PROCEEDINGS

BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIUM & ANNUAL MEETING

BIF

May 19-21, 1975
Hyatt House
Des Moines, Iowa

PROCEEDINGS OF BEEF IMPROVEMENT FEDERATION

RESEARCH SYMPOSIA AND ANNUAL MEETING

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With Assistance from Miss Vicky Kobes

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May 19-20-21, 1975
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MAY 19 - Monday

9:00 a.m. to 9:00 p.m.	Registration	
1:30 p.m.	Committee Meetings, Dixon Hubbard in charge	
	Committee, Chairmen	Meeting Room
	Record Utilization, R. L. Willham	461
	Farm & Ranch Testing, Robert deBaca	Monterey II
	Performance Pedigree, J. David Nichols	VIP
	Merchandising, Mack Patton	Patio
	Carcass Evaluation, Bernard Jones	431
	Central Testing, Bob Rankin	Monterey III
	Reproduction, William Durfey	Executive

4:30 p.m. Election of Directors

Breed Association Caucus--Fred Francis, Presiding

BCIA-at-large--Martin Jorgensen, Presiding

BCIA Western Region--Louis Chesnut, Presiding

Directors whose terms expire in 1975:

Breed Association--Craig Ludwig, American Hereford Assn.; C. D. Swaffar, American Shorthorn Assn.; Don Vaniman, American Simmental Assn.

BCIA-at-large--Jim Wolf

BCIA Western Region--D. D. Bennett

5:30 p.m. Buffet--Monterey I, II, III

6:30 p.m. Beef Carcass Data Service--Robert Leverette, AMS-USDA

7:30 p.m. General Session
Open Meeting, Sire Evaluation Committee--Larry Cundiff, Chairman

MAY 20 - Tuesday

6:30 a.m. Breakfast Meeting, Board of Directors (retiring and new Directors)--Patio Room

Symposium
A New Look at Growth
Moderator, Larry Cundiff--U.S. MARC, Clay Center, NE
Monterey Rooms I, II

8:30 a.m. Alternative Measures of Growth in Relation to Feed Efficiency and Shape of Growth Curve--H. A. Fitzhugh, Jr., U. S. Meat Animal Research Center, Clay Center, NE

9:05 a.m. Genetic Variation in Feed Efficiency at Age, Weight and Composition End Points--G. M. Smith, U. S. MARC, Clay Center, NE

9:40 a.m. Coffee Break

10:00 a.m. Genetic Variation in Carcass and Meat Characteristics at Age, Weight and Composition End Points--R. M. Koch, University of Nebraska, U. S. MARC, Clay Center, NE

10:35 a.m. Evaluating Growth in Central Testing Stations--C. J. Brown, University of Arkansas, Fayetteville, AR

11:10 a.m. Discussion

12:00 noon Luncheon--Lower Monterey Room, Ray Meyer, President, Beef Improvement Federation, Presiding

Address: The Future of Beef and World Food Problems--Gordon Van Vleck, President, American National Cattlemen's Assn

1:30 p.m. Committee Meetings, Dixon Hubbard in charge (see Monday committee room schedule)

3:00 p.m. Coffee break

3:15 p.m. General Session--Committee Reports--Lower Monterey Room, Ray Meyer, President, BIF, Presiding

6:00 p.m. Social Hour--Gazebo Room

7:00 p.m. Beef Improvement Federation Awards Banquet, Frank H. Baker, Dean of Agriculture, Oklahoma State University, Master of Ceremonies--Poolside

MAY 21 - Wednesday

Symposium
Genetic Abnormalities in Cattle
Moderator, William Durfey
National Association of Animal Breeders,
Columbia, MO
Monterey I, II

9:00 a.m.	Genetic Abnormalities in Cattle--Keith E. Huston, University of Minnesota, St. Paul, MN
9:35 a.m.	Pathological Diagnosis of Deleterious Recessives--Horst W. Leipold, D.V.M., Kansas State University, Manhattan, KS
10:10 a.m.	Coffee Break
10:30 a.m.	Tests for Deleterious Recessives and Implications to the Industry--Paul Miller, American Breeders Service, De Forest, WI
11:05 a.m.	Discussion
12:00 noon	Adjournment
12:15 p.m.	Board of Directors Luncheon and Meeting--Patio Room
	For those who wish to visit the facilities of Pioneer Beef, a tour will depart Hyatt House approximately 1:00 p.m. and return to the motel later in the afternoon.

THE FUTURE OF BEEF AND WORLD FOOD PRODUCTION

by

Gordon Van Vleck
President
American National Cattlemen's Association

The world food shortage has focused attention on all resources for food production. Unfortunately, within the United States, there has been a misunderstanding of the role of ruminant animals in providing food, and beef and the cattle industry have been subject to unwarranted criticism.

The basic food supply problems include the world shortfall in grain production during the past two or three years, the disappearance of grain surpluses, the energy crunch, inadequate food production and distribution in developing countries, accelerating population growth, and limitations on the ability or willingness of the developed countries to buy and distribute food to the hungry and starving.

These basic problems are not always recognized, however, and sincere but misinformed people seek simplistic solutions. Some persons have suggested that livestock are consuming large amounts of plant materials that more properly could be consumed directly by man. And they have suggested that if we would eat less beef in the United States--particularly grain-fed beef--the hungry and malnourished would have more food.

As you know, this view does not fully recognize the role of ruminant animals in converting otherwise wasted resources into nutritious food. Nor does it recognize the total economics involved in producing and processing beef.

The beef cattle industry has had, and is having, more than its share of economic problems, and all of the criticism of beef as a food source does not help. However, I am convinced that there will continue to be a cow in our future--not only in the U. S., but throughout the world.

The important role of ruminant animals in human nutrition is a consequence of two distinct characteristics. First, the foods that we derive from ruminants--including beef and dairy products--are highly nutritious and palatable. Foods of ruminant origin provide more than half of the total protein in the American diet, and the protein is of high biological value. These animal products also supply large proportions of our essential vitamins and minerals.

Secondly, because of their unique digestive process, ruminants can transform to food for humans many substances which we cannot or do not choose to eat directly. This obviously has made and will make beef cattle extremely important as a world food resource.

Meanwhile, though, we now have a sort of "Meat Mythology"--a series of misconceptions, or myths, about cattle and beef production in relation to world needs for grains and other foods. Before outlining further my view of the future of beef cattle, I would like now to comment on some of these "myths," or misconceptions, about the role of beef cattle in converting feed to food.

Myth Number One. Plant and animal products are dietary equivalents, and therefore, it is "wasteful" to feed grains to animals.

Actually, meat is far superior to grain in its content of protein and essential minerals and vitamins. Eighteen percent of the retail weight of beef is protein, and virtually all of it is biologically available--because of its balanced content of essential amino acids. Corn contains only eight percent protein, and even with other sources of protein in the diet, only 56 percent of the corn protein is utilizable.

Cattle do not just "consume" grain and other feeds. They convert plant protein to a much higher quality animal protein--a type of protein which has been part of the diet for thousands of years of those nations or civilzations which have accomplished the most in human affairs.

Myth Number Two. Livestock and humans compete directly for plant materials as feed or food.

This assumption is particulary invalid in the case of ruminant animals. In the 1973-74 feeding year, on a tonnage basis, beef cattle obtained 81 percent of their feed needs from otherwise wasted roughages and industrial by-products--materials which are indigestible or not eaten by man. And that figure does not include grass on the more than 900 million acres of grazing land which otherwise would go to waste--land which is too dry, too rough or too infertile to grow crops--land whose renewable resources are harvested by grazing cattle with little use of fossil fuel. Three-fourths of the world's plant material is made up of cellulose--which is not edible by man but which can be digested by ruminants.

Grain represented only 19 percent of the feed eaten by beef cattle in 1973-74. And those grains were not food grains, but coarse feed grains--grains which have been in little or no demand or use as human food, even overseas and even in food relief programs. The reasons for little use of feed grain as food include custom, physical and nutritional characteristics and production economics.

At present, only three percent of the corn used in the United States is consumed directly by humans. At the most, only about 50 percent of our feed grain is of a grade or type suitable for processing into human food.

Myth Number Three. Use of grain in livestock production prevents its use as human food.

This view simply is not valid. There is no sinister plot to restrict feed grains for livestock use. Feed grain is fully available for human food use if someone is willing and able to buy it, ship it and distribute it.

Feed grains are used in livestock production for economic reasons--as the most economical and efficient source of feed energy under most circumstances. The amounts of grain fed to cattle vary with different economic situations.

Because of a reduced volume of cattle feeding--brought on by adverse economics--the amount of grain fed to beef cattle is dropping from 46.4 million tons last year to only 31.5 million tons in the 1974-75 feeding year--a decrese of 15 million tons. However, the grain not being eaten by beef cattle also is not going for human food use. There has been little or no increase in relief shipments of feed grain. Again, it is apparent that purchasing power and distribution are greater food supply problems than is livestock production.

Myth Number Four. Total world grain production will remain limited, and costs will remain high, so our grain supplies should be restricted to human use.

This assumption also is invalid. Most likely, the recent grain shortage is only temporary. Some authorities suggest that world needs for grain relief will run 10-20 million tons annually. USDA says world grain output in 1975 may increase by 88 million tons, with production exceeding use and allowing some increase in reserve stocks. Thus, it appears that there will be adequate grain supplies for food relief--assuming someone will buy the grain and distribute it.

Myth Number Five. Beef cattle are the biggest consumers of grains in the United States.

This is another misconception. In total, all livestock and poultry will consume 70 percent of the 175 million tons of feed grains being utilized in the current marketing year. However, beef cattle will eat only 18 percent of the total feed grains. And, when you also include food grains, beef cattle will eat only 14 percent of the available U. S. grain supply this year. The balance will go to other animals, for export, or for food and industrial use.

Even though we produce much more beef than poultry or pork, these other animals use almost twice as much corn as beef cattle use. Horses, pets and and other miscellaneous animals will eat more than half as much feed grain as beef cattle will eat this year.

Actually, many cattle eat no grain, or very little. In recent months, only 60 percent of our beef supply has come from cattle finished in feedlots. The rest has come from either non-grain-fed or only partially fed animals. Even in periods of greater feedlot feeding, more than 20 percent of our beef supply has come from non-grain-fed animals.

Myth Number Six. Cattle are extremely inefficient in converting grain to beef--using anywhere from 7 to 20 pounds of grain per pound of meat.

If cattle ate nothing but grain, and if all cattle were feedlot-fed, such figures would make some sense. However, beef cattle spend most, if not all, of their lives eating grass and roughage.

Even feedlot-finished cattle generally are not fed grain during at least the first 75 percent of their lives. Cattle are in feedlots for only 3 to 5 months. Most, if not all, of cattle feed needs continue to come from materials not otherwise usable by man.

In the 1973-74 feeding year, the average feed-to-meat conversion rate, for all types of beef, was 5.5 pounds of grain for each pound of beef on a retail equivalent basis. With less grain being fed this year, the overall average has dropped to only 3.8 pounds of feed grain per pound of beef. This overall average includes 4.8 pounds of grain per pound of feedlot-fed beef, on a birth-to-market basis, and only 2.5 pounds of grain per pound of other types of beef.

These figures for beef compare with 6.8 pounds of grain per pound of pork, and 2.7 pounds of grain per pound of poultry.

Myth Number Seven. For each pound of protein produced in the form of beef, cattle use 20 pounds of plant protein which could be eaten directly by man.

This is another myth which ignores the fact that cattle get most of their feed needs from roughage. If you counted roughage, grass, crop residues and everything, cattle might be only 5 percent efficient in converting plant protein to meat protein. However, the only valid comparison is on the basis of protein from grain and oilseed meal which conceivably could be eaten by man.

On this basis, beef cattle often are more than 100 percent efficient in converting plant protein into meat protein--more efficient, in fact, than non-ruminant animals. Even in the case of grain-fed beef, we generally use no more than 2 or 3 pounds of grain or oilseed meal protein to produce a pound of protein in the form of fed beef.

It is easily possible for ruminants to provide as much protein and energy in their food products as is supplied to the animals in feeds conceivably eaten by man. And that is figuring only on the basis of quantity of protein, not on the basis of nutritional value.

Myth Number Eight. Abstaining from or reducing meat consumption will result in more grain for the hungry and starving.

This is a particularly invalid assumption. Abstention from meat may be a symbol of sacrifice, but in reality it does little or nothing to satisfy the hungry or malnourished. Unless there is a mechanism to transfer our sacrifices to the needy, meatless days are only a token gesture.

Even if more people would eat feed grain, someone still would have to buy it, ship and distribute the grain specifically for human use. Eliminating livestock production--one of the sources of feed grain demand, one of the triggers to increased supplies--won't result in more grain for the needy. It more likely would result in reduced feed grain supplies. Grain farmers obviously won't produce grain and then give it away. Without effective demand, production will decline, or we will have a return to costly government subsidies, surpluses and controls.

A University of Minnesota agricultural scientist, in countering meat consumption critics, said: "It's no sound argument to say we should not eat well because others do not. Livestock products contribute to a well balanced diet, and our efforts should be directed toward helping others to achieve adequate diets, not at destroying our own good diets."

Myth Number Nine. If feed grains won't be used extensively as human food, we should convert our feed grain acreage to food grain production.

This assumption ignores factors like soil type, climate and capital investment. It ignores differences in yield per acre. Wheat prices would have to be three times as high as corn on a per bushel basis to bring a conversion from corn to wheat. An Iowa corn farmer with expensive land and equipment investment cannot now afford to convert to wheat, with its much lower yield per acre.

Myth Number Ten. Non-fed, or grass-fed, beef is cheaper than grain-fed beef, and just as palatable, and it therefore is a disservice to continue feedlot feeding.

This mistaken assumption apparently is based on a lack of understanding of cattle and beef production. There are several reasons not to stop grain feeding altogether in the U. S. One reason is based on simple economics.

Contrary to popular belief, it generally is more efficient and economical to produce retail cuts of beef with at least some grain feeding. The cost of producing and processing strictly grass-fed beef is generally higher because of slower rates of growth, because of reduced meat yield per animal, and because of seasonal fluctuations in supplies.

Grain feeding also improves the flavor and palatability of beef.

And it increases total beef supplies. Grazing capacity is limited, and if all cattle were kept on grass and roughage until they were ready for market, at 2 1/2 to 3 years old, our basic cow herd would have to be cut back, per capita beef supplies probably would be reduced by at least one third, and prices would be higher.

Feedlot feeding also results in more uniform supplies and prices throughout the year. Without it, we would have more seasonal fluctuations in supplies, with alternative gluts and shortages. We would have periodic unemployment in the meat industries and much higher average per animal costs of processing.

So-called non-fed beef has been cheaper recently because of cyclically burdensome total numbers of cows and feeder cattle, selling for prices far below production costs. Over the long run, costs must be recovered if a product is to be produced. For now, and for the foreseeable future, at least some feedlot feeding is needed with most cattle in the U. S., to produce retail cuts of beef most efficiently and economically, and still permit an adequate return to all segments of the cattle industry.

Myth Number Eleven. Beef is loaded with cholesterol, and it causes heart disease.

Actually, beef is low in cholesterol content. Furthermore, there is no solid scientific evidence that meat in the diet causes cholesterol abnormality or contributes to heart disease. Increasingly, reliable research and population studies indicate no valid basis for the diet-meat fat-cholesterol-heart disease hypothesis. Total calories and life style, including lack of physical exercise, apparently are much greater problems than is beef consumption.

Myth Number Twelve. Animal protein cannot economically be included in food relief food programs. Food aid must be limited to grain, because of a lower cost per pound.

Such assumptions do not give adequate consideration to the nutritional value of beef and to all of the economics involved.

There is currently a surplus of non-grain-fed cattle and beef in the U. S., and it appears that canned beef could be used as a protein source as part of food relief programs--both private and governmental. Canned beef contains 25 to 30 percent protein, virtually all of which is utilizable.

Two ounces of this beef, coupled with 1.2 pounds of corn, could supply hungry people with their requirement for utilizable protein, plus 2,000 calories of energy per day. Based on recent prices in the U. S., this combination would cost 16¢ per day--including 10¢ for the canned beef and 6¢ for the raw corn. Grain alone, in any amount, will not provide an adequate intake of amino acids.

I have mentioned and commented on all of these meat "myths" not just to defend the cattle industry, but also to emphasize the many positive characteristics of beef cattle as a food resource.

Without any further improvement in production efficiency, cattle would be important simply because of their unique capabilities as scavengers--as walking food factories which can convert millions of tons of otherwise wasted fibrous and pulpy plant materials into human food. However, it is clear that we have only begun to tap ruminant animals' full potential for food production.

We must utilize available technology and techniques more fully, and we must step up our production research. It should be possible to improve reproduction efficiency--through such things as multiple births, estrus control and artificial insemination. We should be able to produce a more desirable product and attain more efficiency through improvements in breeding. We should be able to convert feed to meat still more efficiently through new processing methods, feed additives and feeding techniques. We should be able to reduce disease losses. We should be able to make much greater use of crop residues, animal wastes and other materials. And we should be able to effect beneficial changes, for both the industry and the public, through changes in beef grading standards.

We obviously have a long way to go in improving use of grass and forage. The American Forage and Grasslands Council says that our 1 billion acres of forage-producing land is being used at only 22 percent of its potential.

If we have these kinds of potential for improvement in this country, think what can be done elsewhere in the world, where technology and management are lacking.

Sixty percent of the world's ruminant animal population is in developing countries, but the ruminants in those countries produce no more meat and milk than do the 8 percent of the world's ruminants in the United States. It is apparent that many of the developing countries with ruminants probably have more potential for increasing their food production through better use of these animals than they do through any other agricultural enterprise now available, including grain.

Much of the earth's surface cannot be converted to crop production, but it will support ruminant animals. Ruminants should not be emphasized to the exclusion of crops, but it does appear that both livestock and grains, as well as other food crops, can be used as complementary parts of a total agricultural system.

We should be able to increase total production of both livestock and grains. We need not look at these two food sources as competitive, when, in fact, they are not directly competitive in the United States, or even in many countries overseas.

All links in the world food production and distribution chain must be developed. The elimination of one link, such as ruminant animals, would disrupt the system and result in less food.

Direct transferral of food from the U. S. is only a start in helping the poor. Great strides must be made in improving the productive capacity of developing nations. And this is not just a matter of technology. A recent USDA survey revealed that 46 of 50 countries which are short on food supplies have government policies which are economic dis-incentives--which directly or indirectly discourage domestic production. All of this is in addition to inadequate storage and distribution systems.

The U. S. cattle industry--operating under the incentive or competitive system which has made our country the world's greatest supplier of food--is doing its best to help meet the world's growing needs for protein and other nutrients. But all of the world's organizations, societies and economies will have to work in tandem, and not at odds, in order to assume adequate production and distribution of food in the years ahead.

I feel that we have had too much "meat mythology"--too much fruitless, and even counter-productive, advocacy of reduced meat consumption. Actions aimed at altering U. S. diets would be better directed if they zeroed in on the specific problems of getting more food to the malnourished, or helping developing countries produce and distribute more food.

Instead of debating simplistic and non-productive ways of solving the world food problem, it is time that all of us in this country, and in other countries, got on with the job of actually producing and distributing more food of all types. The remarkable ruminant surely will play a key role in that job.

ALTERNATIVE MEASURES OF GROWTH IN RELATION TO FEED EFFICIENCY AND SHAPE OF GROWTH CURVE

H. A. Fitzhugh, Jr.
U. S. Meat Animal Research Center
Clay Center, Nebraska

Genetic improvement of beef cattle must be measured in terms of increased profitability. Moreover, recommended genetic changes must consider the economic impact at all levels of the production system - cow herd, feeder calf, retail product. Profitability depends on selling price, amount of product and production costs. As dramatically illustrated the past few years, cattlemen have little control on selling price and so must concentrate on the latter two factors. My discussion will emphasize ways and means of increasing product at reduced costs, primarily through genetics.

Selection for daily gains, weight per day, weaning weight or yearling weight have all been recommended to increase amount of product. Stylized growth curves for two bulls illustrate the expected effects of selection for any of these traits (figure 1). Bull 2 is always favored. Consequently, weight of his progeny would be increased at all ages - birth, slaughter and maturity. While increased slaughter weight is usually an advantage, increased birth weight may lead to calving problems and increased mature weight raises maintenance costs for the cow herd. The problem is how to increase slaughter weight without increasing calving difficulty or cow maintenance costs. Three methods will be described:

1. Selection for relative growth rate
2. Change shape of growth curve
3. Mating complementary sire and dam lines

Selection for Relative Growth Rate

The two most common measures of growth rate are Absolute Growth Rate (AGR) and Relative Growth Rate (RGR). They are computed using the difference between weights (w_1 and w_2) at times 1 and 2 (t_1 and t_2).

$$AGR = \frac{w_2 - w_1}{t_2 - t_1}$$

$$RGR = \left(\frac{w_2 - w_1}{t_2 - t_1}\right) \Big/ \tfrac{1}{2}(w_1 + w_2)$$

If time is measured in days, AGR is the same as average daily gain. RGR is simply AGR relative to average weight maintained over the time interval.

AGR identifies fast growing cattle, but RGR identifies cattle which grow rapidly relative to feed costs of maintenance.

The expected responses to selection for yearling weight, AGR and RGR from 12 to 18 months are shown in table 1. These expected results are based on Hereford female data from the USDA station at Miles City, Montana. While only the 12-18 month interval is used, similar results would be expected for other postweaning, preslaughter age intervals (e.g., 10-15 months). A standardized selection differential of 1.0 is approximately equal to selecting the best 38% of the population.

Selection for yearling weight (w_{12}) should increase weight at all ages and AGR but not RGR. For example, selection for w_{12} would have the desirable effect of increasing w_{12} by 3.9% (or .039 x 483 = 19 lb.) but the potentially undesirable effects of increasing birth weight (w_B) 2.2%, (1.7 lb.) and mature weight (w_A) 2.3% (26 lb.).

Selection for AGR would increase both AGR and RGR but also increase all weights. This is a natural consequence of the common observation that the fastest gaining cattle are generally the largest cattle as well.

By contrast, however, selection for RGR would increase postweaning gain but have little effect on body weight. Thus, selection for RGR favors individuals which grow more rapidly than expected for their size.

The effects of selection for postweaning AGR and RGR on birth weight, 15-month weight, daily feed consumption (TDN) and feed efficiency (TDN/Gain) are shown in table 2. These results are based on Angus, Hereford, Shorthorn and crossbred steer data from approximately 7 to 15 months of age. Selection for AGR would increase appetite and efficiency but also weight. Selection for RGR would decrease birth weight while increasing slaughter weight, appetite and efficiency. Selection for RGR should yield two-thirds the increase in efficiency with only half the increase in feed consumption expected from selection for AGR.

Changing Shape Of Growth Curve

There is sufficient "genetic flexibility" in the growth curve to allow effective selection for weight at one age while holding constant (or reducing) weight at other ages. The preferred shape of the curve will depend on how the selected population will be used. For example, a breed used as a dam line or in a rotational cross might be selected for rapid early growth and reduced mature size; whereas, a breed used as a terminal sire line might be selected for rapid postnatal growth and reduced birth weight but no attention to mature size (Fitzhugh, 1972).

Expected changes in the growth curve (tables 3 and 4) depend on the specific selection criteria. Three different criteria are considered:

1. Unrestricted selection for 12-month weight (w_{12})
2. Selection for w_{12} restricting mature weight to no change ($w_{12}.w_A$)
3. Selection for 12-month weight restricting both birth weight and mature weight to no change ($w_{12}.w_B w_A$)

Table 3 gives expected changes for weights at birth, 6, 12, 18 months and maturity (5-6 years) when all weights are observed and used in index. Table 4 gives expected results if selections are made using only w_B, w_6, w_{12} and w_{18} without waiting until w_A is available for use in index.

Unrestricted selection for w_{12} should increase weight at all ages. Thus, the whole curve is shifted higher on the size scale with little change in shape (figure 2).

Selection for w_{12} holding w_A constant does change the shape of the curve. Individuals which grow more rapidly than expected for their mature size will be favored (figure 3). Results are expected to be similar when selection is for w_{12} holding constant both weight at birth and maturity. Holding mature size constant does reduce percent increase in w_{12} to approximately 3/4 of the expected increase from unrestricted selection but gains the advantages in calving ease and lower maintenance costs.

The degree of change in shape of curve is substantially reduced when w_A is not used in selection index (table 4). However, these indexes may be more practical since they allow much earlier selection. By the time mature weight is known, a cow will have had several calves and bulls will have sired even more. Mature weights of relatives (e.g., sire and dam) or skeletal measures of size (either height, body length, etc.), which mature earlier than weight, can also be used in the index to avoid having to wait until mature weight of individual is known.

<u>Complementary Sire And Dam Lines</u>

During the 1974 BIF Symposium, Dr. T. C. Cartwright, Texas A&M University, discussed results from our computer simulation analyses of beef production systems. Cow size was a major variable evaluated in this study. Comparisons were made in terms of return to investment for fully integrated, conception to carcass systems. More details are given by Long <u>et al</u>. (1975).

Returns to investment for straightbred systems using small (mature cow weight, 950 lb.) medium (1100 lb.) and large cows (1325 lb.) were all approximately 14.9%. The advantages of one size (smaller cows had lower maintenance costs) were balanced by disadvantages (smaller calves gained slower in feedlot) so there were no overall economic advantages to any one size. The major economic advantage came when large size genotypes were used as terminal sire lines on small crossbred cows. These combinations utilized both hybrid vigor and complementarity to increase return to investment to over 18%.

Conclusions:

1. Unrestricted selection for weight or absolute growth rate (AGR) will increase weight at all ages and likely lead to increased calving problems and cow herd maintenance costs.

2. Selection for relative growth rate (RGR) should increase rate and efficiency of gain without increasing weights at all ages.

3. The growth curve is genetically flexible and use of restricted selection indices will allow increase in postnatal growth while holding constant weights at birth and maturity.

4. There is no single optimal cattle size for all conditions; however, commercial productivity and production efficiency is improved when breeds are combined in complementary combinations to take advantage of each breed's special attributes. For example, systems mating large sire lines to small dam lines combine the advantages of rapid, efficiently gaining slaughter cattle and low maintenance-cost cow herds.

5. Choice of selection criteria for each breed (or herd) should be based on the role played by seedstock from the breed (or herd) in profitable commercial beef production.

References:

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Fitzhugh, H. A., Jr. 1972. Selection to change shape of growth curves of beef cattle. Texas Agr. Exp. Sta. P. R. 3121.

Fitzhugh, H. A., Jr. and St. C. S. Taylor. 1971. Genetic analysis of degree of maturity. J. Animal Sci. 33:717.

Long, C. R., T. C. Cartwright and H. A. Fitzhugh, Jr. 1975. Systems analysis of sources of genetic and environmental variation in efficiency of beef production:cow size and herd management. J. Animal Sci. 40:407, 421, 433 (three paper series).

TABLE 1. EXPECTED RESPONSES TO SINGLE TRAIT SELECTION[a,b]

Selection Criterion	Expected responses, % of initial mean				
	w_B	w_{12}	w_A	AGR	RGR
w_{12}	2.2	3.9	2.3	2.1	-1.0
AGR, 12-18	1.5	1.4	1.6	4.8	4.3
RGR, 12-18	0	-.5	.1	2.8	5.0
Initial Means	77 lb	483 lb	1116 lb	1.37 lb/day	.23 $\%\bar{w}_{12-18}$

[a]Responses to one generation of selection with a standardized selection differential of 1.0.

[b]Genetic and phenotypic statistics from Fitzhugh and Taylor (1971 and Brinks et al. (1964).

TABLE 2. EXPECTED RESPONSES TO SELECTION FOR POSTWEANING ABSOLUTE AND RELATIVE GROWTH RATES [a,b]

Selection criterion	Expected responses, % of mean			
	w_B	w_{452}	TDN	TDN/Gain
AGR	.8	4.7	4.4	-3.1
RGR	-2.6	1.8	2.2	-2.1
Initial means, lb	75	858	9.9	6.1

[a]Based on unpublished results for Angus, Hereford, Shorthorn and Crossbred steers provided by Dr. G. M. Smith, U.S. Meat Animal Research Center, ARS, USDA.

[b]Response to one generation of selection with a standardized selection differential of 1.0.

TABLE 3. EXPECTED RESPONSES TO INDEX SELECTION, ALL WEIGHTS AVAILABLE[a,b]

Selection criterion	Expected responses % of initial mean		
	w_B	w_{12}	w_A
w_{12}	2.8	4.1	3.1
$w_{12}\cdot w_A$	.4	3.0	0
$w_{12}\cdot w_B w_A$	0	3.0	0
Initial means, lb.	77	483	1116

[a]Response to one generation of selection with a standardized selection differential of 1.0.

[b]Genetic and phenotypic statistics from Fitzhugh and Taylor (1971) and Brinks <u>et al</u>. (1964).

TABLE 4. EXPECTED RESPONSES TO INDEX SELECTION, w_A NOT AVAILABLE[a,b]

Selection criterion	Expected responses % of initial mean		
	w_B	w_{12}	w_A
w_{12}	2.7	4.1	2.9
$w_{12}\cdot w_A$	-.7	2.0	0
$w_{12}\cdot w_B w_A$	0	1.9	0
Initial means, lb.	77	483	1116

[a]Response to one generation of selection with a standardized selection differential of 1.0.

[b]Genetic and phenotypic statistics from Fitzhugh and Taylor (1971) and Brinks <u>et al</u>. (1964).

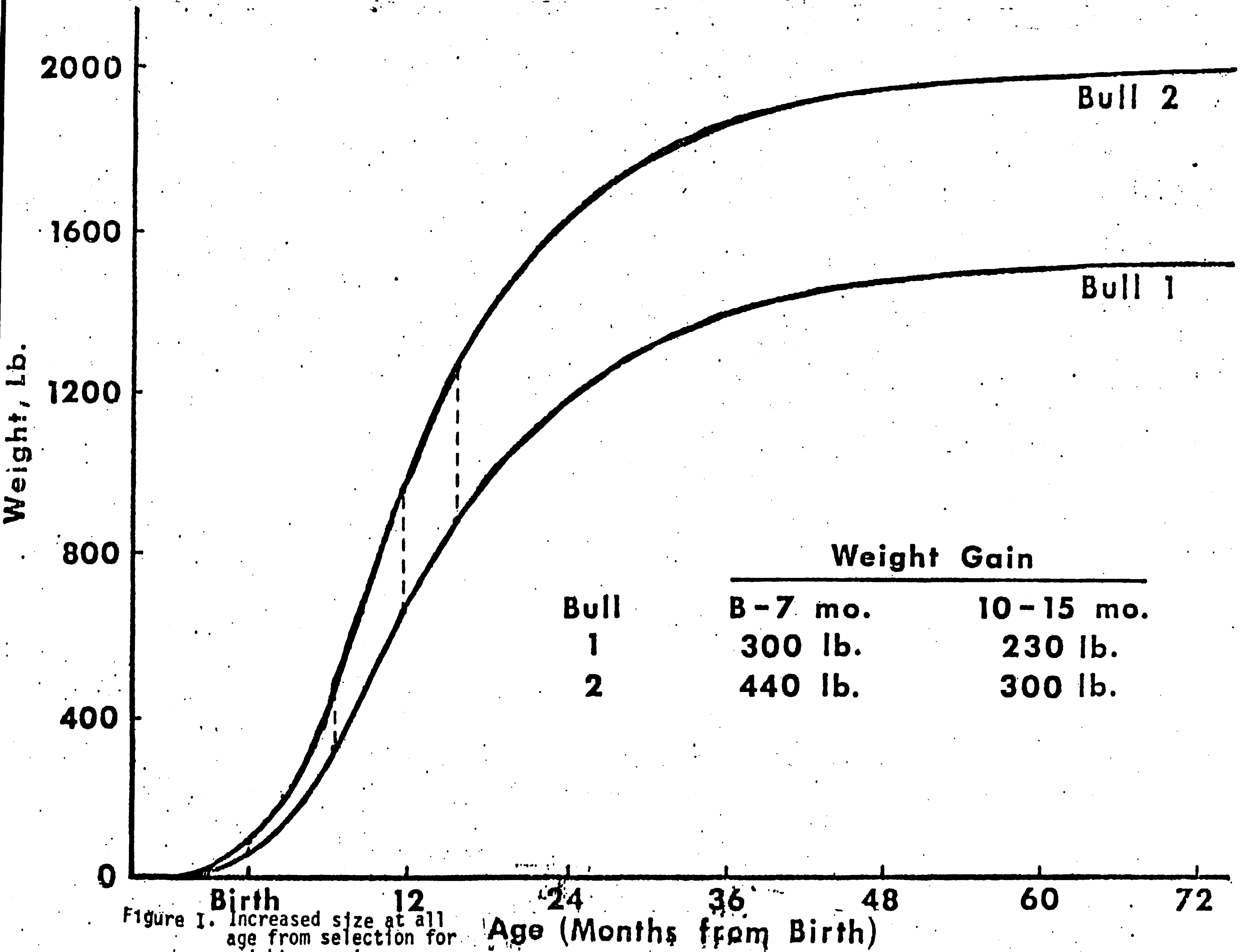

Figure I. Increased size at all age from selection for weight or gain.

