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RELATING FRAME SIZE TO OVERALL PROFITABILITY

Craig Ludwig

The structure of the U.S. beef industry begins with 1.8 million individual ranchers and producers. The seedstock portion of this segment is represented by organizations such as the American Hereford Association. The very fact that these 1,8 million producers make independent decisions about their own programs makes it almost impossible to accurately forecast short-range trends and actions.

A large majority of the U.S. cattle are finished in feedlots handling over 10,000 at a time. Such feedlots handle a cross-section of every breed and breed cross in the U.S. It is therefore impossible for feedlots of this magnitude to concentrate on a specific breed. They must work on averages but knowledge of a specific breed is most important.

The American Hereford Association is primarily concerned with how the straight-bred Hereford performs from conception to slaughter. With over one-half of the cattle in the U.S. being Hereford or Hereford cross cattle, our studies of the breed are significant to the U.S. beef industry in general.

The American Hereford Association's research deals with individual steers. We study and analyze data on individuals through the feedlot and on the rail. These cattle are the progeny of sires whose genetic potential can be determined through such a study of their steers.

The overall problem to the 1.8 million cattlemen in the U.S. is one of identifying those sires which when mated to the average cow will produce a genetically superior product.

The AHA works on this problem through an Association sponsored program known as TPR. This TPR program can be divided into two segments-- the cow-calf phase and the feedlot and carcass phase. In the feedlot and carcass phase, the AHA has processed nearly 20,000 head of cattle representing over 2,000 sires. This is the largest data bank on individual steers known to exist in the U.S. The primary reason for AHA's feedlot and carcass program is to measure performance traits of major economic importance to the entire beef industry and tie that back to sires and bloodlines that will be an asset to the commercial cattleman.

Through the use of a sophisticated computer system, printouts detailing the raw data for each sire tested are made based on the average performance of his progeny. Such data has allowed the Association to identify vast differences in the genetic capabilities existing between the progeny of different sires within the breed. As much as 20 percent variation exists between such progeny groups for such traits as feedlot gain and weight-per-day-of-age. An even higher amount of variation exists between sire progeny groups when carcass cutability differences are examined. For example, Bull A which sires cattle with a cutability of 2.8 as compared to Bull B's progeny's cutability of 4.2, results in a difference in lean

meat production of about \$100.00 per calf in favor of Bull A. Carcass quality also has a large effect on the value of slaughter cattle in the U.S. Cattle with superior carcass quality are worth about \$35.00 more as compared to cattle with lesser carcass quality.

When you look at it all---feedlot gain, weight-per-day-of-age, carcass cutability and carcass quality and the vast differences in the value of cattle which do not perform in these traits as compared to the cattle which perform well in these traits, you can readily see why the AHA feels the progeny test is so important.

There are many reasons for the sire differences we observe between progenies, but the major difference is in their genetic breeding potential. A highly heritable trait and one that affects the growth traits as well as the carcass is type or frame size of cattle. Frame size is best described as how long and how tall the animal is, at a given time.

At an American Hereford Association sponsored conference in 1969, we made available the results of a research project dealing with frame size and its relationship to beef cattle profitability. In this study the shortest, most compact steers were given a frame size score of 1. The tallest and largest steers were given a score of 5. Cattle varying in length and height between these two extremes were designated as 2, 3 and 4 frame sizes. Since then frame sizes of up to 7 have been observed in the industry.

Research data indicates that growth in beef cattle is a function of the bovine growth curve. Larger frame size cattle (frame sizes 4 and 5)

grow faster and reach physiological maturity later than do the smaller frame cattle. At the point of physiological maturity, all cattle regardless of frame size, are equally efficient and have similar carcass merit. The problem is to determine what weight is the most optimum at physiological maturity and then to breed a frame size of cattle to correlate with this end point.

Frame size 1 cattle in the 1969 study reached physiological maturity at about 850 pounds live weight, too light for the U.S. beef market. Frame size 4 cattle reached physiological maturity at about 1,100 pounds, a weight deemed optimum for the U.S. market. Cattle smaller than this are too small while cattle larger than this reach physiological maturity at a weight in excess of the optimum slaughter weight.

