clay Center, NB) suggests that, within a breed, to improve tenderness (by decreasing Warner/Bratzler Shear Force by 1 kilogram) by selecting for marbling would require 78 years of single-trait selection, and--because of the genetic antagonism involved--retail product would decrease 10 percent. Obviously, a shorter-term solution might rest in careful capitalization on crossbreeding.

As attempts are made to target for production of cattle with the desired quality and yield grades, it is important to know both where we now are and where we are headed. At present, the U.S. block-beef supply consists nominally of 2% Prime, 50% Choice, 30% Select and 18% Standard; my personal crystal ball says we need 5% Prime, 75% Choice, 20% Select and no carcasses that grade Standard. My rationale is based on the facts that in the latest year (1985) for which we have complete data, supermarket-members of the Food Marketing Institute sold 0.7% Prime, 75.9% Choice, 0.7% Good (now Select) and 22.8% ungraded ("No-Roll"--a mixture of primarily, but not exclusively, Good and Standard beef) and that the vast majority of HRI and FS beef is of the Prime and Choice grades.

At present, the U.S. block-beef supply consists nominally of 5% Yield Grade 1, 46% Yield Grade 2, 42% Yield Grade 3, 5% Yield Grade 4 and 2% Yield Grade 5; my crystal ball says we need 20% Yield Grade 1, 80% Yield Grade 2 and no carcasses of Yield Grades 3, 4 or 5. My rationale is based on the fact that while beef carcasses of Yield Grades 4 and 5 contain 39.1% and 43.7%, respectively, of separable fat (based on USDA/TAES cutability data) and are admitted by all to be far too fat, carcasses of Yield Grade 3 (with 34.9% separable fat) are also too fat to be considered acceptable to the supermarket trade. There are those in industry who believe that intermuscular ("seam") fat becomes excessive at the Yield Grade 2.5/2.6 juncture; if that is the case, even the upper (fatter) half of Yield Grade 2 will be unacceptable in the near-term.

As a particular breed seeks to resolve issues of which carcass targets (quality or yield grades) to strive for, I can imagine no scenario in which the industry wants or needs carcasses of the Standard Quality Grade or of the No. 4 Yield Grade. All breeds must do everything possible to eliminate lines/strains of cattle that will not (after 100 or so days of high-concentrate feeding) deposit at least slight-minus amounts of marbling (the minimum required to qualify for the Select grade). The only argument for meat-packer reluctance to identify "Select" carcasses--and a valid one--is that it is presently advantageous to all concerned to mix the Selects and Standards so that the latter can be effectively merchandised. TAES research data proves that beef from Standard carcasses is considerably less palatable--on average--and far more variable in flavor, juiciness and tenderness--in the composite--than beef from Select carcasses; as a result, "No-Roll"

beef is not very dependable in eating satisfaction. The best way for the cattle industry to preclude necessity to mix together some "pretty good" and some "pretty bad" beef just to get rid of the "pretty bad" stuff is to not produce the latter. Elimination of such beef from the supply would also make it possible for retailers (for example, Safeway Stores) to obtain beef officially identified (by the USDA) as "Select" from more suppliers and in greater supply. In this manner only--if beef of the Select grade is supplied and enough trades of it can be verified--will the industry ever determine whether or not such beef will command sufficient market-share to make the Select grade a reasonable breed-selection objective and target.

Elimination of Yield Grade 4, and eventually of Yield Grade 3, carcasses from the nation's beef coolers will ultimately require combined efforts of the seedstock industry and of feedlot operators. Economic operation of a feedlot requires that the feeder have sufficient time-latitude to effect an advantageous trade on each pen of cattle. If genetics are such that they dictate the time-course (inasmuch as two additional weeks of feeding would cause the cattle to cross over a Yield-Grade line) of the trade, the feedlot operator is left in the lurch. Cattle with superior muscling are most amenable to further feeding beyond the point they would normally first appear on the "show list", because additional external fatness is partially first appear on the "show list", because additional external fatness is partially offset (in determining ultimate Yield Grade) by concurrent increases--with further feeding--in ribeye area. Increased propensity for muscle growth is then a reasonable breed-selection objective and target.

Picking the right sire, for seedstock-generation or commercial-production purposes, will necessitate collection of meaningful carcass information from his progeny or--perhaps--use of ultrasound, or more advanced electronic, technology and visual appraisal to evaluate the bull directly. Sire summaries presently available for bulls of most breeds do not include Expected Progeny Differences (EPDs) for carcass traits; that for the Angus breed is a notable exception. The 1986 Angus Sire Summary includes EPDs and Accuracies for fat thickness, marbling and ribeye area. Though possibility exists for development of a "National Sire Summary for Carcass Traits," it seems more likely that each breed must decide the merits (relative to time and cost requirements) of collecting and summarizing such data.

As the "cow that matches the environment" is mated to the "bull that matches the endpoint" to produce "offspring that will dominate at the marketplace," principles of selective breeding and complementarity apply to both purebreeding and crossbreeding. "Complementarity" as I describe it here involves the following procedure: (1) Identify the genotype of the female needed to operate in the prevailing environment (temperature; humidity; feed supply), (2) Characterize the end-product (beef Quality/Yield Grades), (3) Determine the targeted end-point (beef Quality/Yield Grades), and (4) Select a bull or a genotype that maximizes probability of producing feeder cattle of the desired kind. Examples of complementarity using crossbreeding are as follows: (A) If the optimum cow is a 750 lb. "Black-Baldy" and the target market is 40:60, Choice and Select, and 60:40, Yield Grade 2 and Yield Grade 3--

then the terminal sire might be Charolais, or (B) If the optimum cow is an 1100 lb. Brahman-Hereford and the target market is 50:50, Choice and Select, and 50:50, Yield Grade 2 and Yield Grade 3--then the terminal sire might be Angus.

If desire is to pure-breed, selective mating within a breed would consist of the following: (1) Characterize the genotype of the cow herd, in terms of Quality/Yield Grades, (2) Select the end-product target in terms of Quality/Yield Grades, and (3) Use bulls of the correct genotype, in terms of Quality/Yield Grades to complement the genotype of the cow herd.

As all of this is done, the industry must be absolutely certain that its eyes are fixed on the appropriate carcass targets. It is axiomatic that cattlemen are haunted by time risk; cattle producers can't make the most effective long-range decisions until it is certain what the consumer wants. From present vantage (mid-1988), it seems likely that "M&M's"--muscling and marbling"--are the traits upon which to concentrate in describing the product-endpoint target. (To that we could add a third "M"--"Mothering/Maternity"--to describe the production objective.)

On the shoulders of the seedstock producer falls much of the burden for improving the genotype of the nation's cowherd and bull stud. In time, cloning and genetic engineering will make possible the creation of any number of transgenically created and near-perfect breeding cattle. Until such time, responsibilities for making the most of that with which the industry must work, rests equally upon seedstock producers, cow/calf producers and feedlot operators. Take comfort from the fact that the beef industry has changed the face of its future by making revolutionary--not evolutionary--changes in the fatness of beef products as they appear at the retail market. Be encouraged also that by recommending to all that they eat the red (muscle) and not the white (fat), they can have their cake (enjoy beef's great taste) and eat it to (without fear of diet/health/nutrition consequences).