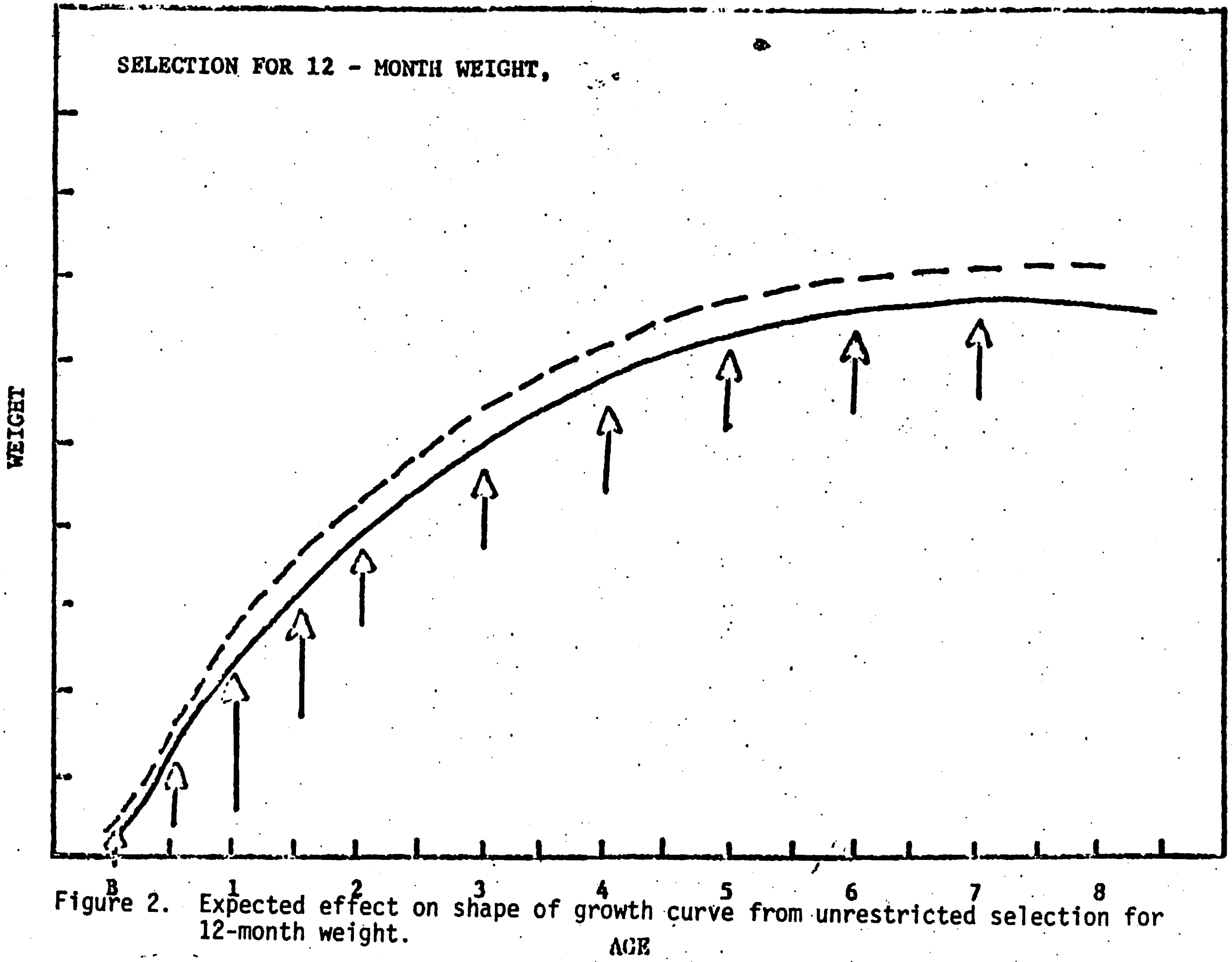

Figure 2. Expected effect on shape of growth curve from unrestricted selection for 12-month weight.

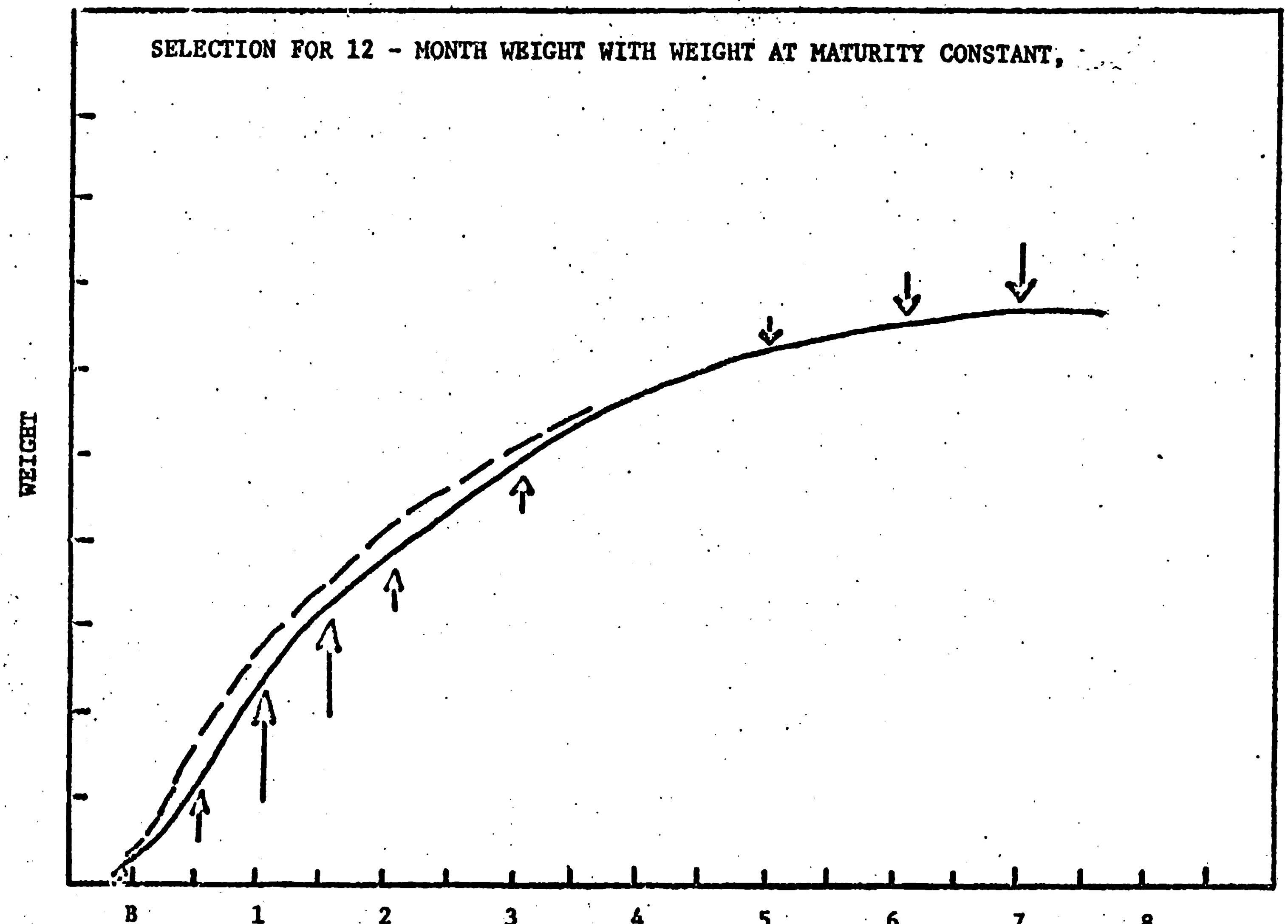

Figure 3. Expected effect on shape of growth curve from restricted selection for 12-month weight holding mature weight constant.

GENETIC VARIATION IN FEED EFFICIENCY AT AGE, WEIGHT AND COMPOSITION END POINTS[1]

Gerald M. Smith[2]

As part of the Germ Plasm Evaluation Program at the U.S. Meat Animal Research Center, cattle of diverse biological types have been characterized for postweaning growth and feed efficiency. In Cycle I of the GPE Program, Hereford and Angus cows were mated by AI to Hereford, Angus, Jersey, South Devon, Limousin, Charolais and Simmental sires to produce three calf crops. Feed-efficiency was evaluated for breed groups fed in replicated pens in each of three years over age-constant (0 to 217 days on feed), weight-constant (530 to 1035 lb.) and grade-constant (0 days to 5% fat in the rib-eye muscle) intervals.

Postweaning growth curves for each breed group are shown in figure 1. Charolais and Simmental crosses were the most rapid growing, while Jersey crosses were the slowest. Limousin, South Devon and Hereford-Angus crosses were similar and intermediate in growth rate.

Cumulative TDN consumption for any constant time on feed (figure 2) was greatest for the larger, faster growing breeds. Breed groups consuming the least TDN to a constant weight (figure 3) tended to be those with the heaviest initial weight. The interpretation of these feed consumption patterns is best examined in terms of efficiency of growth over different intervals of evaluation.

Over age-constant intervals (figure 4), Charolais and Limousin crosses were most efficient; whereas, Jersey crosses were least efficient. Evaluation of feed efficiency over age-constant intervals favors breeds which gain rapidly relative to weight being maintained. The fact that breeds with the highest postweaning ADG were also heaviest tended to reduce differences in feed efficiency relative to weight-constant evaluation.

The ranking and relative differences of breed groups for weight-constant feed efficiency (figure 5) is similar ($r = .94$) to age-constant efficiency, but larger differences were found. Feed efficiency measured over weight-constant intervals is increased by rapid growth rate because fewer days of maintenance are required. It is also argued that steers of large mature size have an additional advantage over a weight-constant interval because of the leaner composition of their gain; however, it is not clear that protein deposition is less efficient than fat deposition. The number of days required to reach 1035 lbs. tended to explain breed group differences in weight-constant efficiency, except that Limousin -- a relatively lean breed -- were more efficient and Jersey -- a relatively

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[1] Cooperation of the University of Nebraska, Lincoln, and Kansas State University, Manhattan, is acknowledged.

[2] U. S. Meat Animal Research Center, Agricultural Research Service, USDA.

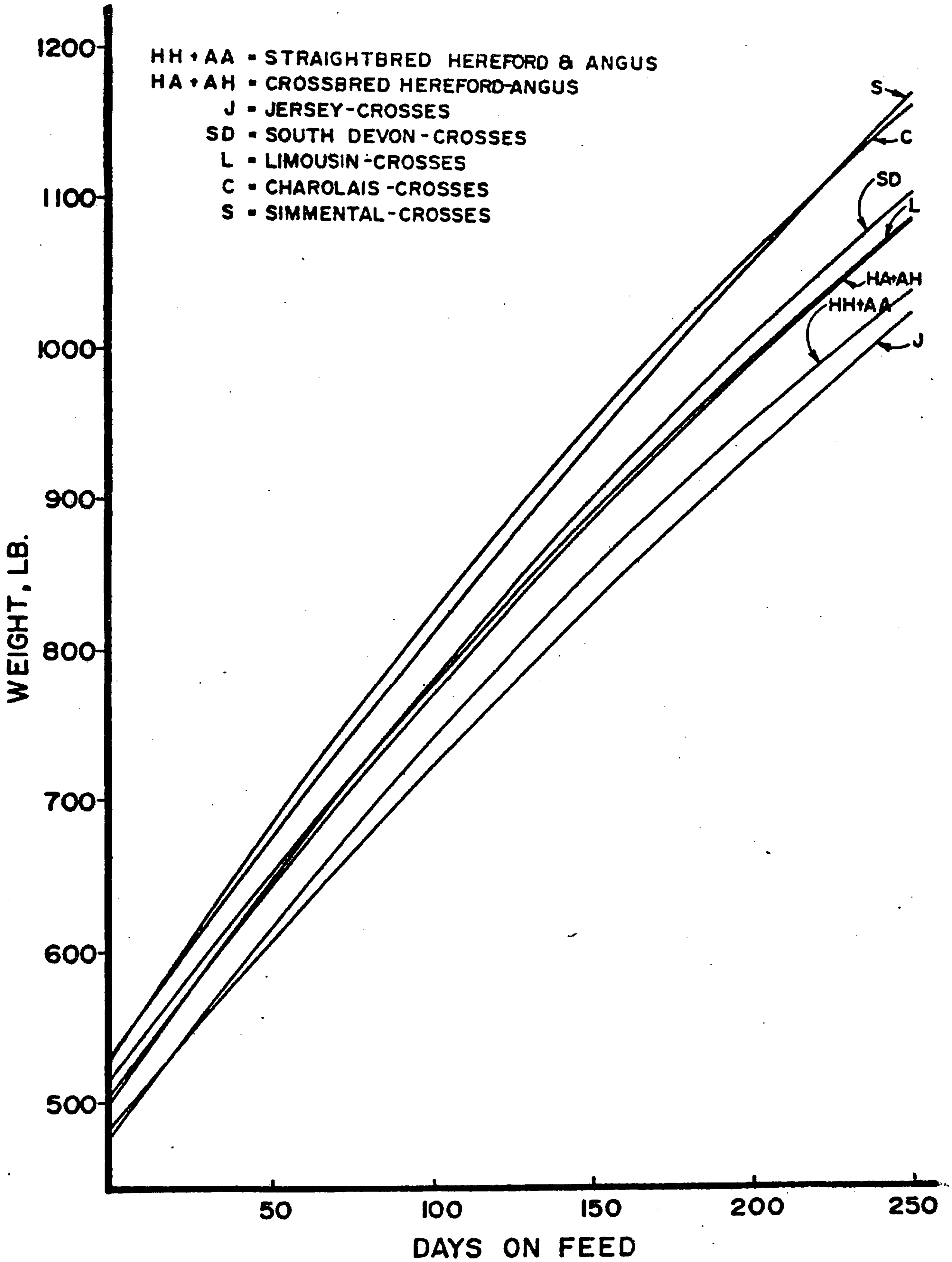

Figure 1. Postweaning growth curves.

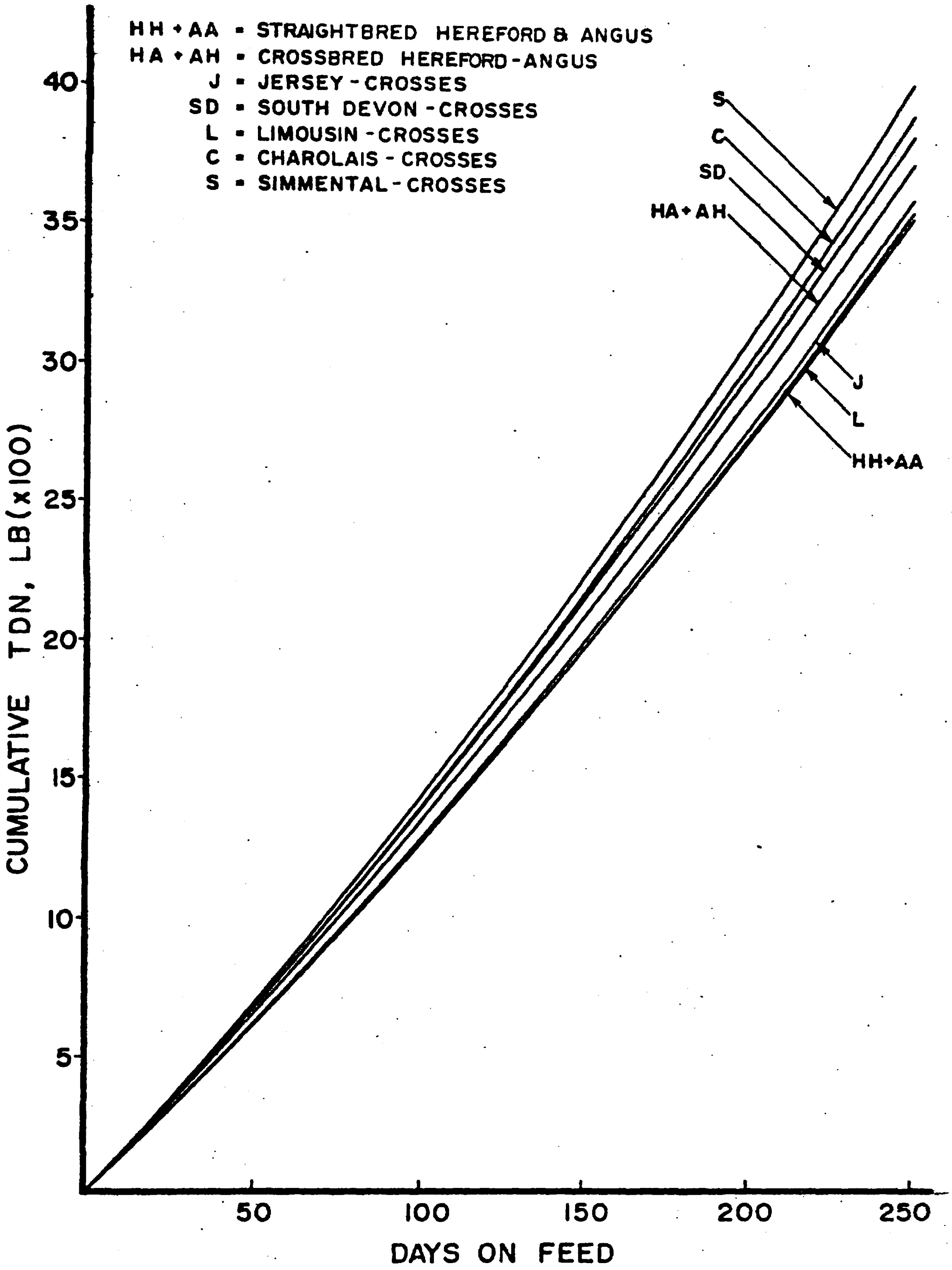

Figure 2. Cumulative feed consumption versus day on feed.

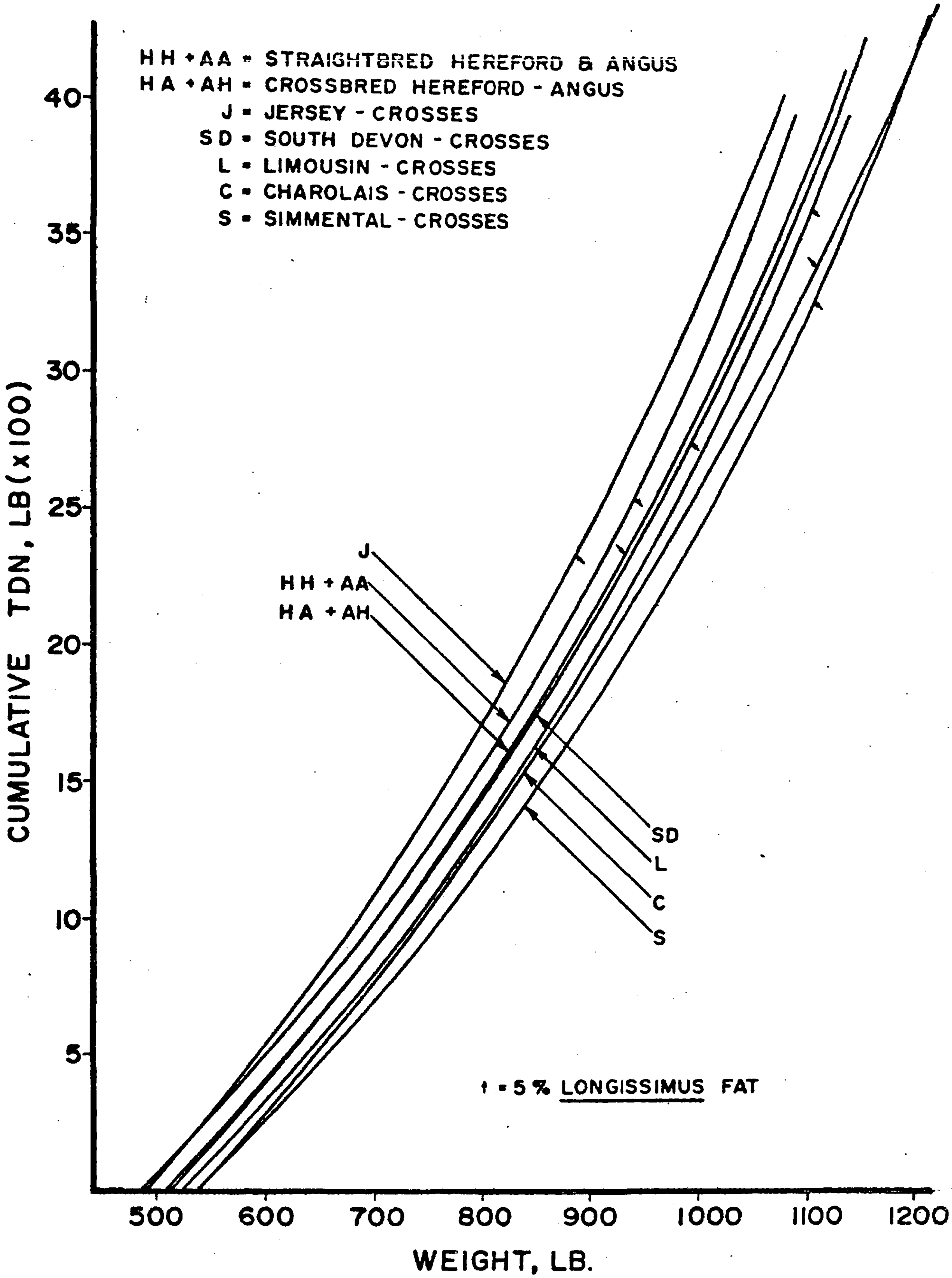

Figure 3. Cumulative feed consumption versus weight.

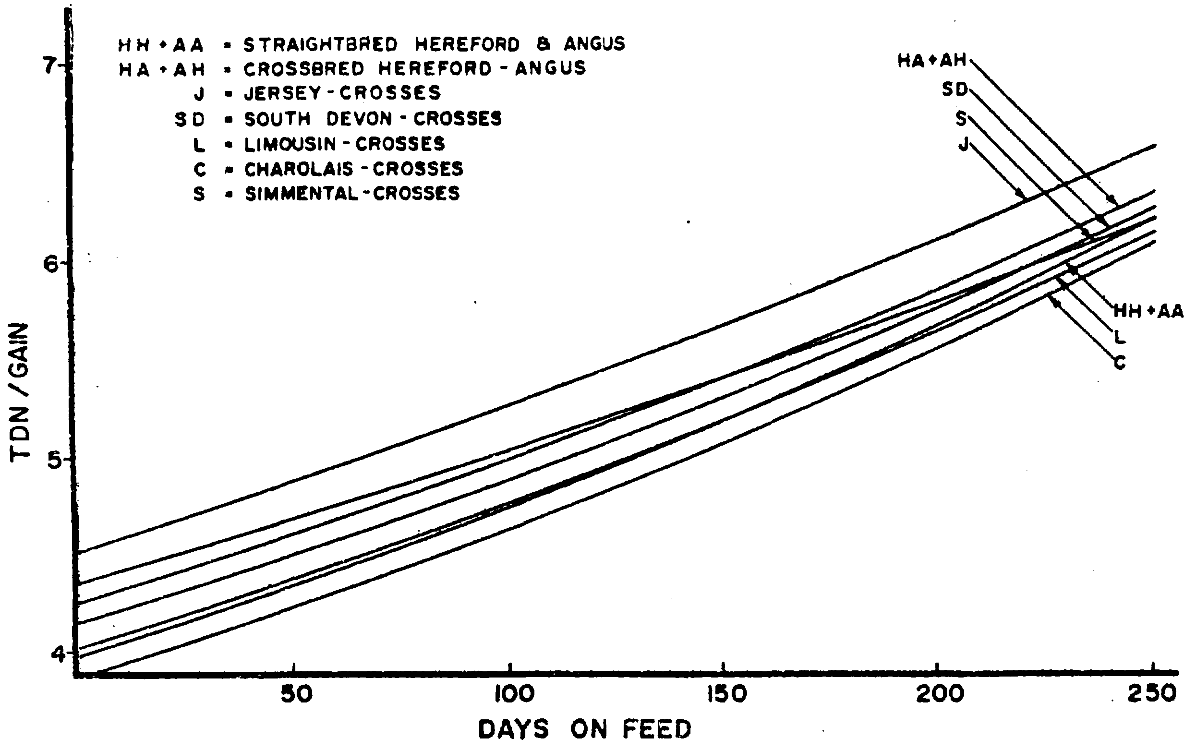

Figure 4. Feed efficiency over age-constant intervals.

fat breed -- were less efficient than predicted from their growth rates. These deviations suggest an efficiency advantage of lean gain, but do not separate composition differences from possible variation in intrinsic efficiency.

Feed efficiency for constant age to weight intervals is depicted in figure 6. Comparison at 927, 880, 988, 1101, 1109 and 1113 lbs. for Hereford-Angus, Jersey, South Devon, Limousin, Charolais and Simmental crosses, respectively, is equivalent to evaluation at a constant grade. Hereford-Angus crosses were most efficient and Limousin crosses the least efficient to a grade-constant end point (figure 7). As with weight-constant evaluation, days to reach 5% longissimus fat tended to explain (r^2 = .64) differences in grade-constant efficiency.

Figure 8 depicts the relationships between feed efficiencies evaluated over age-, weight- and grade-constant intervals and pre- and postweaning average daily gain (ADG) and relative growth rate (RGR) and weights at birth, 200 days, 405 days and 5% fat in the rib-eye muscle. Age- and weight-constant feed efficiencies were greater for the larger, faster gaining, leaner breed groups; however, the genetic variation among breed group means was much greater in the weight-constant (±10%) than in the grade-constant (±5%) interval. The genetic variation among breed group

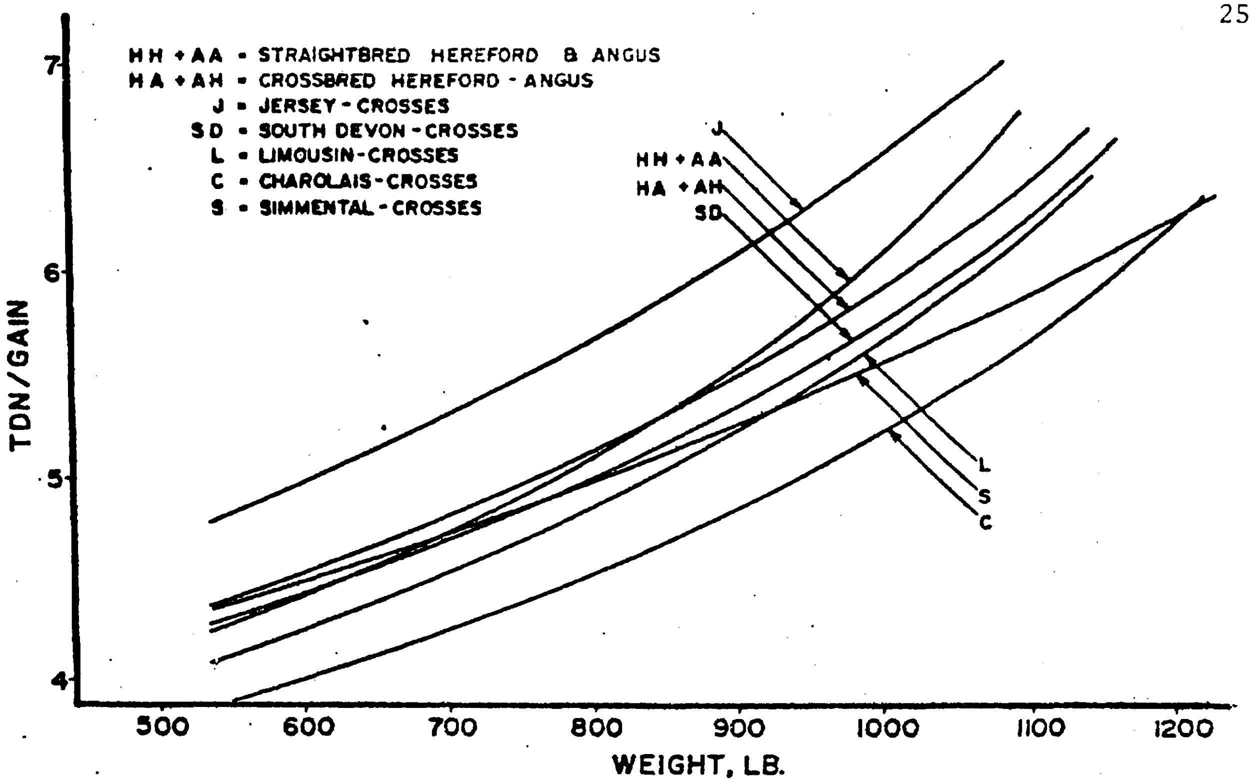

Figure 5. Feed efficiency over weight-constant intervals.

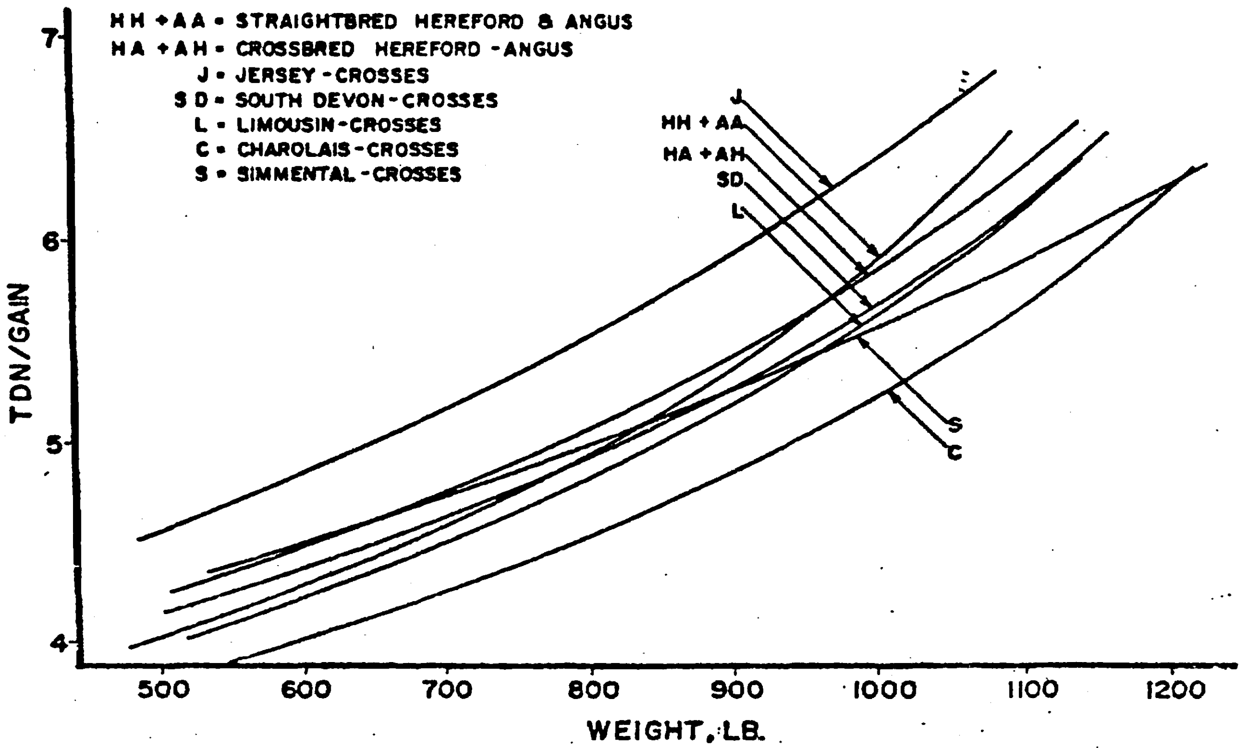

Figure 6. Feed efficiency over constant-age to constant-weight intervals.

means in grade-constant efficiency (±6%) was comparable to that for age-constant efficiency, but tended not to be associated with measures of size or average daily gain.

The fact that knowledge of body weights and growth rates would have revealed most of the breed-group differences in age- and weight-constant efficiencies, but not in efficiency at a constant grade, agree with results of Dickerson et al. (1974, J. Anim. Sci. 39:659) which showed no advantage of individual feed consumption for predicting net merit over age- and weight-constant intervals when measures of growth and fatness are available. These results suggest that direct measurement of feed intake is not necessary for normal evaluations of feed efficiency. The apparent usefulness of postweaning relative growth rate as an indicator of grade-constant efficiency lends support to the contention that relative growth rate would be a useful indicator of intrinsic efficiency.