Our job in 1969 was to find sires of the proper frame size to produce frame size 4 calves from a cow herd that was basically frame size 3's. This job proved more difficult than one might imagine, for in 1969 show ring judges were selecting herd sire prospects in the frame size of 2 and 3. Consequently, these smaller frame size herd sires used on frame size 3 cows produced cattle which reached physiological maturity at too young an age and at too light a weight to be efficient producers of beef by the current U.S. standards.

Changing the genetic background of cattle is a slow process and thus changing the frame size of the nation's cow herd and cattle population took some time. Consider an animal slaughtered in the spring of 1978. Since

it takes about four years to turn each cattle generation, the 1978 slaughter steer's grandparents are cattle of the frame size most popular in the early 1960's.

Following the 1969 study, the Hereford seedstock industry set about selecting and using breeding cattle of a larger frame size. Because frame size is so highly heritable, the seedstock industry made giant strides in the past 10 years toward increasing the frame size in a majority of the nation's cow herds. Evidence of this is in the 1977 Denver champion bull. This bull weighed 2,300 pounds at 28 months of age and carried only .5 inch backfat. As a result, herd sires such as this now being used in the U.S. are producing steer progeny that weigh 1,125 pounds at 14 months of age with both outstanding cutability and quality in the carcass.

Carcass data collected through the Association's TPR program verifies the fact that giant strides have been made. During the past year over 1,000 individual cattle have been tested and measured through the AHA-TPR program. The best one-fourth of these cattle gained 3.29 pounds per day as compared to 2.59 pounds per day for the lowest one-fourth of the cattle tested. This is a significant economic difference.

Carcass cutability figures bear out the same kind of economic differences, with the best one-fourth of the Hereford steers tested being worth \$100.00 more than the low one-fourth of the cattle tested.

Even while feedlot gain increased, carcass cutability increased and the amount of outside fat decreased, Hereford breeders were able to maintain a high degree of marbling and quality in the best cattle they were producing.

When feedlot and carcass cattle being tested today are compared to those tested four and five years ago, vast improvement is noted in all traits. Such data suggest that increased gain, less fat, more red meat and increased carcass quality can be achieved in one cattle generation if selection pressure is exerted through the use of superior breeding stock.

The 1976 American Hereford Association Conference further proved the importance of frame size in cattle and its relationship to economic beef production. Growth and carcass composition differences between the steers used in this conference were largely explained by frame size differences. Data collected at this conference substantiated that frame size 4 cattle are the most efficient utilizers of foodstuffs towards the production of quality red meat. Cattle either smaller or larger than the frame size 4 animal were not as efficient or as profitable when slaughtered at physiological maturity.

While the carcass traits are important to the beef producer, he must also look at other trait groups associated with efficient beef production. Beef cattle genetics can be divided into three trait groups. These are reproduction, growth and carcass. The relative economic importance of these traits groups is 10, 2 and 1, respectively. Thus, we find that the reproductive traits are by far the most important traits contributing toward efficient beef cattle production.

Reproductive traits have a low heritability so improvement in them through selection is slow. However, in the U.S. we have found vast differences in the reproductive ability of the varying breeds when all are handled in the same manner. Thus, there is evidence that fertility and reproduction under normal U.S. cattle management practices can be a breed asset or a breed liability. Fertility and reproduction efficiency are tied very strongly to frame size and physiological maturity. Cattle that reach physiological maturity at too light a weight cannot produce offspring large enough to meet U.S. market demands. On the other end, cattle that get too big, reach physiological maturity at too heavy a weight and are too old to fall into normal U.S. breeding programs where heifers are bred at 14 to 16 months of age. Many times heifers from these extremely large cattle do not reach physiological maturity and consequently do not show estrus until they are too old to fit good management practices for breeding heifers.

Growth traits, while not as economically important as the reproductive traits, are moderately heritable so when selected for, improvement can be realized. Growth traits affect profit for the producer as well as the feeder. Because they affect profits they are of high importance to the U.S. cattleman in his efforts to produce beef more efficiently.

Carcass traits are highly heritable which accounts for the rapid progress we have made within the breed for these traits. Highly heritable carcass traits, however, take a long time to measure and consequently increase the generation interval and thus slows down the progress that could be made by moving the generations faster.