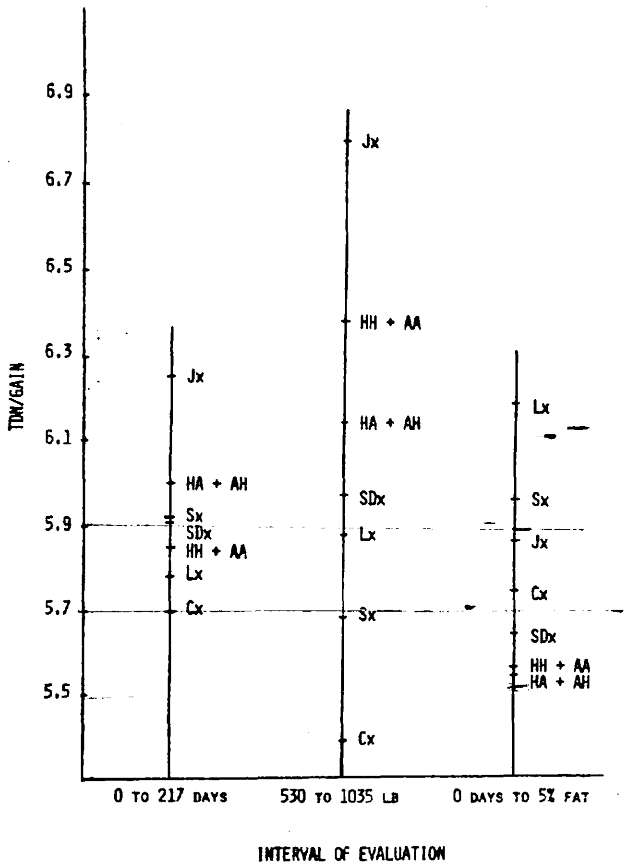

Figure 7. Feed efficiency over age-, weight- and grade-constant intervals.

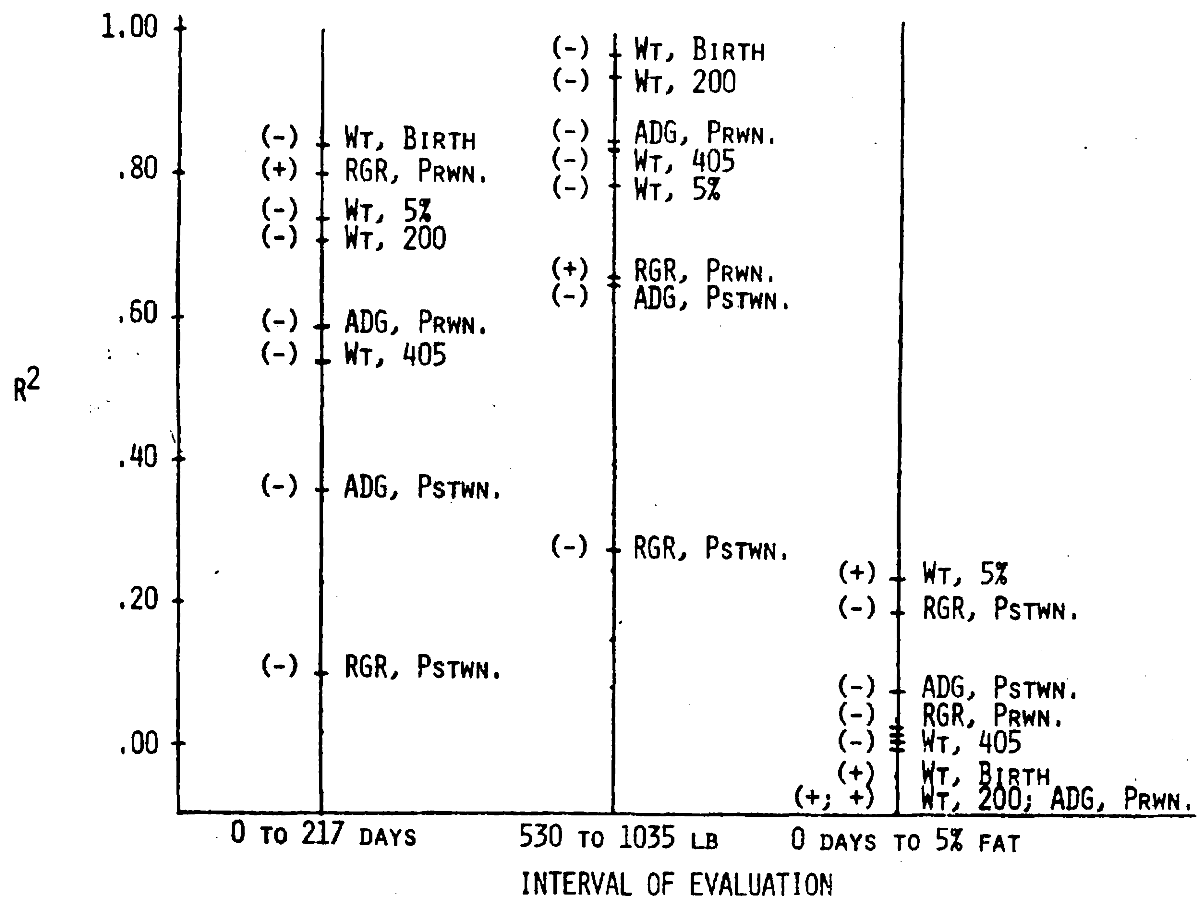

Figure 8. Correlations of breed group means for feed efficiencies over age-, weight- and grade-constant intervals to growth traits.

Gross feed efficiency is a function of feed intake relative to maintenance requirements, composition of gain and of weight being maintained, environment, physiological age and intrinsic efficiencies associated with digestion, absorption or cellular utilization of metabolites. Information necessary to partition causal effects of differences in gross efficiencies are not available in this data; however, examination of gross efficiency over different intervals offers some insight into the importance of some of the different factors. It is apparent from the weight-constant comparisons that growth rate or intake above maintenance is a very important component of gross efficiency. The marked advantage of relatively immature breed groups over weight-constant intervals also suggests that the synthesis and maintenance of lean may be most efficient, but offers no conclusive evidence to resolve the uncertainty (Garrett, 1971, J. Anim. Sci. 32:451) of this point. The breed group differences in efficiency to a grade-constant slaughter weight suggest that genetic variation may exist for intrinsic efficiency.

Genetic variation does exist for apparent advantage in the amount of feed required for growth over various intervals of evaluation. Differences in gross efficiency commonly observed for age- or weight-constant intervals are more likely due to differences in mature size and growth rate than to differences in the intrinsic efficiencies of digestion, absorption or use of blood metabolites. On the other hand, differences in grade-constant feed efficiency are not related to differences in size or growth rate. The inability to partition causal effects of gross feed efficiency does not prohibit its exploitation in beef production systems. To discern the effect of differences among biological types for feed efficiency over age-, weight- or grade-constant intervals on total systems efficiency will require consideration of correlated factors such as reproduction, calving difficulty and cow herd maintenance costs. Nevertheless, the postweaning component of beef production is and has traditionally been an important segment of the cattle industry. The results of the present study, which show major differences among biological types for growth rates and feed efficiency, are directly applicable to the cattle feeding segment of the industry.

GENETIC VARIATION IN CARCASS AND MEAT CHARACTERISTICS AT AGE, WEIGHT AND COMPOSITION END POINTS[1]

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Genetic variation includes differences between breeds or breed crosses and genetic variation within these groups. My discussion today is based on differences among breed crosses. The breed groups represented here are not a random sample of all breed groups nor do they depict the total cattle population adequately for all considerations. Nevertheless, it is my opinion that the genetic associations reported do indicate in a general way genetic tendencies to be expected in a broad sample of cattle breeds and may offer insight to genetic variation within breeds. Breed crosses reported here were part of the Germ Plasm Evaluation program at the U.S. Meat Animal Research Center, the result of mating Hereford and Angus cows by artificial insemination to sires of the Hereford, Angus, Jersey, South Devon, Limousin, Charolais and Simmental breeds. Steer carcasses from three years' calf crops were evaluated. Each year one-third of the steers were slaughtered at each of three slaughter dates spaced about one month apart. Slaughter at three dates provided a range in weight and degree of fatness for each of the breed groups. The average age at the start of the feeding period was 240 days and the average number of days on feed was 217. Slaughter was carried out at a commercial packing plant. After a 24 hr chill carcasses were evaluated for conformation, maturity, marbling, color, texture, firmness and U.S.D.A. quality grade. The right side of each carcass was trucked to Kansas State University where it was processed to obtain detailed cut-out information and taste panel evaluation. The round, rib, loin and chuck were processed into closely trimmed boneless roasts (including steak meat) and lean trim, except for a small amount of bone left in short loin and rib roasts. Fat was trimmed to no more than 0.3 inch on any surface. Lean from the flank, plate, brisket and shank were added to the lean trim from the four major cuts. Chemical analysis of the lean trim in each carcass was used to adjust total lean trim to a 25% chemical fat basis. The sum of roasts and lean trim were called retail product.

A steak from the 12th rib of each carcass was used to determine intramuscular fat of the ribeye (longissimus) muscle. Steaks at the 10th and 11th ribs from four representative carcasses of each breed group at each slaughter date were frozen and later used in a taste panel evaluation of tenderness, flavor, juiciness and overall acceptability.

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[1] Carcass processing, chemical analysis and taste panel evaluation were carried out at Kansas State University under the direction of Dr. M. E. Dikeman and associates.

Genetic merit of animals in each breed-slaughter group was expected to be similar except for sampling variation. Therefore, change in carcass composition of the breed group average from one slaughter date to the next provided a method of adjusting breed group means to three alternative situations for comparison, (1) constant age, (2) constant weight and (3) constant percentage of fat in the ribeye muscle. The constant age used was 457 days (240 days average age at start + 217 days average on feed). The constant weight selected was a hot carcass weight of 635 lb which was close to the average of Hereford-Angus crosses and approximates the carcass weight expected from a 1,000 lb steer. The amount of fat in the ribeye muscle selected as a base of comparison was 5% since this approximated the marbling required for A maturity carcasses to grade U.S.D.A. Choice. Each of the breed group means was adjusted by the linear change observed in the various traits during the last 60 days on feed relative to the change in the base trait of comparison, e.g., carcass weight, days on feed or fat in the ribeye muscle. This method of adjustment estimates values that would be obtained if all animals in a breed group had been fed for fewer or more days until the average of the breed group reached the base selected.

Carcass composition traits and taste panel tenderness compared at 635 lb carcass weight, 457 days of age and at 5% fat in the ribeye muscle are shown in table 1. Adjusted means for composition traits have been expressed as percentages for convenient comparison.

Retail Product. If we plot retail product percentage against hot carcass weight several interesting points become evident. First of all, as cattle are fed to higher weights the percentage of retail product decreases in every breed group, although at rates that differ slightly. Counter to this is a genetic trend associated with the breed group means. The plot of data on an age constant basis suggests a strong genetic tendency for groups that grow more rapidly to have a higher percentage of retail product.

Differences in composition were maximum at a constant carcass weight and smallest at a constant percentage of fat in the ribeye muscle. Charolais, Limousin and Simmental crosses were significantly higher in retail product percentage at all bases of comparison and Jersey crosses were the lowest.

Fat Trim. Fat trim percentage plotted against hot carcass weight is essentially the opposite picture of retail product. Fat trim percentage increased in all breeds as weight due to feeding increased. The genetic trend based on breed group means at a constant age was downward. Fat trim includes kidney and pelvic fat and there were significant differences among breed groups in kidney fat. As with retail product, differences in percentage of fat trim were greatest at a constant carcass weight and least at 5% fat in the ribeye muscle. Jersey and Hereford-Angus crosses had the highest and Charolais, Limousin and Simmental crosses the lowest fat trim percentage. South Devon crosses again were intermediate. Variation in fat trim is the dominant factor available to producers to change by breeding or by feeding and management.

Bone. Weight of bone increased as carcass weight increased and was closely correlated with increase in weight of retail product. Differences in percentage of bone were quite small. As in the case of retail product, bone percentage decreased as breed groups were fed to higher weights, but the genetic trend of the breed group means was for a higher bone percentage as growth rate increased. Although there was a high correlation between weight of bone and weight of retail product, the ratio of retail product to bone was not a good indicator of retail product percentage. Simmental and Charolais crosses had the highest bone percentages at all alternative bases with other breeds switching rank depending on the weight at which they were compared.

Roast and Steak Meat. Breed groups differed significantly in conformation as applied to live animal or carcass appraisal. We used to say that superior conformation was related to higher percentage cut-out of the high priced cuts. More recently studies by various workers, such as Butterfield (1963) and Kauffman et al. (1973), have indicated these differences are very small. To the extent that roast and steak meat is a measure of more desirable cuts we can examine roast and steak meat as a percentage of the sum of retail product, fat trim and bone and as a percentage of retail product only. Roast and steak meat expressed as a percentage of the sum of retail product, fat trim and bone was significantly different among breed groups. However, when roast and steak meat is expressed as a percentage of retail product only the differences are reduced to less than 1% and a general reversal in rank of many breed groups with the fatter breed groups ranking high. Differences in amount of roast and steak meat were influenced slightly by differences in fat content. Removing all differences associated with fat would likely remove any significant difference in relative amount of retail product that is represented by roasts and steaks.

Intramuscular Fat in the Ribeye. Intramuscular fat in the ribeye (marbling) is of considerable economic importance because it is currently the most important factor in determining quality grade. Breed crosses differed significantly in percentage of intramuscular fat when compared at a common age or weight. Jersey crosses were significantly higher than other breed crosses and were followed in rank by Hereford-Angus, South Devon, Simmental, Charolais or Limousin, respectively. If we plot percentage of ribeye fat against carcass weight we note that breed crosses differed by 150 lb in the average carcass weight at which they reached 5% fat in the ribeye. Interestingly, Charolais, Limousin and Simmental were quite similar in the average carcass weight at which they had 5% fat in the ribeye. If percentage of fat trim is considered in relation to ribeye fat it is also evident that increased intramuscular fat was associated with a large increase in total fat trim. The trend was positive for both the environmental effect of feeding and the genetic trend of breed group means.

Taste Panel Tenderness. The generally accepted reason for feeding cattle to higher levels of fatness is improvement in eating quality. In these data, taste panel evaluation of tenderness, flavor and juiciness resulted in significant differences observed among breed groups for tenderness, but not flavor or juiciness. Even though there was statistical significance for tenderness among breed groups, all were well above minimum levels of acceptance and the difference was small.

A plot of taste panel tenderness scores against ribeye fat percentage illustrates two interesting points. Compared at equal ages, there was a slight genetic trend of taste panel tenderness increasing as fat percentage increased. Within breed groups, only the Jersey crosses increased in tenderness score as animals were fed to increased weights and higher percentages of fat in the ribeye. In all other breed groups, tenderness scores were the same or decreased as animals were fed for longer periods of time to increase fat in the ribeye. It appeared that increased tenderness associated with marbling was more than offset by decreased tenderness associated with age. Certainly there is reason to consider carefully whether the penalty of increased fat trim is justified by improvement in eating qualities. The fact that breed group differences in taste panel tenderness were greater when compared at the same ribeye fat percentage than at age or weight constant bases suggests the importance of investigating factors other than ribeye fat.

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TABLE 1. CARCASS COMPOSITION AND TASTE PANEL TENDERNESS COMPARED AT: 635 POUNDS CARCASS WEIGHT, 457 DAYS OF AGE AND 5% FAT IN THE RIBEYE

Breed group[a]	Hot carcass weight lb	Bone[b] %	Retail product[b] %	Fat trim[b] %	Ribeye fat[c] %	Roast & steak (A)[b] %	Roast & steak (B)[d] %	TP tenderness score[e]
			Values adjusted to a hot carcass weight of 635 lb					
HAx	635	12.0	65.6	22.4	6.0	36.1	55.1	7.38
Jx	635	12.0	63.0	24.7	8.2	35.0	55.3	7.61
SDx	635	12.6	67.9	19.5	5.1	37.0	54.4	7.50
Lx	635	12.8	72.4	14.9	3.6	39.3	54.4	7.06
Cx	635	13.6	72.5	13.9	3.6	39.5	54.4	7.46
Sx	635	13.8	71.0	15.2	4.3	38.6	54.6	6.98
			Values adjusted to 457 days of age					
HAx	637	12.0	65.5	22.5	6.0	36.1	55.1	7.38
Jx	593	12.4	64.9	22.7	6.7	35.7	55.0	7.51
SDx	656	12.3	67.0	20.6	5.6	36.6	54.6	7.47
Lx	652	12.5	71.7	15.8	3.9	38.9	54.3	7.00
Cx	691	13.0	71.2	15.8	4.7	38.7	54.4	7.36
Sx	673	13.4	70.1	16.4	4.8	38.2	54.5	6.91
			Values adjusted to 5% fat in the ribeye muscle					
HAx	584	12.6	67.1	20.3	5.0	36.9	55.0	7.44
Jx	550	12.9	66.9	20.3	5.0	36.6	54.7	7.40
SDx	632	12.6	68.1	19.2	5.0	37.0	54.4	7.50
Lx	704	11.9	69.6	18.5	5.0	37.6	54.0	6.79
Cx	704	12.9	70.9	16.2	5.0	38.5	54.3	7.33
Sx	699	13.1	69.7	17.2	5.0	38.0	54.5	6.86

[a] Number of animals in each breed were: HAx (Hereford-Angus crosses), 210; Jx (Jersey crosses), 134; SDx (South Devon crosses), 94; Lx (Limousin crosses), 177; Cx (Charolais crosses), 177; and Sx (Simmental crosses), 175.

[b] Expressed as a percentage of bone + retail product + fat trim.

[c] Percentage of intramuscular fat in ribeye (*longissimus*) muscle section at the 12th rib.

[d] Expressed as a percentage of retail product.

[e] 9 point hedonic scale where 1 = extremely undesirable, ...5 = acceptable, ...9 = extremely desirable.

EVALUATING GROWTH AT CENTRAL TEST STATIONS

By C. J. Brown

University of Arkansas

Growth is a complex trait and can be measured in many ways. I shall limit my discussion to growth as measured by weight increases during a time-constant postweaning feeding period and the efficiency with which that growth was made. These limitations seem consistent with practices at most central test stations.

To illustrate some of the problems in evaluating growth I would like to tell you something of our experiences with central test stations in Arkansas. My first experience in feeding bulls to record postweaning gain was in 1950. This was in a research program where we were concerned with the variability among contemporary individuals and sire groups. We were feeding about 100 bulls and much of our effort was financed by the sale of animals surplus to the research needs. To save labor we decided to sell these bulls at auction with the gain and feed records made available to buyers along with the usual pedigree information. This was a novel idea at that time. The sale was a success. We will hold the 25th consecutive sale this October. After observing that the sale average of this sale was 2 to 3 times that of comparable quality purebred sales in the area breeders asked that a central test station be established to provide similar information on bulls that they would consign. In 1962 facilities to individually feed 60 bulls at 3 locations in the state were established. We are completing the 13th test year. At one of the locations two tests are conducted each year and a fourth test facility has recently been constructed to serve southeast Arkansas.

In these tests we limit the age of entries to between 210 and 300 days of age. Entries are selected by the breeder. After delivery to the station about 3 weeks adjustment and training precedes the 140 day test period. Shrunk weights are taken each 28 days. Daily feed weights are recorded. Each bull is individually fed to the limit of his appetite twice daily. Except for the morning and evening feeding period the bulls are together in exercise lots with access to water and minerals.

Variation Due to Breeds and Breeders

I would like to discuss two analyses that were made to study sources of variation in the records of bulls entered in these cooperative tests. The first was made after 5 years of testing and included 735 bulls from 10 breeds. Percentages of variance associated with three sources for three traits are given in Table 1. The traits were average daily gain, feed conversion, and weight per day of age at the end of the test.

The first source of variability was difference between breeds. At least five breeds were represented in each test and a separate analysis was made for each test at each location to obtain an estimate of breed differences. Five such independent estimates were averaged to obtain the values shown.

The second source of variation was differences among breeders within a breed. Variability from this source occurred because some breeders were more successful than others in producing cattle that were superior, either because they were genetically superior or because of differences in pretest management.

The third source of variability considered was differences among entries from the same breeder. Differences among individual bulls would be reflected here.

Differences among breeds in average daily gain were a relatively minor source of variation (between 9.0 and 27.8% of the total). Differences associated with groups of cattle from different breeders also were a relatively minor source of variation in average daily gain (from 10.2 to 18.7%). Between 62.0 and 74.1% of the total variation in average daily gains was associated with differences among individual bulls from the same breeder. This indicates that breeders were not consistently able to identify faster-gaining calves prior to test. The relatively small share of the variance in average daily gain associated with cattle from different sources indicates that the pretest environment was less important in these tests than has been suggested, since any difference in pretest environment would contribute to the variance among breeders.

There was more consistency at the three locations in the percentage of variance in feed conversion associated with breed differences than for the other variables studied. Breed differences accounted for between 14.6 and 17.6% of the total variance in feed conversion, while from 23.8 to 25.1% was associated with cattle from different breeders. Again this value could be influenced by pretest management and by cattle that actually differ as a group because of a common genetic background. The greatest percentage of the variance in feed conversion (between 58.4 and 61.7%) was the result of differences among individual bulls from a breeder.

Of the three performance traits, the difference between breeds was the most important source of variation for only one - weight per day of age at the end of the test - for which between 36.5 and 49.1% of the variance was associated with breed differences. This is the only trait that reflects differences in size. Both large and small breeds were entered in these tests which perhaps explains why breed differences were relatively more important than differences due to breeders (between 14.3 and 36.0%) and differences among bulls from the same breeder (between 24.9 and 41.2%).

For the traits, average daily gain, and feed conversion, the important source of variability was differences among cattle from the same breeder indicating that efforts should be directed toward recognizing the potential of contemporary animals. Within-herd comparisons to identify superior individual animals are important. Recognition of such animals and their sires and dams should make possible predictions of breeding value that are more in the nature of prophecy than propaganda.

Causes of Variation Among Individuals

A second analysis also revealed something of the magnitude and importance of various sources of variation in records. This analysis included the data accumulated after 10 years of testing. This was a least squares analysis that included the records of 1277 bulls and examined seven sources of variation. These were year, location, breed, condition, age and weight on test, and all interactions among these variables combined into a lack of fit term. The analyses of variance presented in Table 2 shows that all sources of variation were significant for all traits except for the effects of location and age on test on average daily gain. The lack of fit term was small in all cases.

The significant year and location effects indicated that each group of contemporary bulls tested were unique and that comparisons of records made on different tests may be misleading. Examination of the yearly means for trends are of interest because they indicate that the average of contemporary groups tested today are almost 1 pound per day above those tested in 1962. Daily feed consumption has increased about 2 pounds per day and feed conversion has declined almost 1 pound of feed for each pound of gain. Such trends document the efforts of producers to search out and to breed more productive cattle.

In Table 3 is shown the least square means for the seven breed groups examined. The mean performance of these breed groups is perhaps smaller than many might expect. These data illustrate that the differences among breed averages are real but small and again emphasize that it is the variability within breeds that provide the greater opportunity for improvement.

Differences in pretest condition of the bulls had a significant effect on performance. Condition measured as a subjective score, had its greatest effect when bulls were either extremely fat or thin and more consistently affected feed conversion than daily gain or feed consumption.

Age at the beginning of the test had a significant effect on feed consumption and feed conversion, but did not influence daily gain. Within the 90 day limitation of age permitted on these tests the effect of age could be ignored.

Beginning weight had a highly significant effect on all traits. Bulls with larger initial weights consumed larger amounts of feed and consequently gained faster. Larger bulls were frequently less efficient in feed conversion because of their higher maintenance requirement. The increase in feed per pound of gain was about .7 lb. for each 100 pound increase in initial weight.

The relative importance of these sources of variation are illustrated in Figures 1, 2 and 3 for daily feed, daily gain and feed conversion. These comparisons were made using the variability remaining in a group of contemporary bulls of the same breed with the same beginning age and weight as a unit of reference.

Other Considerations

I have talked with you about two economically important traits that were measured in central test stations and some of the factors that have affected the records. I would like to look more directly at the two traits and the phenotypic relationship between them.

In justifying the time and effort to measure postweaning gain it is customary to cite (1) the relationship of gain to the fixed costs of production that are on a per unit of time or a per head basis and (2) the positive genetic relationship between gain and efficiency of feed use. Figure 4 was prepared to illustrate that with the faster gains seen in modern day cattle, the first justification for measurement of gain is less important than when testing programs were initiated.

In justifying the time and effort to measure feed conversion I would say (1) it is not as difficult or expensive as many have suggested. We incorporated these measurements into our testing program at the request of breeders who had seen the broiler industry move from about 4 lb. of feed to 2 lb. of feed to produce a pound of meat. (2) Very small differences in feed conversion have a large economic impact on costs of production. This is illustrated in Figure 5. (3) Feed conversion records can aid in interpreting gain records and assessing differences in rate of maturity. (4) Among cattle gaining at the same rate there is considerable variation in feed conversion. This is illustrated in Figure 6 for a contemporary group of bulls showing three adjustment procedures.

On a negative note we must admit that only a small fraction of the bulls needed by industry are products of central test stations. Small samples of bulls entered in the central test stations may not be representative of the herd, sire progeny group or the calf crop from which they originated. We have all seen records misused in publicity and merchandising of tested animals. Too often gathering and effective use of information has been made secondary to merchandising. The continued lack of standardized requirements and procedures handicap the development of meaningful programs.

Central test stations have been an important aid in developing faster gaining cattle. They have not been as effective as the early enthusiasts envisioned nor have they been as useless as damned by the early critics. Perhaps the greatest contribution has been to provide a focal point for educational activities that involved scientists and breeders concerned with the improvement of cattle. Although such tests were designed to measure postweaning growth the interrelationship of this trait with most other economic traits in cattle and the broader interests of these involved in testing have enhanced central test station programs. Central test station records have aided in assessing herd differences and have been of benefit in bringing attention to outstanding individuals that would have otherwise gone unnoticed. They have provided a more dependable source of bulls with genes for growth. BIF is to be commended for the efforts directed toward more uniformity in gathering and reporting information.

TABLE 1. AVERAGE[1] PERCENTAGE OF VARIANCE ASSOCIATED WITH DIFFERENCES AMONG BREEDS AND BREEDERS

Source of variation	Average daily gain			Feed Conversion			Weight/day/age		
	L 1	L 2	L 3	L 1	L 2	L 3	L 1	L 2	L 3
				Percent					
Among breeds	27.8	12.0	9.0	15.0	17.6	14.6	49.1	36.5	44.8
Among breeders	10.2	13.9	18.7	23.8	24.0	25.1	26.0	36.0	14.3
Within breeders	62.0	74.1	72.3	61.7	58.4	24.9	24.9	27.4	41.2

1) each average based on 5 estimates

TABLE 2. ANALYSIS OF VARIANCE OF POSTWEANING GAIN AND FEED USE

Source of variation	Degrees of freedom	Average daily gain	Feed per day	Feed per pound of gain
		F tests		
Total	1,276			
Year	9	29.83**	35.44**	19.92**
Location	2	0.64	75.95**	70.24**
Breed	6	26.54**	14.30**	66.51**
Condition	7	11.14**	21.03**	5.78**
Age on test	1	1.36	6.22*	4.99*
Beginning weight	1	22.36**	1,115.73**	469.43**
Lack of fit	414	1.76**	3.51**	1.98**
Error	836			

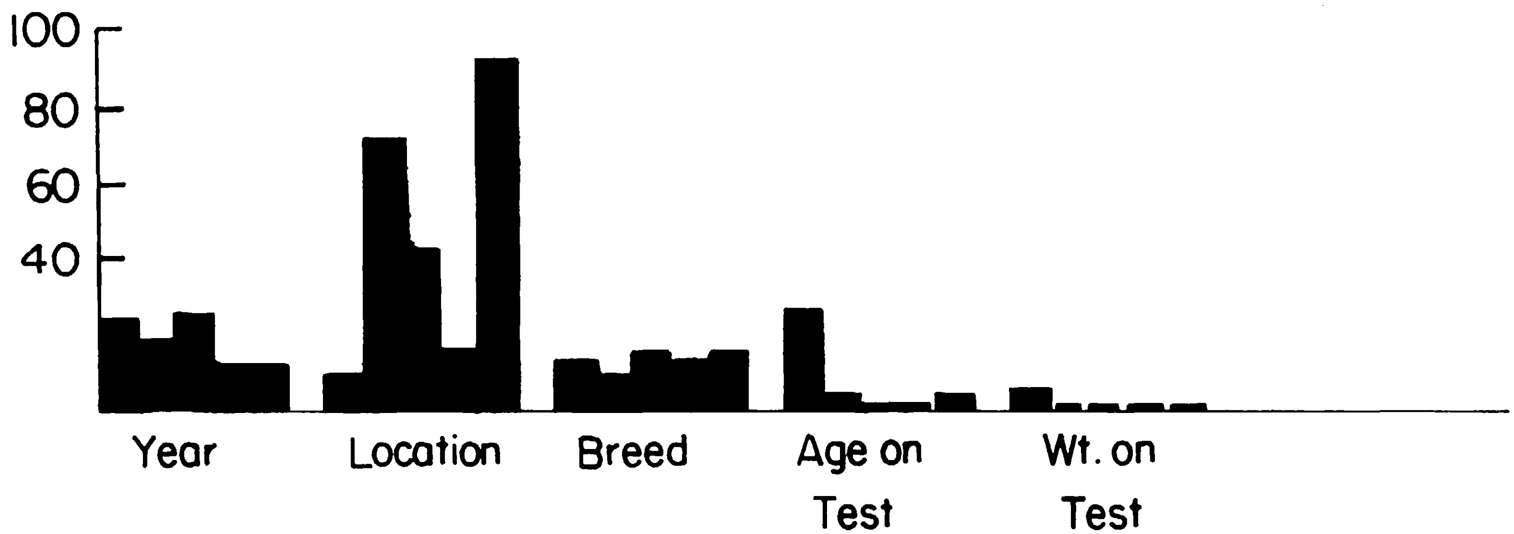
* Significant at 0.05 level.
** Significant at 0.01 level.

TABLE 3. LEAST SQUARES BREED MEANS

Breed	No of animals	ADG	Feed per day	Feed per lb of gain
		Pounds		
PH	300	2.77	22.2	7.91
H	214	2.79	22.3	7.88
A	397	2.65	22.9	8.54
CH	183	2.99	22.5	7.42
SG	66	2.71	21.9	8.05
OB	75	2.70	23.4	8.54
Cb	42	3.16	23.8	7.40
Maximum standard error		.05	2.7	.09

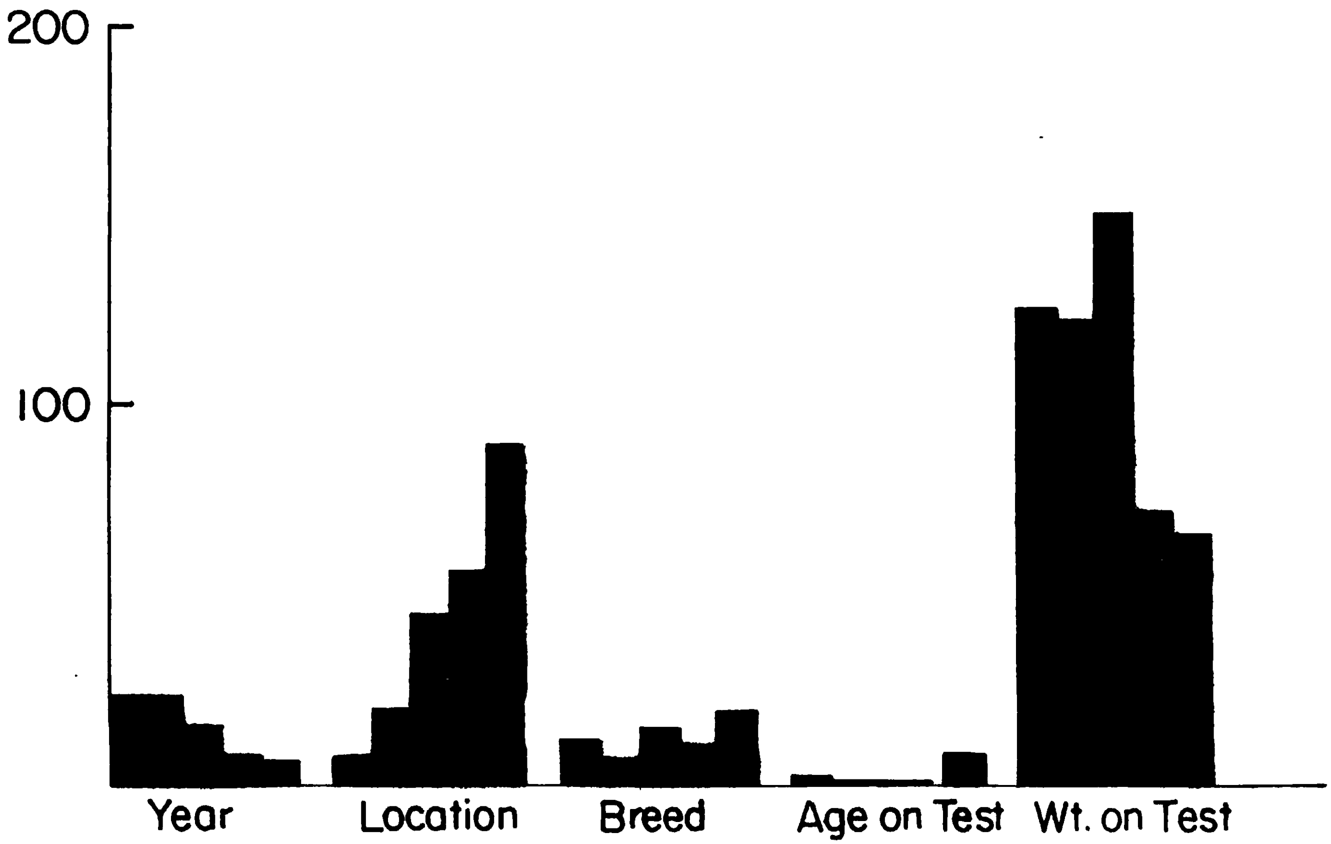
Relative importance of variance from 5 sources on Daily Feed Consumption in five 28 day periods of test

Figure 1



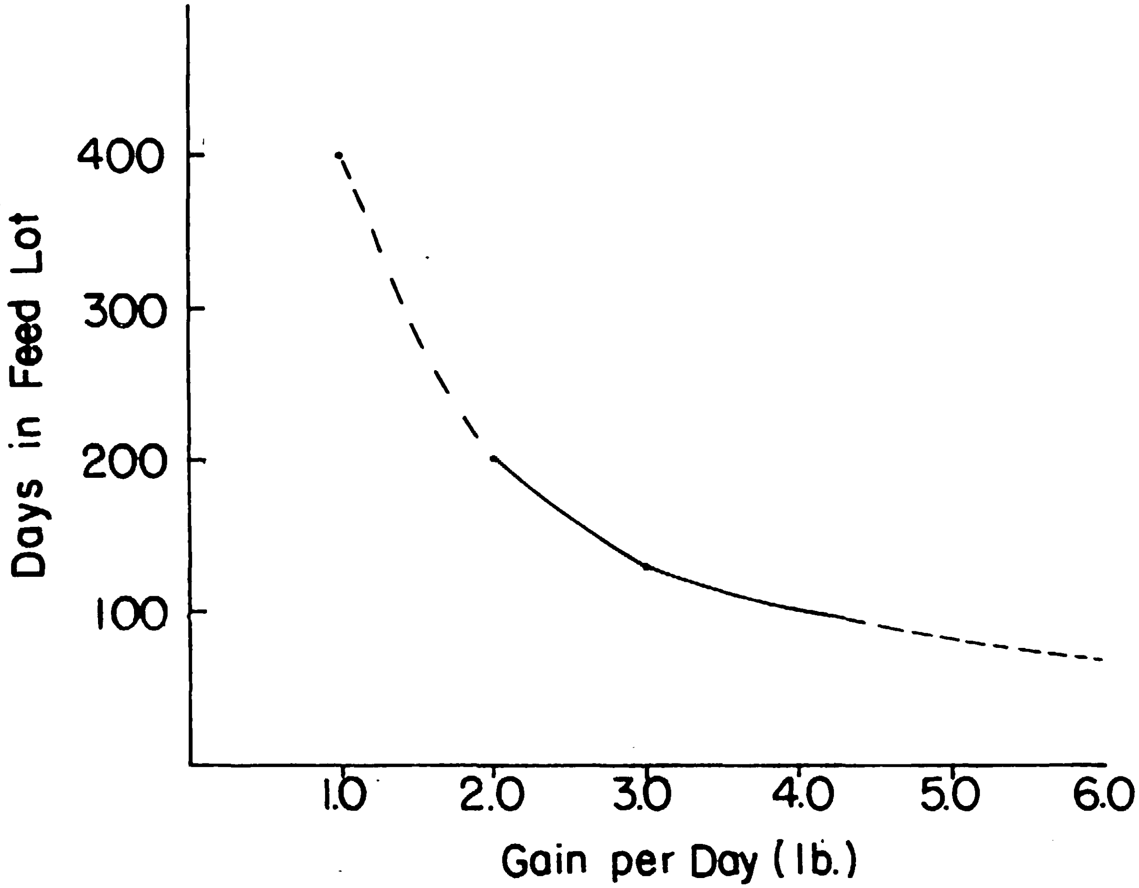
Relative importance of variance from 5 sources on Average Daily Gain in five 28 day periods of test

Figure 2



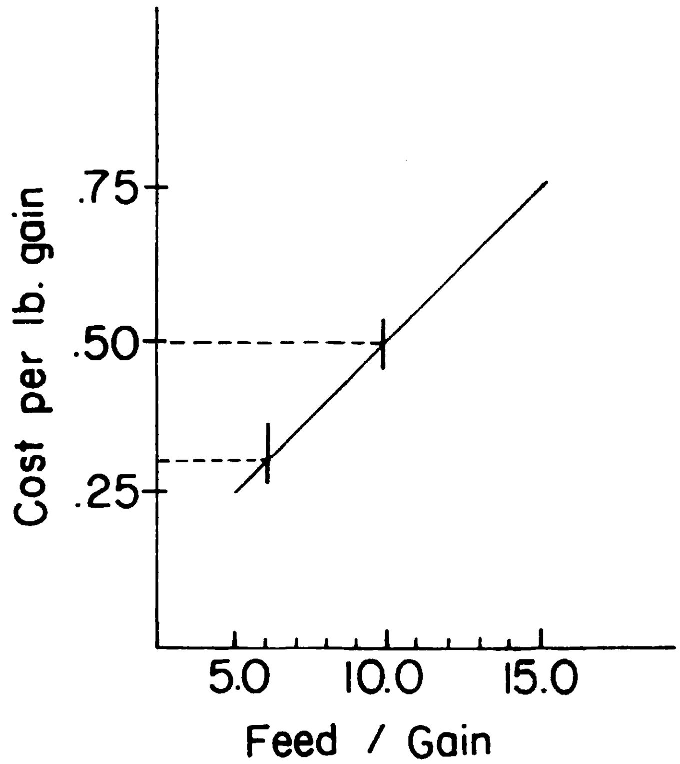
Relative importance of variance from 5 sources on Feed Conversion in five 28 day periods of test

Figure 3



Days in feed lot to gain 400 lb.

Figure 4



Relationship of Feed Conversion Ratio to Cost of Gain - assuming 400 lb. gain and Feed Cost of $100 per ton.

Figure 5

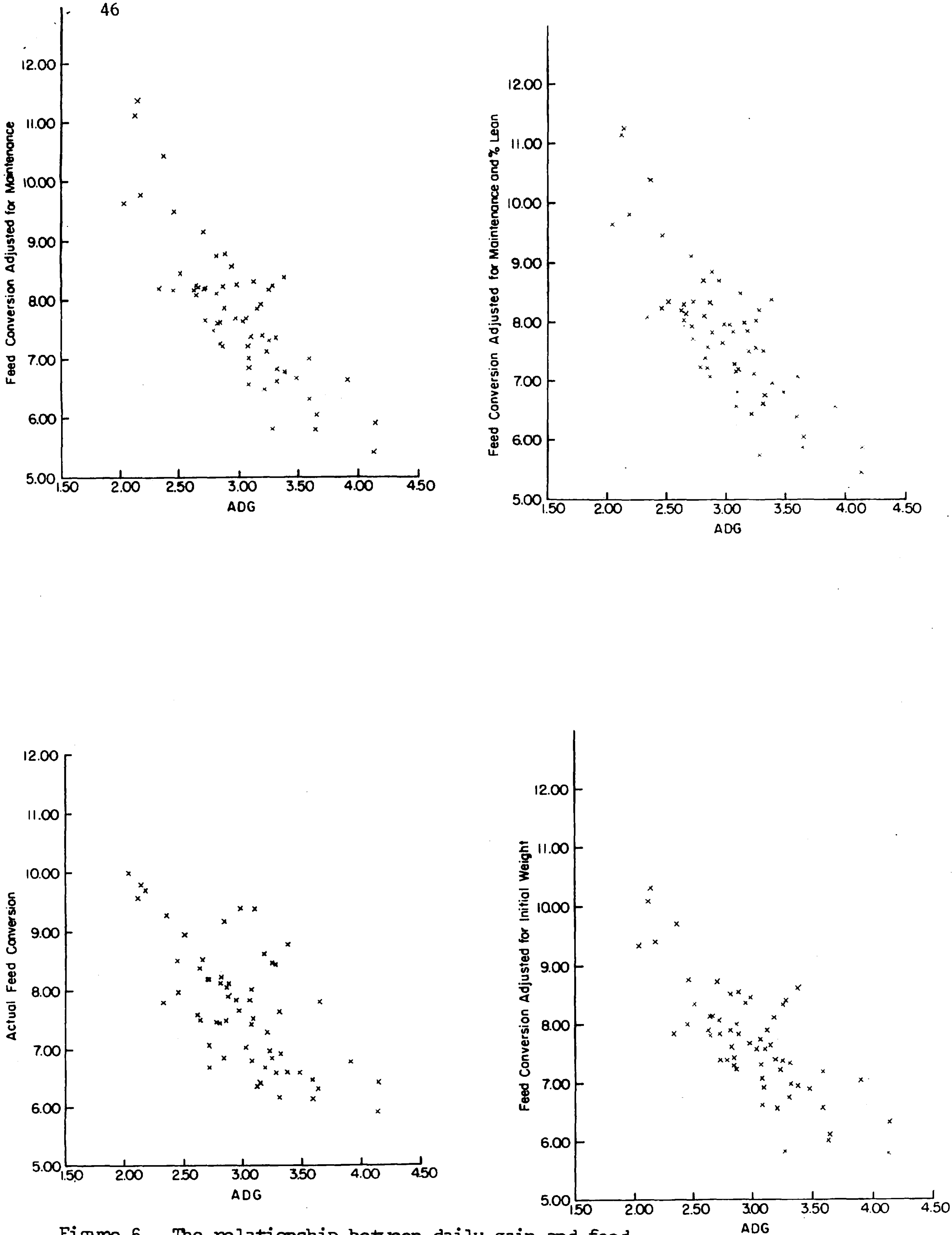


Figure 6. The relationship between daily gain and feed conversion - 3 adjustment procedures

BIRTH DEFECTS AND THEIR IMPORTANCE IN CATTLE BREEDING

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Birth defects occur commonly in most animals. They are visible losses that represent only a modest fraction of reproductive losses that prevent herds from attaining top reproductive efficiency. Birth defects have reached worrisome proportions for a short period of time in a number of breeds. Control and reduction are important matters. Most beef breeders are familiar with the snorter dwarf problem that existed in the 1950's. But breeders oftentimes don't realize that worrisome conditions occurred in other breeds, too. For example, the mulefoot condition was of concern in the Holstein breed in the 1950's and 1960's. Congenital dropsy worried Ayrshire breeders in the early 1960's. Blindness in Brown Swiss has been a nagging problem. Hydrocephalus in all beef breeds has been of concern. In the Charolais, cleft palate and arthrogryposis are of current concern. But no breed is likely to be free of birth defects, for they are a part of a natural process which creates them repeatedly each generation.

I want to tell you about the occurrence of birth defects in general. Dr. Leipold, who follows me on the program, will tell you about the ones that occur most frequently in breeds of interest to you. It is important to remember that in addition to the visible birth defects, there may also be early embryonic deaths, abortions, and other reproductive losses involved.

WHAT HAPPENS!

Commonly, in cattle herds, about four to six percent of the calves are born dead. Usually not more than one-fifth of these calves have some birth defect that is visible on inspection. In addition, there may be one calf in a thousand to one calf in five hundred born alive that has a visible defect.

Occasionally, we find herds that have 10 to 15 percent abnormal calves. The calves usually are similar in their defects but share no common inheritance, that is, the calves may be sired by several different bulls. With such high frequencies, we usually look for some disease or poisonous plant or other environmental cause.

In other herds, birth defects of hereditary origin may occur. But the pattern of occurrence is different from that of nonhereditary defects. The usual situation is for one to three calves to be abnormal. The abnormal calves look very much alike, and are usually sired by one bull, sometimes, from the daughters of another bull.

The situation in the vast majority of herds is for an abnormal calf to be born now and then. The usual rate of occurrence is from one in five hundred calves to one in three hundred calves. Thus, most herds, not involved with peculiar disease or environmental problems or with an outbreak of an hereditary defect, will have little concern. In such a herd of 50 cows calving each year, owners may go 8 or 10 years without ever seeing an abnormal calf. In fact, in some owners' lifetime, they may see no more than one or two defective calves.

WHAT THE OWNER SEES!

The kinds of abnormal calves that occur likely will vary with the breed, the geographical region, the season of calving, and from one year to the next. One study of calves in New Zealand, primarily Jerseys, shows the following kinds of defects. In every 10,000 calves, 8 had deformed legs; 4 were blind or had eye defects; 3 had difficulty drinking; 2 were dwarfs; 2 had deformed feet; 2 were mummified; 2 had abnormal tails, and 1 had a twisted head and neck. Oversized calves and parrot-mouth calves occurred in about 1 in every 12,000 or 13,000 calves. There are other figures available that show a little different pattern, but that gives you some idea of what you can expect.

Because defects are so rare, most herd owners and many veterinarians, in fact, are unable to identify the defect accurately. It is important when a defect reoccurs for a specialist to be involved in diagnosis. This rarity of defects is a source of trouble to owners. Most herd owners see so few defects that they don't know how to evaluate them. In most circumstances, elimination of the abnormal calf is all that is necessary. When the first one is born, the owner may only superficially observe the animal. However, when another is born, then the owner begins to become concerned and may pay greater attention to the defect. Because he is not an expert, the owner may respond with too much concern or with too little concern. The specialist, on the other hand, (and there aren't too many in the United States) may be able to sort the defects out more clearly and identify those that should be of concern and those that likely are not.

WHAT HAPPENS IN THE HERD!

The typical situation in a pasture-bred herd is for one to three abnormal calves to be produced by cows that have been bred to the same bull. Usually, not more than one abnormal is found in every six to eight calves sired by that bull. Usually, all of the abnormals are from daughters or granddaughters of another bull and usually both of the bulls are related. The situation in an artificially inseminated herd varies somewhat depending on the nature of the choice of bulls. If it is customary to use one bull on many females, then the situation will be very much like that with the pasture-bred herd. On the other hand, if many bulls are used each on only a few females, a single abnormal calf is usually the outcome. Pedigree study usually shows that the abnormal calf was from parents that were related. And if the pedigrees are diagramed to show common relatives, a single abnormal calf usually traces back on both sides to a common ancestor, that is, through his mother and his father. Now, if there are several abnormals, they, too, usually trace through both parents to a common ancestor and each of the calves traces back to the same common ancestor.

It is difficult to predict exactly how an owner will respond, but our experience suggests that most owners pay little attention to a single abnormal. However, as the number of abnormals increase, the owners become increasingly more concerned. Most owners are reluctant to publicly expose the birth of an abnormal calf. Purebred breeders, in particular, are ununsually reluctant.

THE NATURE OF HEREDITARY CAUSES

There are three major simple hereditary patterns that cause birth defects. There are also some more complex ones that we won't discuss today. The most easily controlled hereditary pattern is that in which the defect is due to a dominant gene. There is a form of albinism in Herefords that we discovered that is due to dominance. It starts when a single white calf is born. If the calf is allowed to reproduce and mated with colored animals, the only kind of animals available for mating, half the calves will be white. Ultimately, by selection and continued mating among whites, a white strain can be developed. The dominant trait is easily identified because it occurs at such high frequencies and never skips a generation. It is easily controlled by the elimination of the diseased animals. The next inheritance pattern is that of a recessive. A characteristic form of this is the hydrocephalus, or "water-head", that is commonly found in many beef breeds. The defective calf is produced by normal parents which usually are from normal parents, too. A defective calf usually is from related parents. Elimination of the defective calves reduces the frequency of the disease in a breed, but never completely removes it. Ordinarily, recessives need not cause much concern except under accidental circumstances. For example, an outstanding individual, particularly bulls, may be chosen for widespread use. Then, they may be followed by their sons. When the progeny of these sons are from daughters or granddaughters of their father, defective calves often result. The danger in this situation is that artificial breeding makes it possible for a bull to have a great many more sons, each used much more widely than was possible before artificial breeding. Even under those circumstances, calf losses usually never exceed more than 1 in 8 or 1 in 10 and drop down to virtually no losses when an outbreeding program is used as a corrective measure.

There have, however, been a number of birth defects that have reached unusual frequencies in breeds. The defects seem to be recessive. But they occurred so frequently and persisted so long in the breed that some other hereditary pattern was suspected. This arises when an ostensibly normal animal, carrying one of the undesirable genes, is preferred for breeding purposes. This seemed to have been the case with snorter dwarfism, syndactyly in Holsteins, and possibly red coat color in the black dairy breeds. In the case of snorter dwarfism, parents of the dwarfs were normal heterozygotes carrying both the normal gene and a dwarf gene. Iowa workers showed that males like this had superior conformation and, thus, were chosen more frequently than perfectly normal animals. This led to an increase in the dwarfism, maintained for a number of generations. This mode of inheritance is most well-known to us in the form it takes in the Shorthorn breed, where there are reds, roans, and whites. The reds and the whites breed true. But the two roans mated together produce in every four calves one red, two roans, and one white. Roans have been preferred in the past. And, of course, there are no true-breeding roans of this origin. Now, the difference between roaning and snorter dwarfism is that roans are easily identified by their color, whereas the normal and preferred dwarf carrier cannot be easily distinguished from other completely normal animals that are of unusually good conformation.

EVALUATION OF DANGERS

We can summarize these hereditary patterns in terms of danger or damage. Under very unusual circumstances, recessives can be worrisome. Those defects in which the heterozygote is superior to the normal animal are of most concern. Even with those, the damage that occurs usually is greatest from fear and alarm than from the actual calf losses. Old-timers in the audience will remember the snorter-dwarf scare. Control measures identified pedigrees that were clean or dirty. Breeding bulls from herds with dirty pedigrees were shunned. Ultimately, many herds were dispersed simply because they had no value as pedigree herds. In our work with these conditions, we have attempted to work closely with the herd owners and with the breed associations to control the condition before it becomes of great concern. We think that the situation should not be overplayed nor should it be hidden.

WHERE DEFECTS START

The origin of these birth defects is of some interest because there are many herd owners who wish to eradicate the problem forever. Unfortunately, that is generally not possible. The defects originate in the genetic process that provides hereditary variation in living organisms. And that variation is extremely important to a breed because it enables it to adapt to a wide range of conditions. Mutations, that is, the change of one gene to another gene, occur relatively rarely, probably not oftener than one gene in every 10,000, and perhaps so infrequently as one mutant gene in every million to 10 million. Because cattle have many genes, mutations, say, in 1965 are very numerous. Some will be lost in the first generation, but others will continue to survive. As you can see from the graph, some survive year after year. Because the mutation process occurs repeatedly each generation, there can be a build-up of mutations. But, mutations are localized. For example, a mutation occurs in a calf in California; the mutation likely is not visible, can't be seen, can't be measured. That calf stays in California and reproduces and some of its descendants will have the mutation, too. Nowhere else in the country will that particular mutation exist. Perhaps, the mutation will survive in that herd for several generations when it is then dispersed to other herds when carrier animals are sold. If an animal that carries that gene happens to be outstanding and if he happens to be a bull, he may be used in artificial breeding in another state. He then seeds down an area away from the original source, and that will go undetected until another relative of that bull is brought in and used widely. That is the situation that occurred in Holsteins with the mule-footed gene. The mutation apparently originated in eastern Kansas or western Missouri and was well-known in some herds in that area. A particularly outstanding female produced several sons which went into artificial breeding. One of the sons was used in California on more than 20,000 cows and no mule-footed progeny occurred. The bull was then brought back to the Midwest and, as luck would have it, was mated to cows in eastern Kansas and western Missouri. And immediately mule-foot calves were identified. One of the bull's brothers was used under similar circumstances with similar results. It is interesting to find now, nearly 15 years after the sharp reduction of the mule-foot gene in the Holstein, to find it recurring in one of the European beef breeds. Some of the calves born derived their mule-foot gene from Holstein parents, but apparently others derived it from a European breed. Had there not been an earlier introduction of the gene by Holsteins or had there not been restrictions to importation that forced inbreeding among the progeny of the European breed, the mule-foot condition would have remained undiscovered for much time.

SUMMARY

We can summarize the general concern over birth defects as follows:

1. Ordinarily, birth defects are modest sources of loss, particularly in wasted calves.

2. Most defects are recessive and produced by normal parents.

3. Control involves elimination of the defective calves and, when necessary, the parents that produced them.

4. The condition can be controlled by outcrossing since the genes for the defect are usually not uniformly distributed throughout the breed.

5. A continuing effort to identify the birth defects as they occur and to learn about their inheritance is a must for sensible control.

6. Because of the rarity of birth defects, the most sensible control is to maintain a national referral center involving a small team of research scientists dedicated to keeping tabs on all cattle breeds. That way, single rare defects can be identified that otherwise would go unnoticed.

PATHOLOGICAL DIAGNOSIS OF DELETERIOUS RECESSIVES

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INTRODUCTION

Congenital defects are abnormalities of body structure or function present at birth.[23] Many types have been identified in various breeds of cattle in most countries of the world.[1-35] Many cattle breed associations and artificial insemination stations have programs to monitor and control undesirable genetic defects.[18] Congenital defects, although infrequent, have economic and biological significance. This paper discusses the pathological diagnosis of deleterious recessives.

NATURE, EFFECT, AND FREQUENCY OF CONGENITAL DEFECTS

Congenital defects occur as abnormalities affecting only a single anatomical structure, or a single function, or as a syndrome affecting several body systems, or even combining functional and structural defects.[23] The frequencies by body structure differ with breeds, geographic locations, age of parents, levels of nutrition.[6,23,33] However, the central nervous system (brain, nerves, and spinal cord) bones, and muscles are most frequently affected (Table 1).[6,23]

The frequency of congenital defects in calves is estimated between one half to one percent of the calf crop.[6,18,23,33] Although economic losses due to defects are less than losses due to diseases caused by nutritional or infectious agents, congenital defects may cause considerable economic losses to individual cattle owners. In addition, embryonic losses due to genetic causes are particularly worrisome because they may be repeated generation after generation. Environmental agents involved in congenital defects in calves are difficult to identify. In general, environmentally-caused defects do not follow familial patterns but seasonal patterns, or known stressful conditions that may be linked to disease in dams. Genetic evidence needs to be re-evaluated carefully to identify teratogenic agents that cause congenital defects in calves.

FACTORS INFLUENCING PATHOLOGIC DIAGNOSIS

Before discussing specific pathologic aspects of congenital defects currently of concern, it is pertinent to briefly review factors that limit diagnosis and knowledge of bovine congenital defects.

Many defective calves are not reported. Disclosure of birth defects is recommended to allow for examination of larger numbers to study repeat of patterns. Limited knowledge or training has led to inaccurate diagnosis or calves being mistake for premature birth or abortions. Diagnostic judgement and documentation depends furthermore on good histories including information on geographic region, gestation, season, disease, vaccination, feeding and management practices, pasture, plants, and medications given during pregnancy. Inadequate records frequently limit diagnosis of genetic defects in herds. Lack of standardized necropsy procedure, classification systems, lack of standardized terminology and lack of reporting limit severely exchange of useful information.

BOVINE CONGENITAL DEFECTS OF CURRENT CONCERN

The skeletal system is the defective body part most frequently observed in newborn calves. The entire skeletal system is affected in osteopetrosis (marble bone disease) and in dwarfism. Only parts of the skeleton are affected in syndactyly, adactyly, polydactyly, and tibial hemimelia.

Osteopetrosis

Calves affected with a generalized skeletal defect, osteopetrosis, were stillborn and had short lower jaws.[11,22,28] Long bones were fragile and had underdeveloped channels for blood vessels. Bones cut lengthwise had "bone cones" that nearly filled the bone marrow cavity. Congenital osteopetrosis is characterized during early fetal stages by excessive formation of endochondral bone, which is not resorbed later.

Dwarfism

Dwarf calves still are encountered occasionally. Some breeds still carry genes for dwarfism at a low frequency.[6] Studies on recessive types of dwarfism like shortheaded, long-headed, and Telemark and on dominant types of dwarfism like Dexter, Comprest, and Compact indicated that all are part of a complex of conditions from more than one gene locus.[12,13] Slides illustrated diagnosis of dwarfism.

Syndactly

Syndactyly in Holstein-Friesian cattle is inherited as a simple autosomal recessive with incomplete penetrance.[26] The right foot is always affected, followed in order of frequency, by the left front, right rear, and left rear foot. Osteological defects parallel the external patterns of right-left and front-rear gradients. The bone defect is associated with some functional defect involving susceptibility to high environmental temperature.[25,26] Thus, hereditary syndactyly in Holstein-Friesian cattle is an example of a syndrome of a structural, functional, and hereditary defects, so outcomes differ in different environments.

Similar types of syndactyly have been described in Austrian Simmental cattle, Hereford, and in Chianina-Holstein crossbreds of the United States. Other types of syndactyly obviously exist in Angus cattle.[23]

Facial Digital Syndrome

Facial-digital syndrome is a congenital syndrome consisting of skeletal and brain defects of possible genetic etiology has been identified recently in Angus calves. The calves had facial hypoplasia and syndactyly of all four feet. Additional necropsy findings were internal hydrocephalus and other abnormalities of the central nervous system.

Tibial Hemimelia

Another congenital syndrome involving defects of the skeletal system, central nervous and other system has occurred in Galloway cattle of Scotland and the United States.[31] Tibial hemimelia (literally, half a hind leg) affected both sexes and was characterized by bilateral agenesis of the tibia and an open pelvic symphysis. All calves had ventral abdominal hernia, internal hydrocephalus, and encephalocele. The defect occurred in several herds and all calves had a common ancestor. Preliminary results of a breeding trial indicated that tibial hemimelia is caused by homozygosity of a simple autosomal recessive gene.

Arthrogryposis and Cleft Palate

The syndrome of cleft palate combined with bimelic or tetramelic arthrogryposis has been described in various breeds, however, it seems to be most common in Charolais calves.[20,23] The calves are born alive but death results from inhalation pneumonia due to the cleft palate. Various bone lesions characterized the defect, such as distorted distal ends of the metacarpus and metatarsus and hypoplasia of the patella.

Internal Hydrocephalus

Congenital defects of the central nervous system are common and most can be recognized by their structural changes. Functional congenital defects of the brain of cattle have been encountered only rarely. The defects may affect the brain such as anencephaly, encephalocele, neuraxial edema, cerebellar hypoplasia or may affect the spinal cord such as spina bifida.[1,5,23]

One of the common acquired or congenital lesions of the brain is internal hydrocephalus. Its basic pathogenesis needs a lot more clarification.

Hydrocephalus may be difficult to recognize clinically, or it may cause death or obvious clinical signs in calves shortly after birth. Greene and Leipold (1974) studied internal hydrocephalus and associated defects in Shorthorn cattle. A white Shorthorn bull and two paternal halfsisters were affected with hydrocephalus, multiple ocular anomalies, and myopathy. Six calves born from mating these Shorthorns had internal hydrocephalus and retinal dysplasia. These facts combined with field data were consistent with simple Mendelian inheritance, either as a simple autosomal recessive or an incompletely dominant trait.

In addition, Greene, Leipold, and Hibbs (1974) studied 115 calves affected with internal hydrocephalus. Three Hereford and 1 Shorthorn syndrome accounted for 44 of these cases. Further, 30 cases had obstructions of the mesencephalic aqueduct. Seventy-four cases were classified by pathologic lesion or syndrome, and the remaining 41 cases were classified as miscellaneous types. Hereditary influences seem to account for most of the internal hydrocephalus.[1,2,10]

CONCLUSIONS

Many different congenital defects caused by genetic factors have been identified throughout the world and many more undoubtedly exist and await identification. Sources of reporting congenital defects are animal owners, animal scientists, veterinarians, and breed and service organizations. These diseases require different methods of control from infectious or chemical disorders.

Congenital defects are defined as abnormalities of structure and function present at birth. They occur as abnormalities affecting only a single anatomical structure or a single function, as a syndrome affecting several body systems, or as combined functional and structural changes. In cattle the central nervous system, skeletal system, and muscular system are the most frequently affected.

Although economic losses due to defects are less than losses due to diseases caused by nutritional or infectious agents, congenital defects may cause considerable economic problems to individual cattle owners. The diagnosis of genetically-caused defects, such as internal hydrocephalus, osteopetrosis, dwarfism, tibial hemimelia, and arthrogryposis, was discussed.

Definitive etiologic knowledge of bovine congenital defects is minimal. Defects are caused by genetic and environmental factors or their interaction. The following factors that influence diagnosis are discussed; defects not reported; professional knowledge; inadequate history; breeding records; personnel in diagnostic laboratories; lack of standardized classification, terminology, and procedure; chromosomal aberrations; and difficulty in identifying the etiologic agent. Accurate diagnoses of congenital defects in cattle requires a detailed and standardized approach.

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TABLE 1

Congenital Defects in 1,122 Calves in Kansas

Classified According to Body System Primarily Involved

Body System	No. of Cases	No. of Herds	% of Total
Skeletal System	476	231	37.3
Organs of Special Sense	238	68	18.6
Muscular System	190	85	14.9
Central Nervous System	155	75	12.1
Peritoneum and Large Body Cavities	63	27	4.9
Reproductive System	31	27	2.4
Skin	25	14	1.9
Upper Digestive System	24	19	1.9
Lower Digestive System	13	9	0.9
Circulatory System	25	20	1.9
Endocrine System	7	7	0.5
Metabolic Defects	1	1	0.0
Duplication Defects	28	11	2.2
Total Number of Defects	1275		
Total Number of Calves	1122	588	

Source: Greene et al., Irish Vet. 27: 37-45, 1973.[6]

UNDESIRABLE RECESSIVE GENES -- A PERSPECTIVE

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Definition of the title is a good place to begin this presentation:

Genes -- The chemical entities passed from parent to progeny which determine, within environmental limits, the growth and development of the offspring.

Recessive -- Not producing an effect when paired with a dominant gene. The same recessive gene must be inherited from both parents for the recessive condition to be produced.

Undesirable -- Judged objectionable by people.

Perspective -- The relative importance of certain facts from a point of view.

This article presents my evaluation of certain facts relating to breeding practices which enhance, maintain, and diminish the harmful results of inherited defects.

Undesirable Genes are Inevitable -- Lethal genes have been found in every large population which has been carefully studied. Recessive genes are virtually impossible to eliminate from a large population, and spontaneous mutation would soon cause reappearance of the gene if it were eliminated from a large population.

NUMEROUS Undesirable Recessive Genes Exist -- Close inbreeding in many laboratory species has revealed numerous genetic problems not detected in the parent populations. Inbred lines often die out because the foundation animals carried too many genes which were lethal or seriously detrimental when paired in the inbred progeny. The general decline in vigor and reproductive performance which is generally associated with mild inbreeding in cattle is further evidence that detrimental recessive genes are abundant.

Few Losses Occur When Gene Frequency is Low -- The relationship between the frequency of a gene and the frequency of affected animals (those inheriting this gene from both parents) when random mating occurs is as follows:

Frequency of recessive gene	.5	.4	.3	.2	.1	.01	.001
Frequency of affected progeny	.25	.16	.09	.04	.01	.0001	.000001

If the gene is rare, affected progeny are much rarer. Even when the gene is fairly common (up to 30%), less than 10% of the progeny are affected.

Rare Recessive Genes are Mostly Singles -- When an undesirable recessive gene is rare in a population, almost all of these genes are paired with a dominant gene; hence the animal functions normally. In a random mating population, the relationship between the frequency of the recessive gene and the percentage which are singles (paired with a dominant gene) is as follows:

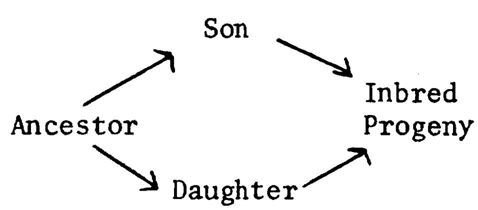
Frequency of recessive gene	.5	.4	.3	.2	.1	.01	.001
Percentage which are singles	50%	60%	70%	80%	90%	99%	99.9%

Even lethal recessive genes become virtually harmless as they become rare, because almost no progeny receive the same recessive gene from both parents.

Long Term Benefits of Heterozygosity -- Certain advantages do exist for retaining recessive genes paired with dominant genes. Genes which produce undesirable results today may produce favorable results in the future. People's standards often change. Selection and evaluation cause the genetic makeup of a species to change, and a gene which produces an unfavorable result in today's genetic system may produce a favorable result in combination with the genes of the future. Environmental change: dietary intake of a nutrient may overcome a genetic inability to synthesize the nutrient. Highly inbred lines (from which most undesirable recessive genes have been eliminated) often lack adaptability, respond unfavorably to stress, and are vigorous and functional only in a narrow range of environmental circumstances.

Relatives Have Genes in Common -- Half of the genes of the parent are duplicated and passed on to each progeny. This duplication and inheritance of genes causes relatives to possess many of the same genes.

Inbreeding Concentrates Genes in Families -- Inbreeding is the mating of relatives. The primary result of inbreeding is increased homozygosity. To illustrate, suppose an ancestor carried a rare recessive gene.



He would transmit the recessive gene to half of his progeny. When sons and daughters are mated, their progeny would be inbred, and one in 16 would inherit the rare recessive gene from both parents. This is a far higher rate than would occur from random mating. Inbreeding not only confines the gene to the family, but it increases the frequency at which the recessive trait will be expressed.

Outbreeding Covers up Problem Genes -- Outbreeding is avoiding the mating of relatives by choosing mates from other families, bloodlines, strains, or breeds. The end result of mating animals with different genetic backgrounds is an increase in the percentage of recessive genes paired with dominant genes, hence fewer affected progeny are born.

Inbreeding vs. Outbreeding -- In a nutshell, inbreeding concentrates recessive genes in families and brings recessive traits to the surface where selection can reduce the frequency of the gene, but at the expense of more affected progeny. In contrast, outbreeding spreads recessive genes more evenly and causes them to be more often paired with dominant genes so that the recessive trait appears less frequently.

Natural Selection Opposes Problem Genes -- Genes remain in the population only by being passed to progeny. Animals which do not reproduce do not contribute genes to the next generation. Genes which keep an animal from reproducing tend to be self-eliminating. This natural selection tends to keep recessive genes at low frequencies if they cause death, sterility, poor health, social rejection, etc. Natural selection is very effective when a recessive gene is common, but becomes progressively less effective as the gene becomes rarer, and is almost totally ineffective in eliminating rare recessive genes. Because recessive genes are protected from selection when paired with dominant genes, they tend to remain at low frequencies in nature.

Some Undesirable Genes Remain Problems -- Many "recessive" genes actually cause a less extreme result when paired with a dominant gene. If selection actually favors the dominant-"recessive" pairs over all other types, the frequency of the "recessive" gene can actually increase despite complete elimination of homozygous recessive progeny. For example, the gene which produces dwarfs when paired with itself appears to cause shorter, thicker calves when paired with the gene for normal size. Selection for short, thick cattle apparently kept the dwarfism gene at problem frequencies despite elimination of all dwarf calves.

Testing for Recessive Genes -- Several kinds of test matings allow calculation of the probability that the tested parent carries an undesirable recessive gene. Table 1 lists the probability that the tested parent is not a carrier if all calves are normal. Matings to homozygous recessives, known carriers, and progeny of known carriers tests for a single recessive gene whereas sire-daughter matings and random matings test for all possible recessive genes.

Test Matings are Inefficient -- The tested animal must produce a large number of progeny or else the test produces more carriers and affected calves than would result from use without testing. Tests for specific genes are not generally advisable unless the bull is a direct descendant of a known carrier and is of sufficient merit to justify the expense of testing.

Widespread Use Provides an Efficient Test -- Carriers will be detected quickly by widespread use in many herds if the gene produces a serious defect and is widespread in the breed. If the gene is not widespread, some carriers will escape detection, half of their offspring will be carriers, but few affected calves will be born. In the next generation, however, carriers will be quickly detected and the original carrier will be implicated. Outbreeding can then prevent losses from daughters of the carrier bulls.

Many Sires Provide Protection -- The individual breeder can protect himself by using a large number of sires in his herd. If one sire does carry an undesirable recessive gene, the entire herd is not suspect. The supposed uniformity resulting from breeding the entire herd to a single bull does not really hold true for growth and performance traits as long as all bulls used meet the same selection criteria.

Sire-Daughter Test Most Reliable -- Mating a sire to his own daughters is the only test which detects each possible undesirable recessive gene carried by the tested sire. Unfortunately, it requires 3 to 4 years to complete, produces numerous highly inbred progeny, and is the most expensive to carry out.

Table 1. Probability of detecting a carrier for various types of test matings

	Tests for a Specific Gene			Tests for all Possible Genes					
No. of Progeny	Homozygous Recessive Mates	Known Carrier Mates	Progeny of Known Carrier	Mated to Own Daughters	Random Mating Frequency of Recessive Gene .20	.10	.05	.01	.001
1	.50	.25	.12	.12	.08	.05	.02	.00	.00
2	.75	.44	.23	.23	.16	.09	.05	.01	.00
3	.88	.58	.33	.33	.23	.13	.07	.01	.00
4	.94	.68	.41	.41	.29	.19	.09	.02	.00
5	.97	.76	.49	.49	.35	.21	.11	.02	.00
6	.98	.82	.55	.55	.41	.24	.13	.03	.00
7	.99	.87	.61	.61	.46	.28	.16	.03	.00
8	.99+	.90	.66	.66	.50	.31	.18	.04	.00
9		.92	.70	.70	.54	.34	.20	.04	.00
10		.94	.74	.74	.58	.37	.21	.05	.00
15		.99	.87	.87	.73	.50	.30	.07	.01
20		.99+	.93	.93	.82	.61	.38	.09	.01
50			.99+	.99+	.99	.90	.70	.22	.02
100					.99+	.99	.91	.39	.05
200						.99+	.99	.63	.10
300							.99+	.77	.14
400								.86	.18
500								.92	.22

Sire-Daughter Test Most Inefficient -- It has been proposed that all bulls be sire-daughter tested before widespread use by Artificial Insemination. Aside from the expense, such a program would delay the early use of the best young sires, thereby slowing the rate of improvement in performance. Test matings to known carriers and daughters of known carriers are quicker and more efficient tests for specific problem genes. Widespread use without previous testing should produce fewer affected calves than the sire-daughter matings, especially if the system for reporting abnormal calves is improved.

In summary, numerous undesirable recessive genes are present in all breeds of cattle, but they create no problems as long as individual genes occur at low frequencies. In many ways, such genes are probably beneficial at low frequencies. Reporting the occurrence of affected calves and removal from service of bulls who are implicated by blood typing to have fathered calves with genetic abnormalities seems to be the most efficient and effective method for testing sires which are widely used by Artificial Insemination.

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March 17, 1975

Reproduction Committee

Report and Recommendations

Bill Durfey, Chairman
A. L. Eller, Secretary

A brief review of the research work and findings in the ares of evaluating breeding soundness in young bulls was given by Wayne Singleton. Reports of work done in the area of scrotal circumference measures and testicle tonometer measures were given by Jim Brinks of Colorado State University, A. L. Eller, Jr., of VPI & SU and Garold Parks of Pioneer. Each report substantiated other work as to the usefulness of scrotal circumference measures. Discussion followed as to whether collection of tonometer data should be recommended and go in the Guidelines. The question was deleted as to whether a cut off point be recommended as a culling level on scrotal circumference.

Upon a motion and second, the committee voted that the Guidelines, as to male fertility, be printed with no changes or additions but that member organizations be encouraged to collect tonometer data and that research institutions be asked to find answers as to use of tonometer measures.

A subcommittee is being appointed by the Chairman to define conditions under which semen evaluation should be conducted: Larry Rice, Chairman, Wayne Singleton, Keith VanderVelde and John Massey.

The committee agreed to recommend that scrotal circumference measures be recorded and reported on a within breed, age group basis. No minimum could be specified as a culling level but will likely be forthcoming. It was agreed that research institutions be asked to find answers as to recommended use of scrotal circumference measures.

The committee voted to leave Guidelines write up as to birth weight as is, but add that if ratios on birth weight are to be used an appropriate explanatory footnote shall be used.

Calving difficulty scores were discussed but are to be unchanged.

The committee voted that a recommendation be added in the new Guidelines that birth weight and calving difficulty scores be taken on all calves born. This would include death line and dead calves.

SCROTAL CIRCUMFERENCE AND TESTICULAR CONSISTENCY OF BEEF BULLS

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Summary

Five-hundred-eighty-five yearling beef bulls were measured to determine the average scrotal circumference and testicular consistency of age groups within breeds. An across breed variance was noted, but in each case scrotal circumference increased with age. Final weight also correlated significantly with testis size. All other performance data had insignificant effects. Changes in testicular consistency could not be explained. It appears that any bull deviating two standard deviations or more from the mean of his group has potential for subnormal semen production and should be culled.

Introduction

The demand for semen from sires with desirable economic characteristics has increased with the development of large AI organizations and the usage of frozen semen. The economic situation of today's cattle business makes it imperative that the greatest number of sperm cells be harvested and the greatest number of calves be sired by these potentially superior bulls. Most bulls or potential herd sires are purchased at a prepubetal age or during early puberty. At this time they possess only a fraction of their semen production potential and its future value must be estimated rather than present value measured. Some method of predicting potential sperm production capacity or identifying the potential "problem" bulls at a young age is of utmost importance (Hahn et al., 1969). Semen collection by either an artificial vagina or an electro-ejaculator can be very time consuming and it may not contain sperm. Young bulls untrained to semen collection procedures can be quite a problem and one or two ejaculates may show only the extra gonadal reserve and be no indication of sperm production capacity. A high correlation between testis size and weight has been found (Hahn et al., 1969; Boyd et al., 1957; Almquist et al., 1961; Willet et al., 1957; Amann et al., 1961; and Carroll et al., 1963). Research data have indicated that up to 96% of the variability in semen output among bulls may be due to difference in testis size and that each gram of testis is capable of producing 20 X 10^6 sperm per week (Boyd et al., 1957; Amann et al., 1961). Scrotal circumference (Scrot) was found to be a better parameter for measuring testis size and weight than the various other linear measurements. Scrot measurements are highly repeatable and give a good indication of size of measurements taken on subsequent years (Hahn et al., 1969).

Semen quality can also be predicted by measuring testicular consistency (Tone). Abnormal sperm are quite often associated with soft testicles (Hahn et al., 1969). In a study of 10,940 semen collections, small size and low Tone were the most often causes of hypoplasia (Carroll et al., 1963).

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Considerable work has been done in this field with dairy bulls. However, little research has been conducted with beef bulls to predict reproductive potential. This study was conducted to determine the average Scrot and Tone for young beef bulls of several breeds on ROP tests in Virginia and West Virginia and to attempt to correlate these values with performance data.

Materials and Methods

Five-hundred-eighty-five beef bulls ranging in age from 306 days to 529 days were measured at four test stations in Virginia and at the Wardensville station in West Virginia. There were 295 Angus, 16 Hereford, 16 Red Angus, 91 Simmental, 2 Limousin, 38 Charolais, 2 Brangus, and 125 Polled Herefords. Scrot was measured with a circular tape at the largest part of the scrotum and Tone was measured in the same place with a standard tonometer as described by Hahn et al., 1969. Initial measurements were taken several times until a high repeatability was achieved. Thereafter, Scrot was measured once and Tone was measured on each testis and the results averaged.

These measures were compared with the average of adjusted 205 day weight, final weight, average daily gain, adjusted 365 day weight, weight per day of age, and age in days for breeds and age groups within breeds of these bulls while on test to attempt to correlate Scrot and Tone with performance. Regression models containing terms associated with desired comparisons and expected sources of variation were used to analyze the data:

$$\text{MODEL SCROT} = \mu + \text{Age} + \text{Finwt} + \text{ADG} + \text{WDA} + \text{ADJ365} + \varepsilon$$

$$\text{MODEL TONE} = \mu + \text{Age} + \text{Finwt} + \text{ADG} + \text{WDA} + \text{ADJ365} + \varepsilon$$

Results and Discussion

Previous research (Almquist et al., 1974; Carroll et al., 1963) and preliminary studies indicate that breed is a major factor. Mean values for Scrot, Tone and performance within breeds were derived and are presented in Table #1. This table also includes the number within each breed that was measured.

Breeds having less than 38 observations were considered inconclusive and were not used in further analysis. Five-hundred-forty-nine observations remained for the final analysis. The four breeds having 38 or more observations (Angus, Simmental, Charolais, and Polled Hereford) were broken into age groups by the following procedure:

If age $\leq$ 330 days, then age group = 1

$\geq$ 331 and $\leq$ 360 days, then age group = 2

$\geq$ 361 and $\leq$ 390 days, then age group = 3

$\geq$ 391 and $\leq$ 420 days, then age group = 4

$\geq$ 421 and $\leq$ 450 days, then age group = 5

$\geq$ 451 and $\leq$ 480 days, then age group = 6

$\geq$ 481 and $\leq$ 510 days, then age group = 7

$\geq$ 511 and over, then age group = 8

TABLE #1

Means of Reproductive and Performance Data by Breeds

Breed	Number Measured	Scrot Inches	Tone*	Adj. 205 lbs.	Final Weight lbs.	ADG lbs.	Adj. 365 lbs.	WDA lbs.	Age days
Angus	295	13.57	.94	549.	1055.	2.94	996.	2.68	395.
Hereford	16	12.88	.92	514.	1070.	2.95	956.	2.54	421.
Red Angus	16	13.78	.94	516.	977.	2.98	955.	2.59	378.
Simmental	91	13.27	.95	580.	1001.	3.10	1023.	2.78	361.
Limousin	2	13.13	.85	536.	1027.	2.98	1015.	2.71	397.
Charolais	38	12.53	.90	606.	1109.	3.19	1078.	2.91	382.
Brangus	2	13.50	.75	565.	1003.	2.61	964.	2.63	380.
Polled Hereford	125	12.99	.93	541.	1092.	2.81	970.	2.61	420.

*Tone is a measure of deflection on a scale of 0-2 divided into tenths.

TABLE #2

Means and Standard Deviation by Breed and Age Group

Age Group	Number	Scrot Inches	Standard Deviation Inches	Number	Tone	Standard Deviation Inches
			Angus			
1	4	12.19	± 1.31	4	.95	± .06
2	71	12.89	± 1.10	71	.96	± .12
3	82	13.32	± .97	81	.94	± .11
4	56	13.91	± .93	42	.95	± .11
5	50	14.20	± 1.21	36	.93	± .08
6	18	14.20	± .91	13	.94	± .07
7	7	14.43	± 1.42	6	.90	± .09
8	7	14.46	± .53	7	.87	± .08
			Simmental			
1	17	12.37	± .90	17	.97	± .08
2	40	13.08	± .95	40	.97	± .09
3	15	13.72	± 1.04	15	.91	± .11
4	9	13.92	± 1.52	9	.97	± .17
5	4	14.44	± 1.74	4	.88	± .05
6	5	14.35	± .85	5	.96	± .11
7	0					
8	0					
			Charolais			
1	1	11.75	± 0	1	1.00	± 0
2	14	11.54	± 1.26	14	.90	± .15
3	7	11.93	± 1.69	7	.83	± .16
4	6	13.29	± 1.05	6	.98	± .12
5	9	14.00	± 1.37	9	.88	± .15
6	0					
7	0					
8	1	12.75	± 0	1	.90	± 0
			Polled Hereford			
1	1	11.75	± 0	1	1.00	±0
2	15	12.27	± .84	15	.93	± .10
3	20	12.50	± 1.08	20	.93	± .12
4	28	12.88	± 1.06	22	.92	± .12
5	31	13.48	± .89	15	.94	± .12
6	14	13.45	± .72	11	.91	± .11
7	12	13.23	± .93	11	.94	± .14
8	4	13.00	± 1.38	4	.88	± .13

TABLE #3

Correlation Coefficients of Scrot by Breeds

Breed	Adj. 205	Finwt	ADG	Adj. 365	WDA	Age	Scrot
Angus (260)*	-.02	.51	.19	.05	.09	.45	---
Simmental (91)*	.32	.57	.19	.39	.28	.48	---
Charolais (38)*	-.04	.65	.16	.23	.11	.56	---
Polled Hereford (125)*	-.14	.36	.05	-.03	.04	.36	---

*( ) indicates number of observations/breed.

TABLE #4

Correlation Coefficients of Tone by Breeds

Breed	Adj. 205	Finwt	ADG	Adj. 365	WDA	Age	Tone
Angus (260)*	.16	-.07	.03	.06	.07	-.02	-.02
Simmental (91)*	-.03	-.15	-.23	-.08	-.06	-.13	-.13
Charolais (38)*	.15	.16	-.06	.12	.16	.00	.20
Polled Hereford (125)*	-.08	-.12	-.09	-.13	-.11	-.07	.18

*( ) indicates number of observations/breed.

TABLE #5

Analysis of Variance of Scrot by Breeds

Item	Angus	Simmental	Charolais	Polled Hereford
DF	5	5	5	5
MS	22.904	9.936	11.025	5.908
Age Seq. R^2	.20**	.235**	.311**	.132**
Finwt Seq. R^2	.067**	.125**	.149*	.014
ADG Seq. R^2	.0002	.015	.018	.007
WDA Seq. R^2	.004	.008	.048	.004
Adj. 365 Seq. R^2	.008	.009	.024	.064
Residual DF	290	86	33	120
Residual MS	1.00	.917	1.41	.874
R^2	.28	.392	.549	.221

*p<.05

**p<.01

TABLE #6

Analysis of Variance of Tone by Breeds

Item	Angus	Simmental	Charolais	Polled Hereford
DF	5	5	5	5
MS	.012	.016	.028	.009
Age Seq. R^2	.741*	.20	.00004	.151
Finwt Seq. R^2	.027	.10	.181	.387
ADG Seq. R^2	.0012	.475	.68*	.011
WDA Seq. R^2	.223	.175	.130	.387
Adj. 365 Seq. R^2	.020	.05	.007	.065
Residual DF	290	86	33	120
Residual MS	.011	.010	.019	.014
R^2	.021	.086	.202	.035

*$p < .05$

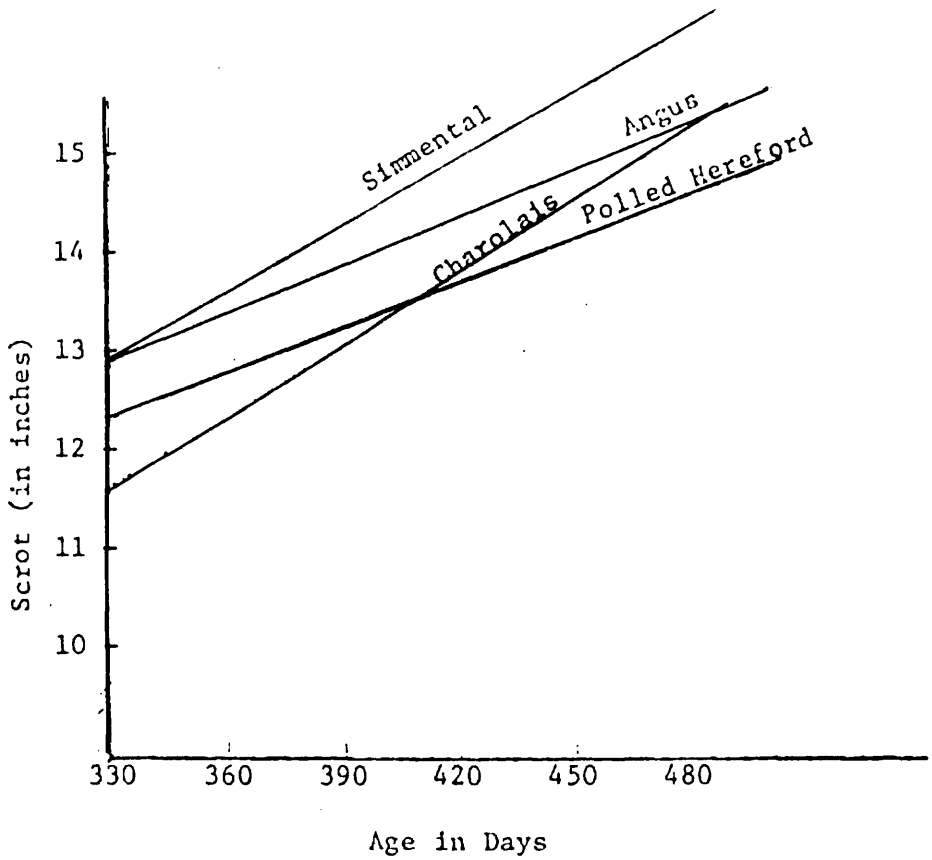

Fig. 1. Changes in Scrot/Age

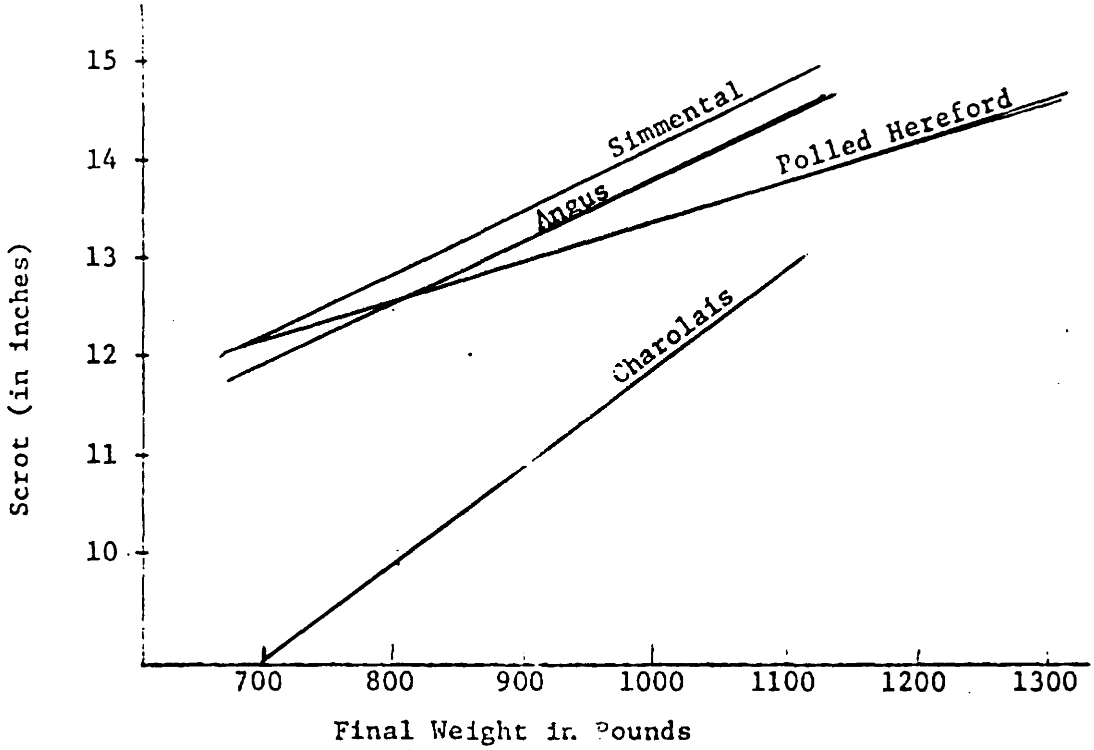

Fig. 2. Changes in Scrot/Finwt.

The means and standard deviations by breed were derived for animals within each 30 day group (Table #2). Here a relationship of Scrot with age is described. The similarity of standard deviations between age groups shows that variation is relatively constant, irrespective of age. Tone did not seem to change in relationship to either increased Scrot or age. Correlation coefficients of these measurements with various performance traits are shown in Tables #3 and #4 to better explain this relationship.

Scrot seems to be directly correlated with age and final weight. No significant correlations were found for tone. Previous research showed low consistency to accompany small testes (Carroll et al., 1963). This relationship did not appear in our studies except in cases of extreme smallness.

An analysis of variance indicated age and final weight to be the only variables having a consistent significant effect on Scrot. When studying these variables by breed, the Polled Hereford showed significance to adjusted 365 day weight and not to final weight. We were unable to explain this. These data are shown in Tables #5 and #6.

It has become evident that testis size increases with age. Testis size increases also with increases in weight. This may be seen in the regression lines that are plotted in Figure 1 and Figure 2. These were derived by the regression models:

$\text{Scrot} = \mu + \text{Age} + \varepsilon$ and

$\text{Scrot} = \mu + \text{Final Wt.} + \varepsilon$

Predicted values can be derived by these formulae:

Angus Scrot = 8.91 + .012 (age in days)

Simmental Scrot = 7.88 + .015 (age in days)

Charolais Scrot = 4.92 + .02 (age in days)

Polled Hereford Scrot = 9.65 + .008 (age in days)

and

Angus Scrot = 3.89 + .005 (Final Wt. in lbs.)

Simmental Scrot = 8.61 + .005 (Final Wt. in lbs.)

Charolais Scrot = 3.57 + .008 (Final Wt. in lbs.)

Polled Hereford Scrot = 9.97 + .003 (Final Wt. in lbs.)

These show Scrot changes in relation to either age or final weight to be linear regression. Previous research (Almquist et al., 1974) indicates that Scrot increases until maximum sexual maturity (5-6 years of age) and then decreases slightly with senility. However, due to short duration of our study and the fact that our studies do not even approach sexual maturity, this type regression seems best to project accurate values.

Conclusions and Recommendations

Any severe deviation from the average testis size suggests a probability for abnormal semen production. Our consensus is that any bull varying 2 standard deviations or more from the mean for his breed and age should be culled to avoid potential problems.

Future investigation is needed on the reproductive efficiency of these subnormal and borderline bulls to determine the degree of hypoplasia.

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EVALUATING POTENTIAL BREEDING SOUNDNESS OF PERFORMANCE TESTED YEARLING BEEF BULLS*

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The use of sterile or subfertile bulls results in a significant economic loss to the beef industry. Surveys (Carroll, 1971 and Singleton, 1975) indicate that approximately 10% of all yearling bulls are classified as unsatisfactory or questionable breeders. Therefore, a program for evaluating potential breeding soundness of bulls would be useful in eliminating these bulls prior to the breeding season. Even though most semen characteristics appear to be only low to moderately heritable, physical defects are apparently highly heritable (Brinks, 1972). Appropriate breeding soundness records will be useful for selection in future generations.

Summary - State of the Art

(1) Durfey (1974) has presented an excellent review of the practical considerations involved when evaluating young bulls under field conditions. Varibles associated with the use of an electro-ejaculator must be considered. Since most bulls are evaluated soon after completion of their 365 day weight record, age and its interaction with breed, sexual maturation and nutrition must also be taken into account.

(2) Since collections are made under field conditions with an electro-ejaculator slight difference between bulls in semen quality are difficult to detect.

(3) There is tremendous variation in semen characteristics within bulls from one collection to another. Therefore, for a true picture of semen quality, several collections over a period of time are required. Therefore, a yearling bull should not be eliminated as a potential breeder based on one ejaculate of marginal quality collected with an electro-ejaculator.

(4) Bulls in A.I. studs should possibly meet higher standards than bulls for natural service in commercial herds.

(5) Nearly as many bulls are classified as questionable or unsatisfactory breeders because of physical limitations (including penis and testicular abnormalities) as are for low semen quality.

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*Prepared for Reproduction Committee of the Beef Improvement Federation, May 19-21, 1975.

(6) No known test of semen quality will give an absolutely accurate estimate of fertility. In fact, by using all known tests one can not predict that a bull will produce 90%, 65% or 40% conceptions.

(7) By observing both physical conditions and tests of semen quality an experienced technician should be able to separate fertile from sterile bulls and identify those of obviously low or unsatisfactory fertility.

REVIEW OF LITERATURE

Variation Between Males in Conception Rate and Embryonic Mortality

Kidder et al. (1954) and Bearden et al. (1956) attempted to determine the relative importance of fertilization failure and embryonic death in variation of fertility between bulls as measured by conception rate. It was found that while the fertilization rate of low-fertility bulls was significantly below that of high-fertility bulls (71.9% and 76.9% for low-fertility bulls as against 100% and 96.6% for high-fertility bulls, respectively, for the two authors) there was no significant difference in the incidence of embryonic death (14.9% and 19.2% for low-fertility bulls as against 25.5% and 10.5% for high-fertility bulls, respectively. These data would suggest that failure of breeding with high-fertility bulls is largely due to embryonic death, whereas for low-fertility bulls it is due both to embryonic death and fertilization failure.

Wiltbank et al. (1965) found that 10 bulls with good quality semen average 22% higher conception rates than 5 bulls with low quality semen. Their data showed that the average fertility of a group of bulls could be predicted with some accuracy but the prediction of fertility of individual bulls was subject to a large error, the principal reason for this error being changes that occur in semen quality from one ejaculate to the next. Similar differences in bull fertility levels have been reported by Bishop et al. (1954) and Bishop and Hancock (1955).

The ram effect has been found to be an important cause of variation among ewes for the number of lambs born per ewe. Hulet et al. (1965) found a highly significant correlation between ram fertility and the fecundity of his mates. Parker and Bell (1966) observed differences in low-fertility and high-fertility rams as determined by the lambing performance of their breeding mates.

Hulet and Foote (1964) separated rams of various fertility levels according to percent ewes settled to which they were mated. This study indicated that fertile rams not only resulted in higher conception rate but also resulted in a higher proportion of twins.

Hulet and Ercanbrack (1962) developed an index of semen quality in rams to measure the relationship between semen quality and fertility. The correlation between predicted fertility and actual fertility was 0.76 for one index and 0.73 for another index. Semen was obtained from the rams by an artificial vagina. In a later study Hulet et al. (1963) found a lower correlation for semen collected by electrical ejaculation (r = 0.45) than for semen obtained by an artificial vagina (r = 0.74).

Shelby (1967) and Singleton and Shelby (1972) found significant differences between boar groups of gilts in the percent of ovulated eggs which were present as embryos after 25 days of pregnancy and in the number of embryos present. Significant differences in conception rates between boars were observed by Aamdal (1959) and Paredis (1962). The latter author also noted highly signigicant differences in litter size between boars. Hancock and Hovell (1961) observed a significant difference in fertility of two boars as analyzed by percent cleaved ova. Similar results were indicated by Radford (1961) and First et al. (1963).

Variation of Semen Characteristics and Their Relationship to Fecundity

Motility. Reynolds (1916) as cited by Erb et al. (1950) was one of the first to describe the various types of motility. He emphasized even then that vigor of motion was necessary for fertility, but the use of sperm motility as a critical means of predicting fertility of a semen sample is questionable. Hammond (1957) noted that many researchers have observed that fertility was lost even though motility was retained. VanDemark and Hays (1954) and VanDemark and Moeller (1951) clearly proved that the rapid transport of sperm cells from the cervix to the infundibulum is almost instantaneous even with nonmotile spermatozoa and was brought about by oxytocin-stimulated contractions of the uterus. Most authors now agree that sperm motility function serves primarily as a means of randomly distributing sperm cells in the oviduct and as an agent in penetrance of the sperm head into the ovum.

Singleton and Shelby (1972) found no relationship between motility and fecundity, even though, they observed significant variation between boars.

Stratman et al. (1958) found a mean percentage motile sperm for fresh and stored boar semen of 74.2% and 47.2%, respectively, while type of motility was 7.6 and 5.2 A type rating of 10 denoted a vigorous straight forward movement with gradations down the scale to 1 which denoted a weak, slow and spasmodic movement of the sperm. The association between the percent motile sperm in fresh semen and the percent of fertilized ova recovered was nonsignificant, but the type of motility and percent of fertilized ova were significantly related. These factors were not significantly related in semen stored for 12 hours. In a similar study by Self (1959) it was observed that the percentage of motile spermatozoa was not significantly correlated with the percentage of fertilized ova, but there was a significant association between percent fertilized ova and the type of motility. Stevermer et al. (1964) ascertained that motility of stored boar spermatozoa was not a reliable indicator of fertility.

Paredis (1962) observed an increase in conception rate when selecting an ejaculate on the basis of initial motility. Paredis and Vandeplassche (1962) observed a significant correlation between conception rate and initial motility of over 75%. Hess et al. (1960) found that semen motility in the 80 to 90% range resulted in higher conception rates at 21 days post-breeding as compared to motility at lower levels.

In a field trial by Borton et al. (1965) there was a suggested but nonsignificant decline in farrowing rate at the lower progressive motility levels; however, a significant association existed between percent total motility and farrowing rate. These authors concluded that progressive and total motility of boar spermatozoa upon collection can be used to determine inferior semen samples and that progressive motility should be above 40% and total motility above 70% for most satisfactory fertilization rates. Above these percentages increased motility was not related to increased fertility of a semen sample.

Hydrogen-ion Concentration. The hydrogen-ion concentration of ejaculated semen is near neutral. Values of pH 6.5 to 6.9 have been reported in bull semen with a mean of about 6.75 (Salisbury and Vandemark, 1961). Most investigations indicate that a pH just above neutrality is optimum for sperm metabolism and survival. The pH value of bull semen can vary considerably depending upon the fraction collected. This fact must be considered when using an electro-ejaculator. Winchester and McKenzie (1941) demonstrated a definite relationship between pH of the media and respiration rates of boar and ram semen. The optimum pH for boar semen was 7.2 to 7.3 and ram 7.0 to 7.2. A unit change in pH was found to have significantly less influence on the respiration rate of ram sperm than on that of boar sperm. A study by Salisbury and Kinney (1957) indicated a pH range from 5.0 to 8.0 had no effect on respiration rates of bull sperm, although it tended to be higher at higher pH levels. High pH levels did increase aerobic fructolysis and lactic acid production. There was extreme variation associated with the individual bull ejcaulates.

Van Duijn and Rikmenspoel (1960) have shown that velocity of bull sperm increases proportionately with increasing pH between 5.7 and 7.5. In a summary of several studies Salisbury (1955) indicated that initial pH bears a consistent relationship to volume, concentration and motility of bull semen.

Erb et al. (1950) summarized data from 371 bull semen samples and found that samples with initial pH below 6.6 showed nonreturn rates inferior to samples with pH 6.6 or higher, while Hulet et al. (1965) found no relationship between the pH of ram semen and ewe fecundity.

Oxygen Utilization. Walton and Edwards (1938) were the first to propose a metabolic measure to predict the potential fertilizing capacity of spermatozoa, and they used oxygen consumption of semen as that measure. Erb et al. (1950) found that standardizing bull sperm concentration to approximately 750,000 per ml. prior to determining resazurin reduction time to the pink end point resulted in a correlation of -.52 with fertilizing capacity. In a later suudy by Erb et al. (1958) it was found that lactic acid increase during incubation resulted in a between-bull relationship with nonreturns (r = 0.79). Other highly significant between-bull correlations with nonreturns included fructose decrease during incubation (r = 0.47), lactic acid after incubation (r = 0.43), ascorbic acid decrease during incubation (r = 0.48), estimated fructose utilization after 10 minutes of incubation (r = 0.56) and resazurin reduction time (r = 0.42). These workers stressed that variable sperm concentration was a major interfering factor involved in interpreting the metabolic measures of semen quality.

Morphologically Normal and Abnormal Sperm. In a typical flagellar spermatozoon it is usually possible to distinguish three regions: sperm-head, midpiece and tail. The latter two structures constitue the flagellum. Certain functions are attributed to each area. The sperm-hear contains the nucleus which carries the male's genetic complement and the acrosome which protects the nucleus. The midpiece is surrounded by the mitochondrial sheath and functions in energy metabolism. The is composed of a fibrinous sheath and functions in movement. The total length of human, rabbit, ram, boar and bull sperm is about 50 microns.

In a study of boar semen characteristics and fertility, only percent normal sperm was found to be correlated with fecundity (Singleton and Shelby, 1972).

Hancock (1959) compared the morphological characteristics of spermatozoa from ejaculated semen of fertile and from apparently sterile boars. The mean percentages from the fertile boars were abnormal heads, 3.0; midpiece defects, 2.7; bent tails, 4.5; coiled tails, 0.9 and cytoplasmic droplets, 28.6, while the percentages for the sterile boars were 11.9, 30.7, 9.1, 0.5 and 54.2, respectively. This worker's data indicated that fertility is likely to be impaired when abnormal heads and midpiece defects approach 21% and 26%, repsectively. Percent live normal, abnormal, abnormal necks and abnormal midpieces were significantly correlated with ewe fecundity by Hulet et al. (1965). Parker and Bell (1966) found a mean of 13.3% abnormal sperm in a high-ferfility group of rams as compared to 15.0% in a low-fertility group.

Wiltbank et al. (1965) observed that a highly fertile group of bulls averaged only 10% abnormal sperm compared to 51% for a low-fertility group. The simple correlation between total abnormal sperm and fertility was -.35.

Sperm abnormalities did not appear to affect fertility in the bull except when the incidence of primary and secondary abnormalities approaced 23% and when abnormal heads were over 18% (Munro, 1961).

Saacke (1970) and Saacke and White (1972) have reviewed the relationship of bull sperm morphology and its relationship to fertility. Their work indicates that acrosomal cap evaluation is more closely related to fertility than either sperm motility or abnormal cell content of ejaculates. Most of the acrosomal cap work has been done with frozen semen and artificial insemination and these findings have not been applied to natural service bulls to a great extent.

Although morphologically normal and abnormal cells may be distinguished on microscopic examination, a normal-appearing cell may contain an abnormal interior which renders it incapable of performing its normal function. Leuchtenberger et al. (1956) found that some morphologically normal sperm cells of infertile bulls contained lower than normal amounts of DNA.

Testicular Measurements and Their Relationship to Fertility. Several reports indicate a positive relationship between testicular size and sperm output of bulls. Foote et al. (1970) observed correlation of .81 between testis size and sperm output from properly teased Holstein bulls collected with an artificial vagina. Caution must be observed when extrapoluting this data to beef bulls collected once with an electra-ejaculator.

Soft consistency of the testicles has been related to poor semen quality and low fertility (Haq 1949 and Carroll et al., 1963). Hahn et al. (1969) developed an instrument, called a tonometer, to measure testis consistency in bulls. They found significant correlations between tonometer readings and tests of semen quality such as % unstained sperm, % normal sperm, % motile sperm after one day storage at 5°C, % post-thaw motile sperm and % nonreturn rate.

Various Reproductive Tract Abnormalities Affecting Fertility. Carroll (1971) has reviewed many of the common reproductive tract abnormalities occurring in beef bulls. The abnormalities may be of infectuous, genetic or of unkown nature. Those of infectuous nature include seminal vesiculitis and epididymitis, both of which can be detected by manual palpation. Other lesions, tumors and abscesses are occassionally observed. Problems thought to be of a genetic nature include patent fremulums (Carroll et al., 1964), crytorchids, hernias and possibly segmental aplasia.

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Carcass Evaluation Committee

Report and Recommendations

Bernard Jones, Chairman
C. O. Schoonover, Secretary

A lengthy discussion was held on the proposed grading changes, the purpose of the carcass evaluation committee and utilization of carcass records.

The Beef Carcass Evaluation Committee recommends that a strong consumer education program be launched through the Beef Improvement Federation and its member organizations in cooperation with other beef industry groups. The committee recommends to the board that top priority be given to consumer education in future BIF symposia and strongly encourages publication of a leaflet on "How Do Beef Carcass Characteristics Relate to Economy, Nutrition and Eating Satisfaction of the Family."

The consumer education program should emphasize the importance of beef grading to the consumer from an unbiased third party standpoint and to the producer from a credibility standpoint.

The committee encourages further research in beef carcass evaluation as it pertains to the producer, the processor and the consumer and more fully evaluate, interpret and utilize the carcass data presently available.

The committee recommends an intensive search for objective mechanized techniques for carcass evaluation.

The committee commends the Ag Marketing Service for the production of the film on the Beef Carcass Data Service Program and encourages member organizations to utilize this film in promoting increased carcass evaluation by beef breeders.

The committee recommends that the President of BIF write another letter to all major packers thanking them for their cooperation and encouraging additional support for the Beef Carcass Data Service Program.

Current BIF guidelines recommend that "grade should be reported by one-third of a grade." This presents a problem because grades are determined primarily by marbling, but the scale in marbling is not directly related to that in grade. This has been a problem in the past, but the problem has been accentuated in the new grading standards by narrowing the range in marbling permitted in the good grade. A table is attached reflecting the situation for A maturity.

This presents a problem in progeny testing, etc., for carcass quality grade. To demonstrate the point, suppose we are progeny testing two bulls with expected progeny differences (EPD) of one degree in marbling. With the current BIF code, if they are tested in a herd that feeds to the choice grade, the progeny of one bull could be expected to grade 13 and the progeny of the other bull 12. If, however, they were fed to the good grade the progeny averages could be 12 and 9, respectively (still differing by 1 degree of marbling). This situation can lead to serious biases in progeny testing within a herd, and especially when data are compiled from different herds as in National Sire Evaluation.

The Carcass Evaluation Committee recommends as a numbering system for quality grade where a units change would reflect a consistent change in marbling throughout the range of grades.

CURRENT AND RECOMMENDED CODE FOR CARCASS QUALITY GRADE (A MATURITY)

Marbling	Quality grade	Current BIF code	Recommended scale
Ab+ Ab Ab-		17	9
Md Ab+ Md Ab Md Ab-	Prime	16	8
Sl Ab+ Sl Ab Sl Ab-		15	7
Md+ Md Md-		14	6
Mt+ Mt Mt-	Choice	13	5
Sm+ Sm Sm-		12	4
Sl+		11	
Sl	Good	10	3
Sl-		9	
Tr+		8	
Tr			2
Tr-	Standard	7	
PD+			
PD PD-		6	1

Merchandising Committee

Report and Recommendations

Mack Patton, Chairman
Dean Frischknecht, Secretary

Chairman Patton distributed a brochure entitled "Performance Records in Merchandising." It was moved by Jim Ross that this brochure be given wide distribution to breed associations, state BCIA's, extension specialists and agents, vo ag instructors and others in an educational capacity. Motion seconded and passed.

The committee recommends that BIF allow breed associations, state BCIA's and individual participants the privilege of reprinting this BIF brochure in its entirety with no alterations, and that they be allowed to print their identity in the blank space on the back page.

A preliminary survey of members indicates six organizations could use 6,100 copies.

The committee recommends that breeders using BIF or breed association or other performance logos actually be members of the testing association program represented by the logo.

Moved by S. Blumenthal that BIF recommend increased use of the computer cow game as an educational program for cattlemen, extension workers, college classes, vo ag classes, and advanced 4-H members. Motion seconded and passed.

Business completed, meeting adjourned.

Record Utilization Committee

Report and Recommendations

Richard Willham, Chairman
R. BreDahl, Secretary

Draft copies to appear in the new BIF guidelines were passed out and members were asked to review these. Everyone did so.

During the discussion of committee business the writing of performance literature was considered. No objection was voiced to writing leaflets on record utilization for inclusion in the Great Plains Beef Cow-Calf Handbook. The Southern region is also developing such a handbook and coordination of effort was suggested. During the meeting the need for the development of a brochure on the types of performance programs currently available and their respective uses was discussed. There appears to be a definite need for this and BIF would be the logical author. General writing on performance probably needs to be done by the member organizations rather than BIF.

The lack of use of the breeding and calving reports was considered. Important reproductive data are currently being lost. Use of pocket breeding and record books was considered good to serve the needs of the breeder, but such data does not now get on the permanent files of most programs.

Record systems that include inventory inputs were discussed including those putting out work schedules for management. Also financial calculations were considered such as depreciation of the cow herd. Possibly guidelines for these inclusions could be drawn up. Note was made that cow-calf identification was most important even when weights were not taken.

How to involve performance records in youth programs was discussed. The problems of including records in judging classes was considered. Also, the use of the computer cow game with teams of students in youth programs was suggested. Several related positive experiences with the game in their extension work was discussed.

The basic problem of program support for the commercial producer wishing to keep performance records was considered. The hand calculator has encouraged many producers to keep their own records.

The role of mating was considered in record keeping. Most analysis of records assumes that mating is random. When breeders mate specific cows to bulls then problems in interpreting records occur. Taking the ratios of weaning performance of calves from cows within sires, for example, eliminates sire differences between cow records only when mating is random. Many within herd sire evaluations are biased by not mating cows at random. The problem of mating relative to performance record interpretation was recognized as a real problem which needs educational effort.

The second meeting of the committee involved lively discussion. It was suggested that guidelines for record use in the show ring be developed. Also guidelines and suggestions for involving performance in youth programs needs to be developed.

Performance Pedigree Committee

Report and Recommendations

J. David Nichols, Chairman
W. "Bill" Yaw, Secretary

During the meeting the Committee made the following recommendations:

1. It was moved, seconded and carried that the birth weights be added to the individual record on pedigrees.

2. It was moved, seconded and carried that the progeny carcass information, productivity of sire's daughter, the average MPPA of sire's daughter and cow efficiency would best be information listed in sire or dam's summaries.

3. It was moved, seconded and carried that the above information listed in motion number 2 be eliminated from the performance pedigree.

4. The motion was made and carried that the Performance Pedigree Committee recommend to the Executive Committee that this committee's responsibilities be transferred to record utilization.

Central Test Committee

Report and Recommendations

Bobby Rankin, Chairman
Charles Christians, Secretary

The following recommendations were made by the committee:

1. Discussion and revision of draft for a separate brochure on Central Test Guidelines.

2. Appointed a review committee of Charles Christians, Don Nelson, Carlton Corbin and Bobby Rankin to finalize the brochure.

3. Open discussion of items for possible revision in the next BIF Guidelines:

   a) Making narrower age restrictions
   b) Entrance weight requirements
   c) Change in report format to more clearly designate measurements which depend on the on-farm weaning weight
   d) Yearling weight computation
   e) Guides for linear measurements and composition estimates
   f) Relative gain as a possible measurement
   g) Rations and possible deficiencies for extremely growthy cattle

Farm and Ranch Pre and Post Weaning Testing Programs Committee

Report and Recommendations

Robert C. deBaca, Chairman
Joe Minyard, Secretary

Age-of-Dam Adjustments

The chairman reviewed comments, suggestions and tabular material submitted by individuals and various breed groups. It is recognized by the committee that the adjustment factors presently recommended by BIF are based primarily on data from the British beef breeds and may not be appropriate for all breeds, especially those noted for higher milk production. In view of comments and data presented and discussion by the committee, it was moved, seconded and passed to appoint a sub-committee to study age-of-dam adjustment procedures, particularly relating to breed differences and differences in management systems.

The following sub-committee was appointed by Chairman deBaca, charged to study the matter and submit its report by September 15, 1975: Jim Glenn, Chairman; C. K. Allen, Tom Burch, Larry Cundiff, Frank Felton and Hank Fitzhugh.

Cow Efficiency Measurements

Various approaches to the measurement of cow efficiency were discussed at some length by the committee. The committee recognizes the need for an appropriate and workable measure of cow efficiency. However, it also recognizes some of the problems and apparent biases in the alternative methods suggested in recent years. The committee feels it should not, at this time, recommend a particular measure of cow efficiency for general use. It is suggested the matter be reviewed again next year.

Adjustment of Yearling Ratios for Selection at Weaning

The current recommendations included in the BIF Guidelines were reviewed and after considerable discussion the committee concluded the procedures currently recommended are quite adequate and suggest that the Beef Improvement Federation make a special effort to encourage adoption and general use of the recommended adjustment procedures.

MPPA

The committee discussed the importance of MPPA projections for beef cows, its application and possible biases from the sires the cows may have been bred to. Suggestions were offered regarding methods that might be used to correct such biases. No action was taken by the committee.

On-Test Weight Procedures

On-test weight procedures were discussed by the committee. Discussion centered around the questions of whether weaning weight should be the starting test weight or have a "warm-up" period between weaning and start of feed test. The committee feels the current recommendations of BIF are valid. That is, for on-farm tests there should be no "warm-up" or "loafing" period; weaning weight should be the starting test weight. Whereas, in Central Test Station programs, there should be an adjustment or "warm-up" period of 21 days or more immediately prior to the test period to minimize pre-test environmental differences.

205 Day Age Adjustment Procedures

It is the general feeling of the committee that the present adjustment procedures tend to encourage heavy birth weights and, since birth weight is a major factor in calving difficulty and calf death loss, it can now be or soon become a significant problem for many cow-calf producers.

It was moved and passed that the Farm and Ranch Testing Committee, in recognition of the critical importance of calving problems to both commercial and seedstock producers and the influence of birth weight on calving difficulty, recommends birth weight be among the standard records taken and that procedures be developed to identify cattle that are likely to contribute to calving problems. The following sub-committee was appointed to develop specific guidelines for taking and using birth weight records. The sub-committee is asked to report by September 15, 1975: Larry Nelson, Chairman; C. Greig, C. Ludwig, W. Rowden, D. Strohbehn, D. Vaniman and J. Wolf.

Early Weaning and Calculated Yearling Weights

The committee discussed the need for adjustment and ranking procedures in those situations where early weaning is desirable for one reason or another. The question was raised regarding early weaning of calves and direct calculation of meaningful adjusted yearling weight and possibility of combining all measures of post-weaning growth in calculating MPPA.

It was moved and passed that a sub-committee be appointed to study the matter of early weaning and direct calculation of adjusted yearling weight and methods of combining all measures of post-weaning growth in calculating MPPA. The study committee appointed consists of: Lary Benyshek, Chairman; Chris Dinkel, J. D. Mankin, Jim Gosey, John Massey, Bobby Rankin and Lee Nichols.

Committee asked to report back by September 15, 1975.

The Farm and Ranch Testing Committee adjourned.

National Sire Evaluation Committee

Report and Recommendations

Larry Cundiff, Chairman

A general session on sire evaluation was held in the evening of May 19. A review of the new National Sire Evaluation Guidelines was given. The BIF organizations having programs gave short reports. Those organizations were the American Angus Association, American International Charolais Association, American Chianina Association, American Hereford Association, American Limousin Foundation, International Maine-Anjou Association, American Polled Hereford Association, American Red Angus Association, American Simmental Association and American Shorthorn Association. Each report indicated the progress and illuded to some of the problems of developing and conducting such programs. The Iowa Beef Improvement Association then reported on its program of custom progeny testing in which 10 herds with over 1,600 cows are in progress of progeny testing 30-35 sires of the Polled Hereford, Angus, Red Angus and Charolais breeds.

The second session of the committee met the afternoon of May 20. The problem of deleterious recessives was discussed. Two problems were considered. These were inadequate diagnostic facilities and the reporting of abnormalities not really known and verified to be genetic. The vet profession needs to be contacted and urged to develop a reporting system that includes a study of pattern of inheritance. Possibly supervisors of diagnostic labs would be the contact. Breeds appear to be identifying animals known to be carriers reasonably well. The committee reserves the right to add to the report after the symposium on deleterious recessives.

NATIONAL SIRE EVALUATION PROGRAM

A. GENERAL CONSIDERATIONS

1. Goals

Sire selection and consequently sire evaluation are basic to all beef breeding programs. The performance of the individuals, that of their ancestors and collateral relatives, and of their progeny can all be used to estimate differences in BREEDING VALUES among sires. The usefulness of these sources of information depend on the HERITABILITY of the trait, on whether the trait can be measured on the individual, on the number of sires in the group which can be fairly compared, and on the prospective use of the selected sires.

National sire evaluation has as its goal the expansion of the number of sires that can be fairly compared on BREEDING VALUE differences obtained from all sources of information. Today, fair comparisons among sires on their own performance are impossible unless they were tested together in the same group. This is due to large differences among groups caused in part by genetic, but primarily by environmental differences. As more is learned about the beef population through the progeny tests, all sources of information on BREEDING VALUE will become more useful.

Sire selection for most traits is paramount in within-breed improvement. This increase can be transmitted directly to the commercial producer even though he may be crossing breeds for heterosis and combining breed strengths in a systematic program. This economic potential for cross-breeding suggests the encouragement of breed-wide sire evaluation programs to strengthen breeds in their effort to be relevant commercially.

2. Definition

A NATIONAL SIRE EVALUATION PROGRAM for a breed is a program designed and conducted by one organization having no direct interest in the test bulls. The purpose of such a program is to enhance the effectiveness of sire selection in the breeding programs of breeders. Currently, this is being accomplished by conducting a program that provides fair comparisons among as many sires of the breed as possible on EXPECTED PROGENY DIFFERENCES computed using progeny averages compared through the progeny averages of REFERENCE SIRES for the traits of major economic concern to the breed.

3. Foundation

The foundation stones of such a sire evaluation program are the many creative breeding programs being conducted in the breed. When HERITABILITY is at least moderate and the trait is measurable on the individual, a sequential selection scheme results in near maximum gain. A sequential scheme involves selection first on own performance followed by selection among those saved based on the performance of their progeny. Top yearling bulls based on their own performance and that of their close relatives are candidates for use and as a result candidates for a progeny test. The development and conduct of a progeny test by the breeder is critical. Such a test can be conducted in the breeding herd and/or in a commercial herd as well when carcass evaluation is important. Proper allocation of cows to test bulls and equal treatment of progeny will result in fair comparisons among test bulls. All that is needed to tie such a program to a breed-wide sire evaluation program is to use REFERENCE SIRES in the test to provide comparison with all bulls of the breed so tested. This gives the participating breeder many more bulls from which to accurately select and thus enhance the effectiveness of his sire selection.

4. History

The basic problem in sire evaluation reduces to one of comparison. Since the world is comparative, the issue becomes to what should sires be compared? Throughout livestock history cattlemen have developed procedures to make comparisons among sires. The oldest is the fair where cattle were assembled and subjectively compared by recognized judges.

Relatively recently objective performance tests were developed and the performance of animals was compared to a designated standard. Then the contemporary average of a group became the standard for comparing individuals in one group with others in similar groups using the ratio. Already a national sire evaluation procedure was operational in dairy cattle made practical by the widespread use of artificial insemination and a national record system.

The BIF Guidelines for National Sire Evaluation Programs have incorporated the experience of dairy sire evaluation and the realities of the beef industry into a system using as the base of comparison REFERENCE SIRES. Comparisons among individually fitted show animals, with set performance standards, with within-group ratios all for one reason or another fail to make adequate comparisons for the current beef industry.

B. PROGRAM TYPES

To date several National Sire Evaluation Program types are being conducted. This diversity is healthy and is encouraged. The types grade from the use of existing field records through designed tests that use breeder progeny tests to programs completely conducted by the organization. The common element of each program type is the base of comparison among sires, REFERENCE SIRES. They are either designated by the organization or rules are defined by which sires used extensively become one. The gradient between program types is the amount of control both in design and conduct exercised by the organization.

1. Field Records

These programs use the performance records available from routine performance programs to estimate the EXPECTED PROGENY DIFFERENCES of sires. Extensive artificial insemination in a breed is necessary to have enough sires used over groups to tie the sire comparisons together. The newly introduced breeds have capitalized on the widespread use of artificial insemination and the performance requirement for registration to develop this type of program for sire evaluation. Fair comparisons among sires have been the rule. As vested interests become involved in exclusively testing bulls problems can arise because of no control over cow assignment or progeny treatment. Clearly more progeny from more groups will be required to eliminate the chance of such problems influencing the comparisons. As the established breeds relax their artificial insemination restrictions, the opportunity exists for them to use such programs in conjunction with existing designed programs to monitor the value of sires being used extensively in the breed.

2. Designed Test

These sire evaluation programs are designed in that the organization specifies the conduct of the breeder operated progeny tests and specifies the particular use of designated REFERENCE SIRES. Such programs vary in the amount of control over the progeny tests and in the use of REFERENCE SIRES. The REFERENCE SIRES can be compared together in a series of progeny tests conducted by the organization and then only one such sire need have progeny in a particular breeder test. The accuracy of this system is dependent on how well the REFERENCE SIRES are compared initially. In another system each breeder progeny test pays its proportionate share of REFERENCE SIRE comparisons by using two or more REFERENCE SIRES. Large numbers of progeny spread over numerous tests give good REFERENCE SIRE comparisons reducing the POSSIBLE CHANGE of EXPECTED PROGENY DIFFERENCES more nearly to a function of progeny numbers from the test bulls. Various degrees of control over the tests can be exercised by the organization. Minimum inspection prerogatives to complete conduct of the program are possible.

C. THE PROGENY TEST

1. Basics

Today the progeny test using REFERENCE SIRE progeny as the common base of comparison is the method to fairly compare bulls on their BREEDING VALUE differences. The basics of a sound progeny test are as follows:

COMPARABLE COWS: All bulls to be compared must be mated to a comparable set of cows. This is necessary to eliminate cow differences from the differences between sire progeny averages.

EQUAL PROGENY TREATMENT: The resulting progeny from all bulls must be given equal treatment. This is necessary to eliminate environmental differences from the differences between sire progeny averages.

Any deviation from these basics lead to comparisons among bulls that are not true reflections of their BREEDING VALUE differences. Organizations conducting a National Sire Evaluation Program must develop a set of progeny test procedures that comply with BIF recommendations for testing, measuring, and reporting specific traits and a set of checks on the conduct of the participating progeny tests. The criteria for developing procedures and checks are as follows:

CREDIBILITY: The degree of control over the progeny tests must be such that the results of the program will have industry credibility.

PARTICIPATION: The procedures and checks imposed must be simple enough to follow so that there will be maximum participation in the program by breeders.

2. Procedures and Checks

To design and conduct a program that has nationwide participation of the significant germ plasm of a breed while maintaining high credibility is not easy.

Suggested test procedures and checks for designed programs are as follows:

a. Planning:

All breeder progeny tests need to be planned carefully in advance and plans need to be approved by the organization. Number of cows available is usually the limiting factor. Management factors that may affect conception rate must be optimized to insure that an optimum number of calves will result from the matings made by artificial insemination for the progeny test. To optimize the use of the test herd, a compromise must be made between the number of bulls to test and the number of progeny to test per bull. In a sequential scheme, at least 20 progeny per test bull are necessary. The number of progeny from REFERENCE SIRES is ten when only one bull is being compared. The number of progeny from REFERENCE SIRES increases by five for the addition of one more bull up to seven where it requires 40 progeny. Additional test bulls over seven require no more progeny from REFERENCE SIRES. Multi-herd tests are encouraged.

b. Cow Assignment:

Progeny tests may be conducted using any kind of cows since the comparisons among test bulls and the REFERENCE SIRES are all within equal opportunity groups. The available test cows need to be grouped on all known causes of differences such as age, breed or cross, and management group. Each test bull and the REFERENCE SIRES need to be bred to a proportion of each cow group.

c. Cow Randomization:

Within each cow group, the bulls must be mated at random to cows. Randomization is an admission of ignorance. When no way can be found to predict which cow is mated to which bull, the assignment is random. The reason for randomization is to assure that unknown differences among cows do not influence the comparisons among sire progeny groups. Two randomization procedures are recommended depending on the circumstance.

(1) The organization can assign cows to bulls within cow groups at random before the breeding season. This procedure is recommended for breeders testing bulls in their own herd to increase the credibility.

(2) The organization can randomly list the bulls including the REFERENCE SIRES repeating some such that the appropriate number of cows to be bred by each bull is realized. Then this bull list can be used to breed the cows as they come into estrus. This procedure is recommended for breeders testing bulls in contract herds where those doing the breeding have no direct interest in the test bulls. This chute randomization procedure helps spread the calves by each sire over the season and is the method of choice.

d. Progeny Treatment:

The progeny tests must manage the resulting progeny as uniformly as possible within cow groups or in a stratified fashion such that all sire progeny groups are represented in each management-sex group. Bull, steer, or heifer progeny may be used in the test.

e. Data Control:

The organization needs assurance that the cows were bred as planned. Birth dates need to be reported promptly and accurately. The tests and resulting measurements required by the organization for the particular breed need to be taken and recorded as prescribed by BIF. The organization needs at least the prerogative to inspect the performance records for accuracy.

D. REFERENCE SIRE SYSTEMS

The organization conducting the breed sire evaluation is responsible for the REFERENCE SIRE system. Such a system when the sires are designated by the organization includes the cooperative handling and the distribution of frozen semen to the progeny tests. Also, included in systems, where the breeder progeny tests are helping to compare the sires, is a procedure for assigning sire comparisons such that all REFERENCE SIRES are compared with each other adequately.

The criteria for a REFERENCE SIRE, in those programs that are developing a large number of them, is that he have a large number of progeny (100 to 500) evaluated in a large number of herd-groups (10 to 50) in comparison with many (5 to 10) other REFERENCE SIRES. In those programs that designate REFERENCE SIRES, these should be chosen from among the top sires tested previously such that a sire is used as a REFERENCE SIRE at least two years and that approximately half are replaced any one year which allows for ties to be created between sets of REFERENCE SIRES. The number of designated REFERENCE SIRES should be minimum to facilitate accurate comparisons among them yet enough to service an expanding program.

A well conducted REFERENCE SIRE system offers the breeds a unique opportunity to measure genetic change in the breed by comparing the progeny performance of new sires with that of the base set of REFERENCE SIRES.

E. EXPECTED PROGENY DIFFERENCE

The EXPECTED PROGENY DIFFERENCE is an estimate from the existing progeny data of half of the BREEDING VALUE of a sire or what he is expected to transmit to his offspring. It is an estimate of how future progeny of the sire are expected to perform relative to the progeny performance of the REFERENCE SIRES when both are mated to comparable cows and the resulting progeny are treated alike. The important aspect is to predict future progeny performance from the sample of progeny performance currently available. Therefore, the sire progeny differences are regressed toward the average EXPECTED PROGENY DIFFERENCE, which is zero, depending on the number and distribution of progeny involved in the difference and on the HERITABILITY of the particular trait. The EXPECTED PROGENY DIFFERENCE should be reported in the units of measure of the trait. It can be either a plus difference or a minus difference. For most traits evaluated a plus value indicates a superior sire.

With each EXPECTED PROGENY DIFFERENCE will be a POSSIBLE CHANGE value which is a measure of the accuracy with which the number and distribution of progeny available allowed the EXPECTED PROGENY DIFFERENCE to predict future progeny performance. It indicates the amount of change either plus or minus that is possible in the EXPECTED PROGENY DIFFERENCE when additional progeny are included. Changes of twice the POSSIBLE CHANGE should occur only one time in twenty.

Because the EXPECTED PROGENY DIFFERENCES are regressed back toward the average depending on the number and distribution of progeny, the EXPECTED PROGENY DIFFERENCES of sires are directly comparable even though the progeny numbers and resulting POSSIBLE CHANGE values are different. The choice of sires to use should be on their EXPECTED PROGENY DIFFERENCES for the traits of importance to the breeder making the choices. When two sires have the same EXPECTED PROGENY DIFFERENCE then the POSSIBLE CHANGE can be used to indicate the extent to use the sires.

Bulls evaluated with 10 to 50 progeny along with REFERENCE SIRE progeny will allow breeders to select breed improving sires from among the top 10 to 20 percent of bulls tested. Which of the several are best will not be known.

F. ANALYSIS PROCEDURES

The calculated EXPECTED PROGENY DIFFERENCES and their POSSIBLE CHANGE values from all sire evaluation programs need to have the same interpretation for the beef industry. A common analysis procedure will help, but is not essential. For those organizations not yet having an analysis procedure, Appendix I provides a recommended procedure.

G. PUBLICATION

Periodically the organization conducting the program should publish a sire summary that includes information on all of the sires evaluated irregardless of their merit. The purpose of such a sire summary is to DESCRIBE the germ plasm available for the traits considered of major economic importance to the breed. Selection of sires from among those DESCRIBED is the prerogative of the breeder.

A sire summary should strive to give as much DESCRIPTIVE data as is necessary and available so that the breeders can have available to them the necessary data on which to make rational decisions. Suggested inclusions are as follows:

IDENTIFICATION: Complete sire information including the parentage is necessary.

EARLY PERFORMANCE: A report on the individual performance of the sire in his herd of origin along with performance on ancestors and close collateral relatives, especially for maternal evaluation would be valuable.

SIRE EVALUATION: For the traits considered of prime importance to the breed, at least the following three items should be included on each sire:

The EXPECTED PROGENY DIFFERENCE reported in the units of measure of the trait. For weaning and yearling weight, ratio differences can also be included.

The POSSIBLE CHANGE reported in the units of measure of the trait.

The actual total NUMBER of progeny tested for the sire. This may differ for different traits.

The exact format for such a sire summary is left to the organization conducting the breed program. The summary should include a description of how to use the sire summary in selection.

H. TRAITS

1. Performance

The particular traits that should be evaluated in a National Sire Evaluation Program is the prerogative of the organization conducting the program for the breed. Individual progeny tests are encouraged to evaluate extra traits especially when these could be important to breed improvement. Traits suggested for consideration by breed programs are as follows:

a. Reproduction:

Some adequate measure of calving ease would be beneficial to some breeds. The inclusion of provisions to evaluate the maternal performance of daughters as to their overall reproductive potential including calving and breeding data would enhance those breeds considering their maternal potential in the commercial industry.

b. Production:

BIF recommends several measures of growth during the relevant commercial period such as weaning weight and several measures of yearling weight; 365 day, 452 day, or 550 day. Again provisions to include the weaning weights of daughters is desirable.

c. Product:

The amount (yield grade) and quality (quality grade) of the product produced is not directly measurable on the sires. Information on carcass evaluation adds new information in a sequential selection scheme. Such carcass progeny tests can be used effectively as sib tests on the sons from the tested sires.

2. Undesirable Genes

The problem of undesirable genes is always present in the beef industry. At this writing work is being done on the development of guidelines for the classification of all detrimental physiological conditions in cattle known to be inherited, the identification procedures necessary to identify the sire once a genetically defective calf exists, and the action to be taken once a sire has been incriminated including consideration of his sons.

Bulls may be progeny tested for undesirable recessive genes by two methods. Both test for all recessives. The first is breeding to a large cross section of cows. The probability of detection is a function of the existing gene frequency. The probability of detection equals

$$1 - (1 - \tfrac{1}{2}q)^n$$

where (q) is the gene frequency in the cows and (n) is the number of progeny. This procedure allows a short generation interval yet is effective in keeping undesirable recessive genes at a low frequency.

The second is to breed a sire to his daughters under strict supervision by the organizations sponsoring the test. The probability of detection uses the same formula with (q) equal to ¼. The production of normal offspring from 22 daughters gives a probability of 19 in 20 that the sire does not contain a specific recessive gene. From 35 daughters, the probability is 99 in 100.

I. CONCLUSION

The philosophy employed in the development of guidelines for National Sire Evaluation Programs by BIF is one of dealing with the overall spirit and rational of sound programs rather than detailing the specifics. This is intentional. Several sound programs of different types are now in operation in the beef industry. Much can be learned from this variety of approaches to the problem of sire evaluation. With the spirit of cooperation now prevailing in the BEEF IMPROVEMENT FEDERATION among the organizations conducting sire evaluation programs, shared experiences should lead to marked improvements in design and conduct of these programs to the improvement of the entire beef industry.

APPENDIX I

ANALYSIS OF SIRE EVALUATION DATA BY MIXED MODEL PROCEDURES[1]

The intent of this paper is to demonstrate the procedures to follow for a mixed model analysis of sire evaluation data. Information contained herein should provide the necessary background for getting the programming ready for data inputs and for carrying out solutions to yield Expected Progeny Difference values and Possible Change (Prediction Error) values.

The model for the analysis is $y_{ijk} = \mu + h_i + s_j + e_{ijk}$ where y_{ijk} is the record on the k-th progeny by the j-th sire in the i-th herd or group, μ is the population mean, h_i is the effect of the i-th herd or contemporary group, s_j is the effect of the j-th sire and e_{ijk} is the unexplainable random portion of y_{ijk}. Equations are set up to solve for the sire effects (EPD's) with μ and h_i effects absorbed. Absorption is merely a mathematical manipulative technique which allows the herd effects to be considered in the analysis without actually estimating them, thus minimizing the number of equations to be solved.

The equations are most easily presented in matrix notation. These equations are As = B where A is a pxp matrix (p = number of sires to be evaluated) and is called the coefficient matrix, s is a px1 vector of the sire effects and B is a px1 vector and is called the right hand side vector. The following shows the equations in more detail:

$$\begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1p} \\ A_{21} & A_{22} & & \\ \vdots & & \ddots & \\ A_{p1} & & & A_{pp} \end{bmatrix} \begin{bmatrix} s_1 \\ s_2 \\ \vdots \\ s_p \end{bmatrix} = \begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_p \end{bmatrix} \qquad (1)$$

or in linear form

$$\begin{aligned} A_{11}s_1 + A_{12}s_2 + \ldots + A_{1p}s_p &= B_1 \\ A_{21}s_1 + A_{22}s_2 + \ldots + A_{2p}s_p &= B_2 \qquad (2) \\ \vdots \qquad\qquad &\quad \vdots \\ A_{p1}s_1 + A_{p2}s_2 + \ldots + A_{pp}s_p &= B_p. \end{aligned}$$

Thus there are p equations with p unknowns (s values).

The values in A and B are as follows:

$$A_{11} = \sum_i n_{i1.} \left(1 - \frac{n_{i1.}}{n_{i..}}\right) + \alpha$$

$$A_{22} = \sum_i n_{i2.} \left(1 - \frac{n_{i2.}}{n_{i..}}\right) + \alpha$$

Thus the r-th diagonal element of A is $\sum_i n_{ir.} \left(1 - \frac{n_{ir.}}{n_{i..}}\right) + \alpha$ where $\alpha = \left(\frac{4}{h^2}\right) - 1$, h^2 = heritability of the trait.

$$A_{12} = -\sum_i \frac{n_{i1.}\, n_{i2.}}{n_{i..}}$$

$$A_{13} = -\sum_i \frac{n_{i1.}\, n_{i3.}}{n_{i..}}$$

$$A_{ip} = -\sum_i \frac{n_{i1.}\, n_{ip.}}{n_{i..}}$$

$$A_{21} = -\sum_i \frac{n_{i2.}\, n_{i1.}}{n_{i..}}$$

Note that $A_{12} = A_{21}$, the two halves of the A matrix are mirror images; i.e., any $A_{ij} = A_{ji}$. The uv-th off-diagonal element of A is $-\sum_i \frac{n_{iu.}\, n_{iv.}}{n_{i..}}$.

$$B_1 = \sum_i n_{i1.} (\bar{y}_{i1.} - \bar{y}_{i..})$$
$$B_2 = \sum_i n_{i2.} (\bar{y}_{i2.} - \bar{y}_{i..})$$

Thus the r-th element of B is $\sum_i n_{ir.} (\bar{y}_{ir.} - \bar{y}_{i..})$. An explanation of the notation may be necessary here.

$n_{i1.}$ = number of progeny by sire #1 in the i-th herd

$n_{i..}$ = number of total progeny in the i-th herd

$n_{i2.}$ = number of progeny by sire #2 in the i-th herd

$\sum_i$ = summation over subscript i (over all herds)

$\bar{y}_{i1.}$ = mean of progeny records by sire #1 in the i-th herd

$\bar{y}_{i..}$ = mean of all progeny records in the i-th herd

Consider the following example where the only progeny are those by sires 1, 2 and 3 in herds 1, 2 and 3.

	sire 1	sire 2	sire 3	herd summary
herd 1	10 progeny 1000# ave.	10 progeny 1050# ave.	no progeny	20 progeny 1025# ave.
herd 2	20 progeny 1050# ave.	no progeny	10 progeny 900# ave.	30 progeny 1000# ave.
herd 3	no progeny	30 progeny 925# ave.	10 progeny 825# ave.	40 progeny 900# ave.

$n_{11.}=10$, $n_{12.}=10$, $n_{13.}= 0$, $n_{1..}=20$, $\bar{y}_{11.}=1000$, $\bar{y}_{12.}=1050$, $\bar{y}_{13.}= 0$, $\bar{y}_{1..}=1025$

$n_{21.}=20$, $n_{22.}= 0$, $n_{23.}=10$, $n_{2..}=30$, $\bar{y}_{21.}=1050$, $\bar{y}_{22.}= 0$, $\bar{y}_{23.}=900$, $\bar{y}_{2..}=1000$

$n_{31.}= 0$, $n_{32.}=30$, $n_{33.}=10$, $n_{3..}=40$, $\bar{y}_{31.}= 0$, $\bar{y}_{32.}=925$, $\bar{y}_{33.}=825$, $\bar{y}_{3..}=900$

The elements of A and B can be found in the following ($h^2 = .40$, $\alpha = 9$):

$$A_{11} = 10(1 - 10/20) + 20(1 - 20/30) + 0(1 - 0/40) + 9 = 20.667 \quad (3)$$

$$A_{22} = 10(1 - 10/20) + 0(1 - 0/30) + 30(1 - 30/40) + 9 = 21.500$$

$$A_{33} = 0(1 - 0/20) + 10(1 - 10/30) + 10(1 - 10/40) + 9 = 23.167$$

$$A_{12} = A_{21} = -[(10.10)/20 + (20.0)/30 + (0.30)/40] = -5.000$$

$$A_{13} = A_{31} = -[(10.0)/20 + (20.10)/30 + (0.10)/40] = -6.667$$

$$A_{23} = A_{32} = -[(10.0)/20 + (0.10)/30 + (30.10)/40] = -7.500$$

$$B_1 = 10(1000 - 1025) + 20(1050 - 1000) + 0(0 - 900) = 750$$

$$B_2 = 10(1050 - 1025) + 0(0 - 1000) + 30(925 - 900) = 1000$$

$$B_3 = 0(0 - 1025) + 10(900 - 1000) + 10(825 - 900) = -1750$$

Note here that the sum of the elements ih B is zero. The equations to be solved are:

$$20.667\, s_1 - 5.000\, s_2 - 6.667\, s_3 = 750 \quad (4)$$

$$-5.000\, s_1 + 21.500\, s_2 - 7.500\, s_3 = 1000$$

$$-6.667\, s_1 - 7.500\, s_2 + 23.167\, s_3 = -1750$$

Solutions to the equations As = B can be obtained by iteration. Iteration is a repetitive process of reestimating the values of s using previous estimates of s. Iteration is completed when successive estimates of all s_j value meet a prescribed degree of agreement. The equations in (2) can be written as the following:

$$s_1 = \frac{1}{A_{11}} (B_1 - A_{12}s_2 - A_{13}s_3 - \ldots - A_{1p}s_p)$$

$$s_2 = \frac{1}{A_{22}} (B_2 - A_{21}s_1 - A_{23}s_3 - \ldots - A_{2p}s_p)$$

$$\vdots$$

$$s_p = \frac{1}{A_{pp}} (B_p - A_{p1}s_1 - A_{p2}s_2 - \ldots - A_{p(p-1)}s_{p-1})$$

Initially, no estimates for the s vector are available, so they are assumed to be zero. Thus the first estimates, ${}^{1}s$, are the following:

$$ {}^{1}s_1 = B_1/A_{11} $$

$$ \vdots $$

$$ {}^{1}s_p = B_p/A_{pp} $$

From here on, the most recent estimates of the s values are used. Observe the following: (the notation ${}^{2}s_1$ refers to the second estimate of sire #1)

$$ {}^{2}s_1 = \frac{1}{A_{11}} (B_1 - A_{12}\,{}^{1}s_2 - A_{13}\,{}^{1}s_3 - \ldots - A_{1p}\,{}^{1}s_p) $$

$$ {}^{2}s_2 = \frac{1}{A_{22}} (B_2 - A_{21}\,{}^{2}s_1 - A_{23}\,{}^{1}s_3 - \ldots - A_{2p}\,{}^{1}s_p) $$

$$ {}^{2}s_3 = \frac{1}{A_{33}} (B_3 - A_{31}\,{}^{2}s_1 - A_{32}\,{}^{2}s_2 - A_{34}\,{}^{1}s_4 - \ldots - A_{3p}\,{}^{1}s_p) $$

For ${}^{2}s_1$ above, only the first estimates of the other sires were available. For ${}^{2}s_2$, the second estimate of s_1 plus the first estimates of the other sires were available. In general notation, these are represented by the following:

$$ {}^{K+1}s_j = \frac{1}{A_{jj}} (B_j - \sum_{m=1}^{j-1} A_{jm}\,{}^{K+1}s_m - \sum_{m=j+1}^{p} A_{jm}\,{}^{K}s_m) $$

The process continues or repeats through the sires until $\left| {}^{K+1}s_j - {}^{K}s_j \right|$ is less than some prescribed value for <u>all</u> sires.

From the example in equations (4), solutions via iteration would proceed as follows:

$$ {}^{1}s_1 = 750/20.667 = 36.2897 $$

$$ {}^{1}s_2 = 1000/21.500 = 46.5116 $$

$$ {}^{1}s_3 = 1750/23.167 = -75.5385 $$

$$^2s_1 = \frac{1}{20.667} [750 - (-5.000)(46.5116) - (-6.667)(-75.5385] = 23.1743$$

$$^2s_2 = \frac{1}{21.500} [1000 - (-5.000)(23.1743) - (-7.500)(-75.5385)] = 25.5503$$

$$^2s_3 = \frac{1}{23.167} [-1750 - (-6.667)(23.1743) - (-7.500)(25.5503)] = -60.5978$$

etc.

When finished, the final s values are the EPD values.

The Possible Change (PC) values accompanying the EPD for the j-th sire is $(\sigma^2/A_{jj})^{1/2}$. The value of σ^2 requires some extra calculations on the data, but these are relatively simple. The following describes what is necessary for these calculations:

$$\sigma^2 = (T - H - S)/(n_T - n_h - n_s + 1)$$

where $T = \sum_{ijk} y^2_{ijk}$ = sum of the squared progeny records

$H = \sum_i y^2_{i..}/n_{i..}$ = sum of the herd totals squared and divided by the number in them

$S = \sum_j s_j B_j$, s_j is the final EPD value

n_T = total number of progeny in the data = n...

n_h = number of herds in the data

and n_s = number of sires in the data.

<u>Solutions Using Matrix Inversion - An Alternative to Iteration.</u>

If it is computationally feasible, the equations can be solved by $s = A^{-1}B$. Then the PC associated with the EPD for the j-th sire is $(\sigma^2 . A^{jj})^{1/2}$ where A^{jj} denotes the j-th diagonal element of A^{-1}. The EPD values produced by either this method or by iteration will be the same. The PC values may differ. Calculating PC as $(\sigma^2/A_{jj})^{1/2}$ is used as an approximation to $(\sigma^2 . A^{jj})^{1/2}$.

Ideas on Handling the Data.

It may be best to have a data file in storage that can be added to each time another herd's data are submitted to the computing facility. The data should be screened so that only records on sires to be evaluated are included. This data could be stored in some form of the equations (1) or (2). Only A and B need to be stored until EPD's are calculated. The dimensions of A and B are the number of sires to be evaluated. Each sire must be assigned a number to indicate which row and column of A and which element of B receive the data for the sire. If an additional sire(s) needs to be included, one row(s) and column(s) need to be added to A and one element(s) to B. When a herd's data come in, merely add the appropriate values to the appropriate elements of A and B. This can be seen in equations (3) for the 3 herds. Note in going from left to right across the page how each herd's data are added on. The values of α may be added to the diagonal elements at the first or after the last herd's data are tabulated.

Also needed are the values to calculate the PC values. As the data come in, $\sum_{ijk} y_{ijk}^2$ should be updated, i.e., each (progeny record)^2 and added plus $\sum_i y_{i..}^2/n_{i..}$ should be updated, i.e., each (herd total)^2/(number in herd) and added.

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[1] The procedures described and the theory on which they are based were developed by C. R. Henderson. For detailed account readers are referred to:

Henderson, C. R. 1973. Sire evaluation and genetic trends. Proc. of the Animal Breeding and Genetics Symposium in Honor of Dr. Jay L. Lush. American Society of Animal Science and American Dairy Science Assoc., Champaign, Ill. p. 10.

Henderson, C. R. 1974. General flexibility of linear model techniques for sire evaluation. J. Dairy Science 57:963.

Report on National Sire Evaluation Program

1. Sponsoring organization American Chianina Association

2. Type of program (check one):

   a. Field test[a] X

   b. Breeder operated designed test[b] ______

   c. Organization operated designed test[c] ______

3. Number of bulls being tested 79

4. Number of reference sires 19

5. Number of herds involved in the test 2,984

6. Number of cows or total number of matings involved 42,800

7. Traits measured and included in evaluating expected progeny differences (list):

   Weaning Weight

   Yearling Weight

[a]Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b]Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c]Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

Report on National Sire Evaluation Program

1. Sponsoring organization American Hereford Association

2. Type of program (check one):

   a. Field test[a] ______

   b. Breeder operated designed test[b] ______

   c. Organization operated designed test[c] X

3. Number of bulls being tested 50

4. Number of reference sires 3

5. Number of herds involved in the test 4

6. Number of cows or total number of matings involved 2,129

7. Traits measured and included in evaluating expected progeny differences (list):

   Calving ease, calf vigor, 205-day adjusted weight, yearling weight, feedlot gain, weight per day of age, cutability, carcass quality, efficiency of gain.

[a] Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b] Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c] Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

Report on National Sire Evaluation Program

1. Sponsoring organization American-International Charolais Association

2. Type of program (check one):

   a. Field test[a] ______

   b. Breeder operated designed test[b] X

   c. Organization operated designed test[c] ______

3. Number of bulls being tested 44

4. Number of reference sires 12

5. Number of herds involved in the test 7

6. Number of cows or total number of matings involved 1,297 (minimum)

7. Traits measured and included in evaluating expected progeny differences (list):

   a. Calving Ease (Number Births, Number Abnormal Presentations, Percentage Normal Presentation Unassisted Live Births)

   b. Weaning Weight

   c. Pounds of Lean/Day of Age

   d. Carcass Quality

   e. Carcass Cutability

[a] Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b] Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c] Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

Report on National Sire Evaluation Program

1. Sponsoring organization American Polled Hereford Association

2. Type of program (check one):

   a. Field test[a] ______

   b. Breeder operated designed test[b] X

   c. Organization operated designed test[c] X

3. Number of bulls being tested 141

4. Number of reference sires 12

5. Number of herds involved in the test 19

6. Number of cows or total number of matings involved 12,050
   (matings made to date)

7. Traits measured and included in evaluating expected progeny differences (list):

On all bulls:
- Weaning weight
- Yearling weight
- Carcass weight
- Cutability
- Marbling
- Retail Produce per day of age

Whenever possible:
- Birth weight
- Weaning wt. ratio of calves out of daughters

[a] Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b] Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c] Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

Report on National Sire Evaluation Program

International Maine-Anjou Association

The programs used by the IMAA consider the suitable performance records from on the farm or ranch performance programs to estimate expected progeny differences of sires. In order for data to be termed suitable, more than one sire must have been used with at least one of the sires being a designated reference sire. Reference sires are bulls that have a minimum of 300 progeny in 10 or more contemporary groups.

Our 1975 National Sire Summary (compiled in Fall - 1974) evaluated the progeny from 20 bulls, 9 of which were designated reference sires. There are currently over 80 purebred bulls registered. Each prebred bull with sufficient numbers and comparisons to reference sires will be considered in the upcoming summary. There were 785 contemporary groups evaluated at weaning in the 1975 summary. There were 9207 progeny weaning records considered. Approximately the same number of all progeny records could not be considered in the sire summary. These records were discarded for 2 primary reasons:

1. No reference sire used in the herd.
2. Only one sire used in the herd.

The traits presently considered in the IMAA National Sire Summary are:

birth weight
calving ease 1st calf heifers
calving ease 2nd calf and older cows
calving ease index
weaning weight
yearling weight

If sufficient numbers are available, carcass data will be included on future summaries.

The sire summary is distributed free of charge to any interested breeders.

SIRE EVALUATION REPORT

June 1, 1975

The Board of Directors of the American Angus Association approved this Program on March 10, 1972. Since that time more than 200 bulls located in more than 20 states have been enrolled by their owners. The results of the progeny performance of two groups of bulls have been reported.

The Program is up-dated frequently. Two new evaluations, calving ease and pounds of retail cuts per day of age, were recent additions. The number of Reference Sires has been reduced to four. Each test uses only two, one selected by the breeder and one assigned by the Association. The progeny performance of ALL bulls must be published at least once. If an owner wishes to withdraw his bull following this initial report, he may do so.

There is an alternate plan called "purebred option". This allows the evaluation of calving ease, weaning weight and yearling weight. Carcass data is not required. Breeders with average sized herds or less, can register all the offspring. Results are listed separately from the bulls on regular Sire Evaluation.

The main objective of the Program is not to find the "super bull". If accurate performance information is supplied to the membership, then they can make the choices to fit their own breeding program. Complete details of the Program are available from The American Angus Association, 3201 Frederick Boulevard, St. Joseph, Missouri. 64501.

Report on National Sire Evaluation Program

1. Sponsoring organization AMERICAN SIMMENTAL ASSOCIATION

2. Type of program (check one):

   a. Field test[a] ______

   b. Breeder operated designed test[b] __X__ (SEE ATTACHED SUMMARY)

   c. Organization operated designed test[c] ______

3. Number of bulls being tested ______

4. Number of reference sires ______

5. Number of herds involved in the test ______

6. Number of cows or total number of matings involved __?__ ______

7. Traits measured and included in evaluating expected progeny differences (list):

______

______

______

______

______

[a] Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b] Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c] Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

	JULY, 1975 NATIONAL SIMMENTAL SIRE SUMMARY SUPPLEMENT	JANUARY, 1975 NATIONAL SIMMENTAL SIRE SUMMARY
Total Number of Animals	251,790 increase = 26%	199,732
Animals with Calving Data	217,713 increase = 26%	172,040
Animals with Weaning Data	193,458 increase = 29%	150,160
Animals With Yearling Data	10,581 increase = 14%	9,294
Animals with Carcass Data	988 increase = 400%	247
Animals for Sires Daughters 1st Calf	37,568 increase = 81%	20,781
Total Number of Sires Processed	853 increase = 20%	711
Total Number of Sires Qualified for Summary	335 increase = 60%	209
Total Number of Reference Sires	42 increase = 14%	37
Within-herd Tests	10,510 increase = 29%	7,467

Report on National Sire Evaluation Program

1. Sponsoring organization North American Limousin Foundation

2. Type of program (check one):

   a. Field test[a] ________

   b. Breeder operated designed test[b] X

   c. Organization operated designed test[c] ________

3. Number of bulls being tested 75

4. Number of reference sires 16

5. Number of herds involved in the test 3,500 members--1,754 mgt units

6. Number of cows or total number of matings involved 53,266 from 100,000 records

7. Traits measured and included in evaluating expected progeny differences (list):

   See attached sire summary.

[a]Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b]Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c]Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

Report on National Sire Evaluation Program

North American Limousin Foundation

Performance records from on the farm and ranch performance programs of members registering Limousin sired calves with the North American Limousin Foundation (NALF) are used to estimate the expected progeny difference of sires. For a sire to be included in the summary the following conditions must be met:

1. All progeny must meet contemporary group requirements. A contemporary group is a group of calves which are born within a 90-day period in the same herd, are of the same sex and percentage Limousin blood, and have been handled under the same management program. Contemporary groups are referred to as management units in each sire summary.

2. Each bull must be used with three or more contemporary groups.

3. Each bull must have a minimum of 30 progeny and no less than two head in any one contemporary group.

4. There must be a designated Limousin reference sire used in each contemporary group for data to be included in the analysis. Limousin sires with large numbers of progeny from several herds are designated as reference sires.

5. All aforementioned progeny must be registered with the NALF.

The 1975 sire summary evaluated the progeny of 75 Limousin sires, including 16 reference sires. There were 1,754 contemporary groups at weaning with a total of 53,266 progeny evaluated in the 1975 summary. Traits evaluated included:

Birth weight
Adjusted 205-day weight
Adjusted 365-day weight
Daughter's first calf weaning weight
Carcass percent cutability
Carcass pounds trimmed retail cuts per day of age

Report on National Sire Evaluation Program

1. Sponsoring organization American Shorthorn Association

2. Type of program (check one):

   a. Field test[a] ________

   b. Breeder operated designed test[b] ________

   c. Organization operated designed test[c] XXXX

3. Number of bulls being tested 22

4. Number of reference sires ________

5. Number of herds involved in the test 3

6. Number of cows or total number of matings involved 980

7. Traits measured and included in evaluating expected progeny differences (list):

   Weaning weight, yearling weight, rate of gain,

   carcass data, calving difficulty, reproductive

   eff., replacement females

[a]Field test: These programs use the performance records available from on the farm or ranch performance programs to estimate expected progeny differences of sires.

[b]Breeder operated designed test: The organization sponsoring the program specifies the conduct of the breeder operated progeny test and specifies the particular use of designated reference sires.

[c]Organization operated designed test: The organization sponsoring the program contracts with one or more test herds and supervises the conduct of the entire progeny test.

UPDATE OF THE BEEF CARCASS DATA SERVICE--JUNE 1975

The Beef Carcass Data Service (BCDS) was expanded on a nationwide basis in July 1972. Since this time, 108,000 official BCDS eartags have been distributed and data have been collected on approximately 20,000 ear-tagged cattle. The number of organizations serving as cooperators by distributing eartags has increased to 33. To meet this growth rate, the Carcass Data Processing Center in Washington, D. C. was recently automated. This automated system will reduce processing time and thus provide for more timely return of data to the eartag owner.

In an effort to promote the BCDS, a 10-minute narrated movie "The Connecting Link" was produced in April 1975. The film explains the operational aspects of the BCDS and copies are available through Land Grant College and Livestock and Information Division field offices. A slide series covering similar material was also produced and is available.

Progress of the BCDS has been satisfactory during the past 3 years. The eartag is becoming more widely recognized by all segments of the trade. For the most part, meat inspectors are doing a better job of spotting eartags and transferring them. However, indications are that this area is still a source of "slippage." We are continuing to maintain close and frequent contact with meat inspection regarding this program. Additionally, it appears that packer and in some instances feeder cooperation, is still a major stumbling block that must be overcome. There are indicators that the practice of removing BCDS eartags prior to slaughter or refusal to purchase eartagged cattle by packers or their buyers may be increasing. In this connection, it would be in the best interests of the program if organizations such as the Beef Improvement Federation would contact feeders and packers to explain the importance of BCDS and encourage their cooperation.

Also, eartag owners may wish to contact packers or the local meat grading office in advance of the tagged cattle being slaughtered. Although this is not a requirement of the program, it may help to reduce the possibility of lost data.

It has not been determined what "percentage return" can be expected by using the BCDS. Some eartagged cattle have been "missed," however, we have no idea of how many. Although we have had a few complaints, we have received a number of compliments from some cooperators concerning the high percentage rate of data they have had.

Beef Improvement Federation Luncheon and Awards Program

May 20, 1975

Ray Meyer, President, Beef Improvement Federation, Presiding

Invocation....................................Michael J. Pulsifer
Indianola, IA

Welcome to Iowa..............................Don Nelson
President, IBIA
Danville, IA

BIF Pioneer Awards...........................R. L. Willham
IA State Univ.
Ames, IA

Address: The Future of Beef and World Food Problems......................Gordon Van Vleck
President
Am. Natl. Cattlemen's Assn.
Plymouth, CA

The Pioneer Awards

Jay L. Lush	IA State Univ.	Research	1973
John H. Knox	NM State Univ.	Research	1973
Ray Woodward	Am. Breeders Serv.	Research	1974
Fred Willson	MT State Univ.	Research	1974
Charles E. Bell, Jr.	Ext. Serv., USDA, Wash. DC	Education	1974
Reuben Albaugh	Ext. Serv., Univ. of CA	Education	1974
Paul Pattengale	Ext. Serv., CO State Univ.	Education	1974

1975

Glen Butts - Performance Registry International - Research

Glen Butts, Secretary of Performance Registry International, Joplin, Missouri has long been an advocate of selecting seedstock beef animals for performance traits. As a long-time manager of a leading Polled Hereford herd and in his own seedstock herd, he has demonstrated the value of sound selection practices for performance in beef cattle. He was influential in the organization and development of the Oklahoma Beef Cattle Improvement Association as well as Performance Registry International.

Keith Gregory - ARS-USDA, U. S. Meat Animal Research Center - Research

Keith Gregory, Director of the U. S. Meat Animal Research Center at Clay Center, Nebraska has been a long-time leader in the national beef cattle breeding programs. He joined USDA in 1955 as research leader and coordinator of the North Central Regional Beef Cattle Breeding Project. A publication, Principals of Record of Performance in Beef Cattle, authorized by Dr. Gregory and others in 1961, provided a summary of the basic principals that should be considered in record of performance programs. The concepts set forth in this publication have been widely used by many organizations in the development of record of performance programs. The Beef Improvement Federation publication, Guidelines for Uniform Beef Improvement Programs, was developed, using many of the conepts set forth in the publication by Gregory and others in 1961.

Bradford Knapp, Jr. - USDA - Research

Bradford Knapp, Jr., former U.S. Department of Agriculture and State Department employee, is retired and lives in Bradenton, Florida. Knapp was one of the earliest advocates of measuring performance traits in beef cattle. He served as the research leader at the U. S. Range Livestock Station, Miles City, Montana. In 1936, Knapp presented a paper before the American Society of Animal Production (now Animal Science) entitled, "A Method of Measuring Performance in Beef Cattle." Knapp was instrumental in establishing Line 1 Herefords at the Miles City Station. This is currently one of the popular seedstock lines in the Hereford breed.

Beef Improvement Federation Recognition and Awards Banquet Program

May 20, 1975

Master of Ceremonies	Frank H. Baker Dean of Agriculture OK State Univ
Invocation	Glen Butts Secretary PRI
President's Address	Ray Meyer Sorum, SD
Presentation of President's Plaque to Ray Meyer	Frank H. Baker
Certificate of Excellence Presented to Seedstock Producers	Dave Nichols Anita, IA
Certificate of Excellence Presented to Commercial Producers	Dr. S. A. Ewing Iowa State Univ.
Award Seedstock Producer of the Year	Vincent H. Arthaud Univ. of NE
Award Commercial Producer of the Year	Wendell Severin Secy-Treas Red Poll Cattle Club
Award Organization of the Year	Irvin T. Omtvedt Univ. of NE
Continuing Service Awards	Merlyn Nielsen Univ. of NE
Award to Frank H. Baker -- Service to BIF	Ray Meyer

The Seedstock Breeder Honor Roll of Excellence

John Crowe	CA	1972
Dale H. Davis	MT	1972
Elliot Humphrey	AZ	1972
Jerry Moore	OH	1972
James D. Bennett	VA	1972
Harold A. Demorest	OH	1972
Marshall A. Mohler	IN	1972
Billy L. Easley	KY	1972
Messersmith Herefords	NE	1973
Robert Miller	MN	1973
James D. Hemmingsen	IA	1973
Clyde Barks	ND	1973
C. Scott Holden	MT	1973
William F. Borror	CA	1973
Raymond Meyer	SD	1973
Heathman Herefords	WA	1973
Albert West III	TX	1973
Mrs. R. W. Jones, Jr.	GA	1973
Carlton Corbin	OK	1973
Wilfred Dugan	MO	1974
Bert Sackman	ND	1974
Dover Sindelar	MT	1974
Jorgensen Bros.	SD	1974
J. David Nichols	IA	1974
Bobby Lawrence	GA	1974
Marvin Bohmont	NE	1974
Charles Descheemaeker	MT	1974
Bert Crane	CA	1974
Burwell M. Bates	OK	1974
Carlton Corbin	OK	1974
Maurice Mitchell	MN	1974

1975

Name and Address	Breed	Nominated by
Robert Arbuthnot Haddam, KS 66944	Hereford	KS LS Assn BCI Com
Glenn Burrows Clayton, NM 88415	Polled Hereford	PRI
Louis Chesnut Spokane, WA 99204	Simmental	Am Simmental Assn
George Chiga Guthrie, OK 73044	Red Angus	Red Angus Assn
Howard Collins Rocheport, MO 65279	Hereford	MO BCIA
Jack Cooper Willow Creek, MT 59760	Hereford	MT BCIA
Joseph P. Dittmer Lacona, IA 50139	Polled Hereford	IA BCIA
Dale Engler El Dorado, KS 67042	Maine-Anjou	Intl Maine-Anjou Assn
Leslie J. Holden Valier, MT 59486	Hereford	Am Hereford Assn
Jorgensen Brothers Ideal, SD 57541	Angus	Jim Wolf
Robert D. Keefer Ryegate, MT 59074	Murray Grey	Am Murray Grey Assn
Frank Kubik, Jr. Manning, ND 58642	Polled Hereford	ND BCIA
Licking Angus Ranch Seneca, NE 69161	Angus	NE BCIA
Walter S. Markham Salinas, CA 93901	Hereford	CA BCIA
Gerhard Mitteness Benson, MN 56215	Polled Hereford	MN BCIA

Breeders of the Year

John Crowe	CA	1972
Mrs. R. W. Jones	GA	1973
Carlton Corbin	OK	1974

1975

		Nominated by
Leslie J. Holden	Valier, MT	Am Hereford Assn
Jack Cooper	Willow Creek, MT	MT BIA

The 1975 Seedstock Producer Award was unique inasmuch as two Hereford breeders were selected as co-winners. The men are half-brothers who run seperate registered Hereford herds in west central Montana. They were described as "working very closely on their selection and performance programs, and for many years have worked toward the same goals in improving Hereford cattle." Both maintain detailed records on the performance of their cow herds and use these records in selection of replacement animals.

Both are active participants in the American Hereford Association activities as well as the Montana Beef Improvement Association. Both herds have the same genetic background.

The wide acceptance of seedstock animals produced in these herds by Hereford breeders throughout the United States is evident of the effectiveness of their selection and performance programs.

Both men are active in state and national livestock organizations. Both serve on many local boards and civic organizations in their home communities.

BIF Awards' Program

The Commercial Producer Honor Roll of Excellence

Chan Cooper	MT	1972
Alfred B. Cobb, Jr.	MT	1972
Lyle Eivens	IA	1972
Broadbent Brothers	KY	1972
Jess Kilgore	MT	1972
Clifford Ouse	MN	1973
Pat Wilson	FL	1973
John Glaus	SD	1973
Sig Peterson	ND	1973
Max Kiner	WA	1973
Donald Schott	MT	1973
Stephen Garst	IA	1973
J. K. Sexton	CA	1973
Elmer Maddox	OK	1973
Marshall McGregor	MO	1974
Lloyd Nygard	ND	1974
Dave Matti	MT	1974
Eldon Wiese	MN	1974
Lloyd DeBruycker	MT	1974
Gene Rambo	CA	1974
Jim Wolf	NE	1974
Elmer Maddox	OK	1974
Henry Gardiner	KS	1974
Johnson Bros.	SD	1974

1975

Name and Address	Breed	Nominated By
John Blankers Holland, MN 56139	Charolais	MN BCIA
Paul Burdett Philipsburg, MT 59858	Heref x Red Angus	MT BCIA
Oscar Burroughs Orland, CA 95963	Gelbvieh Cross	CA BCIA
John R. Dahl Gackle, ND 58442	Hereford	ND BCIA
Eugene Duckworth Amoret, MO 64722	Angus - Simmental	MO BCIA
Gene Gates Coldwater, KS 67029	Angus	KS LS Assn BCI Com
V. A. Hills Mankato, KS 66956	Simmental	Am. Simmental Assn
Robert D. Keefer Ryegate, MT 59074	Murray Grey	Am. Murray Grey Assn
Kenneth E. Leistritz Rushville, NE 69360	Heref x R Angus x Short	Pioneer Beef
Marshall S. McGregor Stoutland, MO 65567	Angus x Heref	PRI

Commercial Producer of the Year

Chan Cooper	MT	1972
Pat Wilson	FL	1973
Lloyd Nygard	ND	1974

<u>1975</u>

		Nominated by
Gene Gates	Coldwater, KS	KS LS Assn BCIC

Gene Gates, the outstanding commercial producer of the year, operates a 300-head commercial Angus herd in southwest Kansas. He began his herd with proceeds from his 4-H club steer projects in 1949. Since 1968, the herd has been a performance testing program. All replacement females are selected according to their growth records. He has used purebred performance tested bulls since 1962. Two bulls used in the Gates' herd have earned the Certified Meat Sire Award.

Feedlot operators have sought the Gates Ranch steers because of their growth, feedlot gain and packer acceptance.

The outstanding group of feeder heifers at the 1973 World Angus Forum came from the Gates Ranch.

Gates is an active participant in the Kansas Livestock Association, the Comanche County Beef Cattle Improvement Association, Comanche County Farm Bureau and the County Extension Council.

Organization of the Year

Beef Improvement Committee, Oregon Cattlemen's Association	1972
South Dakota Livestock Production Records Association	1973
American Simmental Association, Inc.	1974

1975

American Simmental Association, Inc.

The American Simmental Association was selected as the outstanding beef performance organization for the second year. The annual report of activities and services provided to members of the association was outstanding. The rapid rise to a leadership position among breed registry associations indicates the wide acceptance of the concepts of performance testing, sire evaluation, expected progeny differences and Most Probable Producing Ability among seedstock producers.

BCIA Organization of the Year

1975

Iowa Beef Improvement Association

An award signifying outstanding leadership among state beef cattle improvement associations was made for the first time at the 1975 meeting. This award was presented to the Iowa Beef Improvement Association. This organization offers its members performance programs for on-farm herd evaluation of weaning and yearling weights. Also offered is on-farm feedlot tests for bulls. A sire summary is published. A major emphasis of the IBIA is the services rendered through central bull testing stations. The organization operates four central test stations that feed from 800 to 1,000 bulls annually. The superior animals in each test are merchandised at public auction.

Continuing Service Awards

Clarence Burch	Oklahoma	1972
F. R. Carpenter	Colorado	1973
E. J. Warwick	ARS-USDA, Washington, D.C.	1973
Robert deBaca	Iowa State University	1973
Frank H. Baker	Oklahoma State University	1974
D. D. Bennett	Oregon	1974
Richard Willham	Iowa State University	1974

1975

LARRY V. CUNDIFF - Research Geneticist at the U. S. Meat Animal Research Center, Clay Center, Nebraska and Coordinator for the North Central Regional Beef Cattle Breeding Study (NC-1). Cundiff represents USDA-ARS as an ex-officio member of the Board of Directors of the Beef Improvement Federation. He has had an active leadership role in BIF where he has served as committee and/or program chairman. He was directly responsible for organizing and directing recent symposia held in connection with the annual BIF meetings. Dr. Cundiff is a native of Kansas. He holds degrees from Kansas State and Oklahoma State Universities. He has served on the Animal Science faculty of the University of Kentucky and presently holds an appointee as Professor on the Animal Science staff of the University of Nebraska.

DIXON D. HUBBARD - Extension Animal Scientist, U. S. Department of Agriculture, Washington, D. C. He has been an active leader in the development of the ongoing program of the Beef Improvement Federation. He currently serves BIF as its Program Coordinator. In the position, he works closely with the various state animal science extension leaders in establishing the membership of the various committees of BIF. He has had a primary role in the development and publishing of Guidelines for Uniform Beef Improvement Programs. Hubbard is a native of Oklahoma and holds degrees from Oklahoma State University.

J. DAVID NICHOLS - Anita, Iowa. The immediate past president of the Beef Improvement Federation has provided leadership in the organization since it began. He was elected a member of the first Board of Directors of BIF in 1968. He has continued to be an active leader in the ongoing program serving as committee chairman, vice-president and president of BIF (1973-75). Nichols, in partnership with his father, Merrill, and brother, Lee, owns and manages a 550 purebred Angus herd. They have recently established a purebred Polled Hereford herd near Anita, Iowa. Both herds are enrolled in the performance programs of their respective breed associations. The wide acceptance of seedstock animals from these herds illustrates the value of their rigid selection for performance traits in beef cattle.

Minutes of Midyear Board of Directors Meeting
Beef Improvement Federation
Airfield Plaza Inn
Omaha, Nebraska
October 10, 1974

Members present:

Ray Meyer	- Sorum, S. D.	Craig Ludwig	- Kansas City, Mo.
John Airy	- Des Moines, Ia.	Dave Nichols	- Anita, Ia.
Frank Baker	- Lincoln, Ne.	Dwight Stephens	- Lincoln, Ne.
Louis Chesnut	- Spokane, Wa.	C. D. Swaffar	- Omaha, Ne.
Larry Cundiff	- Clay Center, Ne.	Don Vaniman	- Bozeman, Mt.
Robert deBaca	- Coon Rapids, Ia.	Robert Vantrease	- Denver, Co.
William Durfey	- Columbia, Mo.	Jim Wolf	- Albion, Ne.
Fred Francis	- St. Joseph, Mo.	John Whaley	- Queenstown, Md.

The meeting was called to order at 9:00 am by President Ray Meyer.

Agenda included (1) general plans for the annual meeting, (2) symposia subject for the 1975 annual meeting, (3) general plans for finalizing new Guidelines publication, (4) transfer of Secretaryship to Dwight Stephens and (5) other business.

Secretary Baker reported that the 1975 annual meeting would be held in Des Moines, Ia. at the Iowa Hilton Hotel. A press release, well in advance of the meeting, would indicate dates, location, subjects and speakers.

A general discussion of symposia subjects for the 1975 meeting resulted in the following recommendations: (1) a 1/2 day symposium on "A New Look at Measuring Post Weaning Growth" and a second 1/2 day symposium on "A Review of Genetic Abnormalities in Cattle and How to Deal with Same." The Program Committee, with Larry Cundiff as chairman, was instructed to work with the Iowa Beef Improvement Association and personnel at Iowa State University to identify subject matter areas and personnel to be invited as participants. It was the concensus of the group that these were timely and vital topics that should be of interest to the entire beef industry. It was suggested that the format for the meeting be approximately the same as the 1974 meeting at Denver.

Secretary Baker provided the Board with a manuscript of the preliminary draft of the proposed 3rd edition of Guidelines for Uniform Beef Improvement Programs as prepared by Dixon Hubbard. It was indicated that a table of contents and a glossary of terms were to be added. It was suggested that the glossary include an explanation of all abbreviations used throughout the text. A suggestion was made that the Guidelines material might be improved by the use of some illustrations in the introductory section. Illustrations prepared by Secretary Baker were reviewed and a suggestion was made that R. L. Willham might be asked to provide illustrative material. A general discussion of the manuscript material followed.

Cundiff raised a question regarding Uniform Breed Codes as shown on page 66. By common consent, a committee of Cundiff, Durfey and Hubbard was asked to prepare revisions of breed codes.

Motion was made by Whaley, seconded by Swaffar, and passed to authorize this committee to resolve problems associated with breed coding prior to publication.

Meyer suggested certain changes in the section on Farm and Ranch Pre-weaning and Post-weaning Testing Programs (page 71). Motion by Durfey, seconded by Chesnut and passed, that the following changes be made: page 71, beginning at line 18 to read "It is also recommended that weights be recorded as close to 205 days as possible. Calves weaned outside this range should be accounted for by a special management code and handled as a special management group in computing 205 day weights and ratios. Records of calves in this management code should not be adjusted for age of dam, since appropriate correction factors are not available." A sentence, "Research results indicate that early weaning may enhance subsequent mothering ability of heifer calves." was deleted.

Motion by Airy, seconded by Nichols: Following a review of the comments and recommendations of the Board and BIF membership, a committee, composed of Baker, Cundiff, Hubbard and Stephens, be authorized to proceed with publication of a 3rd edition of Guidelines for Uniform Beef Improvement Programs. Motion passed.

Secretary Baker advised the Board that in his new position as Dean of Agriculture at Oklahoma State University, effective November 1, 1974, he would be unable to continue as Secretary to the Beef Improvement Federation. He expressed his gratitude for the opportunity to work with the Beef Improvement Federation and indicated he would continue to have a vital interest in ongoing activities.

A motion by Nichols, seconded by Wolf, that Baker be elected an ex-officio member of the Board of Directors, Beef Improvement Federation, was passed unanimously. An expression of appreciation for the leadership and professional services provided through the years by Dr. Baker was extended via a hearty applause.

Secretary Baker reported that Board members had been contacted relative to Dwight Stephens serving as temporary Secretary to the Beef Improvement Federation. Board had approved this by mail response. It was indicated that the administration of the University of Nebraska would permit Stephens to accept the assignment.

Following a discussion regarding expenses for travel and per diem for the Secretary, a motion by Swaffar, seconded by Nichols to authorize the sum of $600.00 to cover travel and lodging by the Secretary in preparation for the 1975 annual meeting was passed.

The discussion of costs for the 1975 annual meeting resulted in the following action: Motion by Francis, seconded by Whaley, to authorize the Program Committee to expend up to $2,000.00, if needed, above registration receipts to underwrite cost of the 1975 annual meeting, publication of proceedings and other necessary expenditures. Motion passed.

Other Board actions included the following items: Motion by Airy, seconded by Wolf, asking Baker to express to the University of Nebraska Vice Chancellor appreciation for services of Stephens as the temporary Secretary. Motion passed.

A report by Baker to the Midyear Directors Meeting included the following items:

1. Committee Assignments. It was recommended that BIF membership be asked by form letter, to recommend individuals to serve on various BIF committees. A motion by Durfey, seconded by Whaley, that Dixon Hubbard survey the membership by February 1, 1975 and that committee members be identified and notified prior to March 1, 1975 passed.

2. Publication of Leaflets. At the April, 1974 meeting the Board authorized publication of information leaflets as follows: (1) central station testing, (2) merchandising, (3) national sire evaluation. These items were recommended by the committees representing these production areas.

Following a brief discussion, it was recommended that Cundiff prepare the leaflet on sire evaluation and that the Committee on Central Testing Stations assemble materials for a leaflet on this subject. By common consent, it was agreed that the leaflet on merchandising be omitted.

3. Report from Dixon Hubbard (by Baker).

A. Bobby Rankin, New Mexico, expects to prepare a revised list of central testing stations in the next few months.

B. USDA Extension Service expects to conduct an evaluation survey regarding results of extension service's efforts of the past 20 years relative to the development and adaptation of procedures for performance testing of beef cattle. This will include a listing of current breed association testing and record keeping activities. It was suggested that the role and activities of the extension service related to performance testing programs might well be changed in future years.

C. The Sire Evaluation Committee assignment remain the same. It was suggested that organizations be asked if they wish to retain the same member on the Sire Evaluation Committee.

4. Baker called attention to the leaflet, Education for a Growing Agriculture. He indicated he would provide members with copies.

5. Beef Carcass Data Service (eartag sales and services). Will continue to be handled via the Secretary's office.

6. Financial Report.

Bank Balance, July 1, 1973	$4,296.98
Bank Balance, July 1, 1974	4,866.92
Estimated Balance Following Midyear Board Meeting	8,525.00
Estimated Expenditures for Annual Meeting Travel, Miscellaneous Needs	2,600.00

Following a discussion of the position of the secretary for BIF, President Meyer named a committee composed of Larry Cundiff as Chairman, William Durfey and Louis Chesnut as members to recommend to the Board a permanent secretary for the organization.

Motion to adjourn was made by Durfey, seconded by Vaniman and the meeting adjourned 2:10 pm.

Board members not present:

James Bennett	Red House, VA	BCIA Eastern Region
D. D. Bennett	Hermiston, OR	BCIA Western Region
Martin Jorgensen	Ideal, SD	BCIA-at-large
Tom Burch	Mill Creek, OK	PRI
Robert Miller	Mabel, MN	BCIA-at-large

Ex Officio:

Dixon Hubbard	Ext. Service, USDA	Washington, D. C.
W. A. Gillis	LS Div., Dept. of Ag.	Ottawa, Canada

Regional Secretaries:

A. L. Eller	An. Sci. Dept., VPI	Blacksburg, VA
Bobby J. Rankin	An. Sci. Dept., NMSU	Las Cruces, NM

Minutes of the Board of Directors Meeting

May 20, 1975

Members present: D. D. Bennett, James Bennett, Burch, Chesnut, Durfey, Francis, Jorgensen, Ludwig, Meyer, Nichols, Whaley, Wolf. Members absent: Airy, Miller, Swaffar, Vaniman, Vantrease. New Directors present: Allen, Cooper. Ex-Officio members present: Baker, Cundiff, Hubbard, Stephens. Regional Secretaries present: deBaca, Eller.

The meeting was called to order at 7:00 a.m. by President Ray Meyer.

The minutes of the mid-year meeting at Omaha were reviewed. The minutes were amended as follows:

"Following a discussion of the position of the Secretary for BIF, President Meyer named a committee composed of Larry Cundiff as Chairman, William Durfey and Louis Chesnut as members, to recommend to the Board a permanent Secretary for the organization."

Motion by Chesnut, second by deBaca to approve minutes as amended. Passed.

The Secretary's report was presented and reviewed.

The financial report was presented by the Secretary. Motion to approve by Francis, seconded by Nichols. Passed.

The President called for the report by Nominating Committee for Secretary of the Beef Improvement Federation. Committee members: Cundiff, Chesnut and Durfey. The report was given by Cundiff. The committee submitted two names for consideration: A. L. (Ike) Eller, Extension Beef Specialist, Virginia Polytechnic Institute, Blacksburg, Virginia and Irvin T. Omtvedt, Chairman, Animal Science Department, University of Nebraska, Lincoln, Nebraska. Chairman Cundiff indicated that each nominee had been contacted and each had indicated a willingness to serve in the position. Following the committee report, Eller was asked to leave the meeting. The President asked if the Board wished to make further nominations for the Secretary's position. Jim Wolf nominated Robert deBaca. deBaca was asked to leave the meeting. Following comments by past secretary Baker, Wolf was asked to ascertain whether deBaca was willing and available to serve as Secretary. deBaca indicated he would serve if the Board so desired. President Meyer indicated that only members of the official Board present (not newly elected members) were to cast ballots. Following two ballots, Robert deBaca was elected as Secretary.

The President called for a report of the election of Board members. Fred Francis, breed association caucus chairman reported election of Craig Ludwig, representing American Hereford Association, Don Vaniman, representing American Simmental Association and C. K. Allen, representing American Polled Hereford Association. It was determined that there were two three year terms and one two year term among the newly elected breed association directors. By a flip of a coin, it was determined that Craig Ludwig will fill the two year term and that Allen and Vaniman would serve three year terms. Louis Chesnut, BCIA Western Region caucus chairman, reported that Jack Cooper, Willow Creek, Montana, was elected as Director for BCIA Western Region. Cooper replaces D. D. Bennett. Martin Jorgensen, caucus chairman BCIA-at-large, reported the reelection of Jim Wolf, Albion, Nebraska, to a three year term representing BCIA-at-large.

The Board members and terms are as follows:

Name	Address	Representing	Term Expiring
Breed Associations			
1. C. K. Allen	4700 E 63 St Kansas City, MO 64130	Am. Polled Heref Assn	1978
2. Fred Francis	3201 Frederick Blvd St. Joseph, MO 64501	Am. Angus Assn	1977
3. Craig Ludwig	715 Hereford Dr. Kansas City, MO 64105	Am. Hereford Assn	1977
4. Raymond Meyer (President)	Sorum SD 57654	Red Angus Assn	1976
5. Don Vaniman	Box 24 Bozeman, MT 59715	Am. Simmental Assn	1978
6. Robert Vantrease	309 LS Exch Bldg Denver, CO 80216	No. Am. Limousin Found	1976
State BCIAs & PRI			
7. James Bennett	Red House VA 23963	BCIA Eastern Region	1976
8. John R. Whaley	The Wye Plantation Queenstown, MD 21658	BCIA Eastern Region	1977
9. Louis Chesnut	4314 Scott Spokane, WA 99200	BCIA Western Region	1977
10. Jack Cooper	Willow Creek MT 59760	BCIA Western Region	1978
11. Martin Jorgensen (Vice-President)	Ideal SD 57541	BCIA-At-Large	1977
12. Robert Miller	Mabel MN 55954	BCIA-At-Large	1976
13. J. David Nichols	Anita IA 50020	BCIA-At-Large	1976
14. Jim Wolf	Wagonhammer Ranches Albion, NE 68620	BCIA-At-Large	1978
15. Tom Burch	Mill Creek OK 74856	PRI	Cont.
Other Organizations			
16. John Airy	1916 68th St. Des Moines, IA 50322	Am. Natl Cattlemen's Assn	Cont.
17. William Durfey	512 Cherry St. Columbia, MO 65201	Natl Assn of Animal Breeders	Cont.

Ex-Officio

1. Frank H. Baker	College of Agriculture OK State University Stillwater, OK 74074
2. Larry V. Cundiff	US MARC Clay Center, NE 68933
3. Robert deBaca (Secretary)	The Garst Co. 220 5th St. Coon Rapids, IA 50058
4. Dixon D. Hubbard	Extension Service, USDA Washington, D. C. 20250

Regional Secretaries

1. A. L. Eller	Animal Science Dept. VPI Blacksburg, VA 24061
2. Bobby J. Rankin	Animal Science Dept. NM State University Las Cruces, NM 88003

Following a discussion of terms for Board Members, it was suggested that the annual program list the Directors, the area of representation and the length of term each was serving. Baker suggested a review of Ex-Officio Board Members was appropriate. This is to be discussed at the mid-year board meeting. Hubbard suggested that voting delegates for BCIA caucuses be identified at the time of official registration.

President called for discussion of old business.

Baker indicated that the committee charged with the responsibility of selecting the outstanding organization of the year had made a recommendation concerning the BIF awards and recognition program. On the basis of the committee recommendations, Baker moved, seconded by Chesnut, that an additional award be authorized to recognize the outstanding state BCIA organization. The awards committee had recommended this award go to the Iowa BCIA for the 1975 year. Motion approved. The Secretary was authorized to secure a suitable plaque and to instruct the chairman of the committee selecting the outstanding organization to announce at the awards banquet the new award and awardee.

The President called for election of officers for 1975-76.

Ray Meyer was reelected President and Martin Jorgensen was reelected Vice-President.

The Secretary having already been elected, there followed a discussion regarding a new office of Secretary-Treasurer wherein the present duties of Secretary and Treasurer would be combined in one office and location. In as much as both the present Secretary and/or Treasurer are authorized to issue checks on BIF checking accounts, it was felt that one individual could very well handle this aspect of BIF business.

Motion was made by Chesnut, seconded by Ludwig, to recommend to the general session that the offices of Secretary and Treasurer be consolidated in one position to be known as the Secretary-Treasurer of the Beef Improvement Federation. Motion passed.

The President announced that a board meeting would be held at 6:30, May 21, in order to shorten the regularly scheduled board meeting scheduled at 12:15, May 21.

The meeting recessed at 8:30 a.m., May 20.

Minutes of the Reconvened Board of Directors Meeting

May 21, 1975

Members present: Airy, Allen, Baker, J. Bennett, Burch, Chesnut, Cooper, Cundiff, deBaca, Durfey, Eller, Francis, Hubbard, Jorgensen, Ludwig, Meyer, Nichols, Rankin, Stephens, Whaley, and Wolf.

The meeting was called to order by the President at 7:00 a.m.

There was a discussion of committee reports as follows:

1. Reproduction (report by Durfey). Committee recommended that all calves born be given calving ease score and actual birth weight. The committee suggested these items be included in the Guidelines revision. There was some discussion as to the value of scrotal circumference measurements. The committee felt that there should be more definitive guidelines for semen evaluation. Durfey moved acceptance of the report. Whaley seconded. Passed.

2. Record Utilization (report read by Baker). Following a discussion of the report, Baker moved that the Board go on record as opposed to the commitment of BIF resources for the development of guidelines relating to the use of performance records in the show ring. Seconded by Durfey. Passed.

3. Central Test Station (report by Rankin). Rankin moved acceptance. Chesnut seconded following brief discussion. Motion passed.

4. Carcass (report read by Baker). Following discussion, it was moved by Baker, seconded by Allen that the Carcass Committee be instructed to study the issues regarding guideline changes and take appropriate action after a decision is made regarding federal carcass grade changes. Motion passed. It was recommended that the item in the committee report concerning the use of BIF resources for consumer education be deleted.

5. Farm and Ranch Testing (report by deBaca). deBaca moved acceptance of report, seconded by Bennett following discussion. Motion passed. Hubbard moved, Wolf seconded, deBaca be instructed to prepare a statement on cow efficiency as it relates to the current status of cow efficiency and that this statement be included as a part of updated BIF guidelines. Motion passed.

6. Performance Pedigree (report by Nichols). Moved by Nichols, seconded by Airy, to accept report. Motion passed.

7. Merchandising Committee (report by Whaley). Whaley moved acceptance, seconded by Nichols, motion passed. A brief discussion regarding merchandising leaflet prepared by this committee. Francis moved, seconded by Baker, to approve payment of publication costs of leaflet up to $250.00 by BIF. Motion passed.

A discussion of copyrighting the BIF logos was followed by a motion by Baker that all organizations who used BIF logos and who are not members of BIF be extended an invitation to become members of BIF. Seconded by Bennett. Motion passed.

Other business:

Baker moved, seconded by Chesnut, that Dixon Hubbard be asked to continue as Committee Coordinator for BIF. Motion passed. Hubbard suggested that he desired to have at least one board member serve on each committee and that this board member would act as liaison between the committees and the board.

President Meyer announced that the Program Committee for the 1976 meeting would be Don Vaniman, Chairman; James Brinks and Ray Woodward, members. He asked that this committee report at the mid-year board meeting with suggestions for the 1976 program. Baker suggested that the current program foremat be continued with two 1/2 day symposia wherein two issues are discussed. It was suggested one issue be of general concern to the cattle industry and one on current research. Meeting recessed at 8:40 a.m.

Board reconvened at 12:30, May 21.

Members present: Airy, Allen, Baker, Bennett, Chesnut, Cundiff, deBaca, Durfey, Eller, Hubbard, Jorgensen, Ludwig, Meyer, Nichols, Rankin, Stephens, Whaley, Wolf.

Items delayed for discussion at mid-year board meeting:

1. Status of Ex-Officio members.
2. Voting delegates identified at registration.
3. Status of board member Robert Miller (Miller had reported that press of farm work would not permit his attendance at Des Moines meeting).
4. Status of BIF logos.

Secretary Stephens raised a question as to the timing of the transfer of the office records and accounts to the new Secretary Designate, deBaca. Stephens expressed a willingness to prepare the proceedings of the 1975 meeting and to proceed with the preparations of the revised Guidelines in anticipation both items could be completed by July. Baker moved, seconded by Whaley, that the Secretary's recommendation be accepted, motion passed.

It was moved by Whaley, seconded by Allen, that an executive committee composed of the President, Vice-President, Secretary, Secretary-Elect, and Program Coordinator be authorized to handle the transfer and audit of the office of Secretary-Treasurer. This action is to be completed by July 1, 1975. Motion passed.

Motion by Airy, seconded by Ludwig, that mid-year board meeting be held in Denver, Colorado on Tuesday, October 21.

There was a brief discussion regarding the expansion of the Sire Evaluation Committee with no action taken.

John Airy requested that the board be furnished an agenda with appropriate comments prior to the mid-year board meeting in Denver.

It was suggested that with the return of Dr. Everett J. Warwick to his position with ARS, he be invited to participate in the mid-year board meeting.

Time and place of the 1976 annual meeting was discussed with suggestions of Kansas City, Omaha and Denver as possible sites. It was suggested that inquiries be made of the Missouri BCIA and BIC of Kansas Livestock Association to see if these organizations would be interested in hosting the meeting in the Kansas City area. Allen and Ludwig to follow up on suggestion. Decision to be made at mid-year board meeting.

Wolf raised a question regarding the return of carcass data ear tags. It was suggested that action be delayed until some action is forthcoming on the proposed grade changes.

Baker indicated that he was asked to prepare an article on the Beef Improvement Federation for the World Review of Animal Production. Such an article has been prepared and reprints will be available for distribution to board and others as available.

Airy moved, seconded by Baker, that Secretary Stephens be instructed to prepare letters of appreciation to the Iowa Beef Improvement Association for their efforts in planning and conducting of the 1975 annual meeting. Motion passed.

The Board expressed appreciation to Secretary Stephens for his services as interim Secretary.

Moved by Ludwig, seconded by Chesnut, meeting to adjourn.

Meeting adjourned at 1:30 p.m.

Dwight F. Stephens
Secretary

Minutes of General Session Business Meeting

Lower Monterey Room

Meeting was called to order by President Ray Meyer, 3:30 p.m.

The President called for any new business. Motion was made by Frank Baker, second by Fred Francis, that the by-laws of the Beef Improvement Federation be amended so as to abolish the office of treasurer and the duties formerly assigned to this office be included in a new office to be identified as the Secretary-Treasurer of the Beef Improvement Federation. Motion passed.

President Meyer called on Dixon Hubbard to report on the election of board members and officers for 1975-76. Hubbard reported as follows:

Board Members

C. K. Allen	-	Representing American Polled Hereford Assn. Three year term replacing C. D. Swaffar, American Shorthorn Assn.
Craig Ludwig	-	Representing American Hereford Association. Reelected for two year term.
Don Vaniman	-	Representing American Simmental Association. Reelected for three year term.
Jack Cooper	-	Willow Creek, MT. Elected to a three year term representing Western Region BCIA's.
Jim Wolf	-	Albion, NE. Reelected to a three year term representing BCIA's-at-large.

Dixon Hubbard, Program Coordinator of BIF, called for reports from the standing committees of BIF. The following committee reports were presented and authorized to be printed in the 1975 proceedings:

1. Merchandising - Mack Patton
2. Performance Pedigree - William Yaws
3. Farm and Ranch Testing - Joe Minyard
4. Carcass Evaluation - Bernard Jones
5. Central Test Stations - Bobby Rankin
6. Reproduction - William Durfey
7. Record Utilization - R. L. Willham
8. Sire Evaluation - Larry Cundiff

It was requested that the names and addresses of all committee members be published in the proceedings.

Meeting adjourned at 4:45 p.m.

1974-75 Secretary's Report
Dwight Stephens

As the temporary Secretary for BIF, I have been primarily concerned with preparations for the 1975 Annual Meeting since assuming the office last November.

At the October Board Meeting, it was suggested that the Program Committee schedule two symposia. These were arranged by Larry Cundiff as Chairman of the Program Committee. John Airy was most helpful in arranging for Gordon Van Vleck, President of the American National Cattlemen's Association to appear on the program.

James Glenn and Keith Vandervelde of the Iowa Beef Improvement Association have had a major part in arranging for the meeting. I am most grateful for the time and effort each of these individuals have given in developing the 1975 BIF program.

The response from BIF membership on the request for annual reports, nominations for awards, etc. has been very good. The information relative to current officers and organization activities is contained in the 1975 member reports and yearbook. Reports from state BCIA organizations indicate a continued interest in the overall program of performance testing and the use of various programs to improve production efficiency in the beef industry. A review of the reports from the various breed associations indicate increasing participation by seedstock producers in the association programs designed to aid them in identifying superior seedstock animals.

Status of Guidelines Revision

A preliminary draft of the proposed Guidelines revision was sent to BIF membership in November, 1974. There was a very limited (8 individuals) response to the request for comments and suggestions. Most of the suggestions deal with errors in the manuscript and/or rephrasing of certain portions to clarify the meaning of certain sections.

Drs. Cundiff, Nielsen and I spent many hours reviewing the manuscript. Many of the suggested changes have been incorporated into the manuscript. The delay at this time is the sole responsibility of the Secretary. My University responsibilities since January 1 have not permitted me to devote the necessary time to completely incorporate the suggestions into manuscript.

Following this Annual Meeting, I will have some time that I can devote to the completion of this work. I feel certain that I can have the retyped manuscript to Dixon Hubbard by July 1.

Status of Secretary for BIF

The minutes of the Midyear Board Meeting in Omaha indicate that I am a temporary BIF Secretary. The minutes that were prepared and mailed to the Board following the October 10 meeting failed to include one action by President Meyer. A committee composed of Larry Cundiff as Chairman, William Durfey and Louis Chesnut as members was named by President Meyer to seek a permanent Secretary for BIF.

While I have found much satisfaction and personal enjoyment in working with BIF, there are several reasons why I feel that the Board should select a permanent Secretary. My primary workload at the University comes at the same time that I should be busy on things for BIF. I really felt considerable pressure the past 4 months in trying to take care of the student needs at the University as well as provide adequate leadership in planning the Annual BIF Meeting. Furthermore, I do not "feel comfortable" in this kind of a leadership role. There is a substantial workload in being Secretary of BIF if the individual is going to do a first class job. I doubt that many people realize the many many hours Frank Baker devoted to BIF activities. Therefore, I request that the Board name a permanent Secretary to carry forward the activities of the secretary's office.

I will complete the work on the Guidelines manuscript as I have indicated earlier in this report. I will also assume responsibility for the publication of the proceedings of the 1975 Annual Meeting.

I think these items can be completed by July 1, 1975. At that time, I would like to turn over the records, publications on hand and the accounts of BIF to a new secretary. I will be most happy to work with and assist a new secretary in carrying forward the activities in BIF. I have enjoyed the relationship with BIF and I wish to continue to serve the organization in some role other than as its Secretary.

Record of Financial Transactions
5/1/74 -- 5/1/75

Month	Receipts	Disbursements	Balance
Balance 5/1/75			$7,309.39
May		$1,817.76	5,491.63
June	$ 129.00	753.71	4,866.92
July		15.00	4,851.92
August	1,553.90	82.00	6,323.82
September		81.00	6,242.82
October	2,894.50	587.88	8,549.44
November		1.30	8,548.14
December	944.59	279.20	9,213.53
January	408.50	529.66	9,092.37
February		126.10	8,966.27
March		28.60	8,937.67
April	237.80	5.00	9,170.47
Total	$6,168.29	$4,307.21	$9,170.47

Balance May 1, 1975 -- Bank Statement $9,170.47

Election of Board of Directors and Officers

Vacancies of the Board of Directors were filled by election in accordance with the by-laws, i.e., representatives of breed associations caucus and elect members to represent them; state BCIA representatives elect regional directors in regional caucuses and at-large directors in a caucus of all BCIA's.

Director	Address	Representing	Term Expiring
Breed Associations			
C. K. Allen	4700 E 63rd St. Kansas City, MO 64130	Am. Polled Heref Assn.	1978
Fred Francis	3201 Frederick Blvd. St. Joseph, MO 64501	Am. Angus Assn.	1977
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William Durfey	512 Cherry St. Columbia, MO 65201	Natl. Assn. of Animal Breeders	Cont.

Ex-Officio

Frank H. Baker	College of Agriculture, OK State Univ., Stillwater OK 74074
Larry V. Cundiff	US MARC, Clay Center, NE 68933
Robert deBaca (Secy)	Garst Co., 220 5th St., Coon Rapids, IA 50058
Dixon D. Hubbard	Extension Service, USDA, Washington, D.C. 20250
Don Nicholson	Livestock Div., Dept. of Ag. of Canada, Ottawa, Canada

Regional Secretaries

A. L. Eller	An. Sci. Dept., VPI & SU, Blacksburg, VA 24061
Bobby J. Rankin	An. Sci. Dept., NM State Univ., Las Cruces, NM 88003

The Role of the Beef Improvement Federation in the Year Ahead

Raymond W. Meyer

President, Beef Improvement Federation

BIF's role for the coming year in the cattle industry, as I see it, will be an expanded program of information for all the member organizations. The directors of BIF and myself will be available to explain BIF programs, BIF's role in research, and the need of member participation in BIF.

We plan to initiate a program to stimulate BCIA's, their programs, and to help get inactive BCIA's moving again. I would like to see expanded research initiated on calving problems to help reduce labor at calving time and the death loss. These are the two most costly and frustrating problems cattlemen must face today.

BIF, researchers and cattlemen need to use caution in their decisions on these items:

1. Visual selection of breeding stock has given us a variety of problems. In the past four decades, we have changed type selection from average size cattle, to small compress type, back through average size, and now to the "stretch cattle." We found the compress cattle developed into wasty cattle with many serious genetic problems. What will we find in the "stretch cattle?" When we select cows to look like steers, we are bound to select infertility. When we select the extreme-length bulls, we are finding back weaknesses causing breeding problems and reduced numbers of cows serviced.

2. Extreme-performance selection of breeding stock is not without hazards either. High-indexing bulls often increase the birth weight of the progeny causing extra labor for the cattleman, and a higher death loss. The problems of high-index heifers are infertility and low milk production. Many cattlemen believe the ideal replacement heifers that are the best producing group of their herds are those indexing between 95 and 105. We find that while a lot of high-indexing heifers are poor producers because of over conditioning at some stage of their development, we also find that many people tend to cull too many good females just because they do not index 100 or above. This is a waste of valuable breeding stock. We need to recognize a broader range of index in selecting replacement heifers.

When we use a combination of "wrong conformation" and "extreme performance," what can we expect? We will be changing the breed type. We need to maintain each of the beef cattle breeds with their wide variation of desirable traits. We must not select all breeds for one common trait. With this variation between breeds, we can then combine two or more breeds in crossbreeding programs to produce a specific product for specialized markets of the future.

We need to recognize the need for crossbred bulls and various percentage bulls. They are valuable in commercial cattle production for a specific product as well as having high fertility and breeding vigor.

3. Bull testing is not without its problems also. Gain testing and a 365-day-weight are a must, but are we wrong in how we are testing? Shouldn't we be testing our bulls using less cerial grains, and emphasizing maximum forage for growth and muscle development? What is the real value of a four-pound gain per day bull? A four-pound daily-gain bull is really impressive for bar stool chatter. A four-pound bull is very unimpressive to the cattle breeder if this four pounds of gain has left him impotent or infertile. Far too many of our bulls are being burned on gain tests, leaving them with poor fertility, a shortened useful life span, and many are physically unsound or foundered.

High forage rations for bull growth comparisons really make sense. After all that bull comes off test to be placed in a breeding pasture where generally forage is all that is available for him to eat while breeding the cows. A forage test ration would also eliminate the need for long "let down" periods while we are waiting for fat to disappear and fertility to improve.

Researchers, seedstock producers, multipliers, find the cattle in your herds that can produce the best carcass on maximum forage and minimum grain. Base your program on these cattle and help get beef cattle independent of the ups and downs of the feed grain market.

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