To summarize, frame size is a compromise. To keep the reproductive traits, the growth traits and carcass traits in biological equilibrium, research indicates animals of the frame size 4 are near optimum. Frame size 4 cattle are efficient, profitable producers of beef for the producer, the feeder and the packer. Cattle which are too small will not fit the needs of the meat industry but by the same token, cattle that are too large do not fit the needs of the producer because of their poor reproductive performance.

Beef is a staple for the working families throughout the U.S. We must produce it as cheaply as possible to keep it a good buy for those who eat it. The beef industry has come a long way in the U.S. the past 100 years.

Backed by sound and practical research, the American Hereford Association and its breeders have strived to produce the kind of animal that fits a biological equilibrium between reproduction, growth and carcass traits. Cattle of moderate size with a sound performance background prove to fit the needs of everyone. Through the breed's extensive research program, Herefords have been able to maintain their number one ranking throughout the world.

THE PROGENY TEST IS MOST VALUABLE

W. Dean Frischknecht

Genetic evaluation of an animal is usually based on (1) pedigree, (2) individual performance, (3) performance of close relatives and (4) progeny testing.

Pedigree information is most useful in selecting young animals before their own performance or their progeny's performance is known. Pedigree is useful in selecting for longevity of production by identifying close relatives that have had a long productive life. Pedigree also is useful in selecting against known inherited defects.

Selection on an individual's performance is most valuable when heritabilities such as growth rate are high. Selecting on individual performance permits rapid turnover of generations.

A good policy is to make initial selections based on pedigree, individual performance, and information on close relatives such as half-siblings. Then progeny test the top individuals thus selected. Progeny testing provides the ultimate information to determine the extent to which a bull is used. The advantage of using progeny test information over pedigree information and individual performance is accuracy.

Selecting by progeny testing permits evaluation of how an animal produces based on the performance of its offspring. This method of testing takes time and money. To be most effective, progeny of several males should be tested so there can be a possibility of identifying a few sires that are outstanding genetically. For a progeny test to have accuracy, 8 to 10 offspring from each sire should be tested.

Progeny testing is the best way to evaluate bulls on their genetic makeup for carcass merit, milk production, and for any possible inherited defects. Traits such as milk production are expressed only in the female even though the male transmits genes for such traits. To determine the genetics of a male for traits expressed only in the female, or for traits of low heritability, progeny testing is the most effective method.

Since the main purpose of a progeny test is to obtain the best estimate of the relative genetic merit of the bulls being tested, it is most accurate if cows of similar breeding are assigned to bulls at random. A superior

set of cows can make a bull look better than he is. If several sires within a herd are to be progeny tested, it is essential that cow groups of equal potential be assigned to each bull. Uniform management of cows and progeny until weaning will increase accuracy of bull evaluation. After weaning, progeny should be handled similarly.

Central Station Progeny Testing

Central progeny testing stations such as the Columbia Basin Agricultural Research Center at Hermiston provide a uniform environment for evaluating differences in performance traits of cattle from many herds over a wide geographical area. Although environmental differences exist before animals arrive at this station, a few weeks are allowed for animals to adjust to uniform rations and environment before the official test begins. This station obtains information on progeny groups which includes pen feed efficiency, individual average daily gain, and carcass merit. This program also acquaints breeders and commercial producers with performance testing procedures.

Growth Rate

Growth rate or rate of gain is of economic importance because of the length of time cattle are on feed. At this station, cattle are carefully weighed at the beginning of the feed test and again at the finish. Every precaution is taken to measure this trait as accurately as possible. Care is taken to equalize fill of cattle before they are weighed, because any error in weighing decreases accuracy of information.

Fill can be equalized fairly well by removing cattle from feed and water for 12 hours before weighing. Two weights taken at the start of the trial and two weights at the finish can be averaged to increase accuracy of initial and final weights.

At this station, most cattle are fed until it is anticipated they will grade "low Choice." This is near the normal market age and weight for most slaughter cattle.

Feed Efficiency

Feed efficiency, sometimes called efficiency of gain, is obtained at this station on a pen basis. Feed consumed in relation to gain of cattle in each pen is determined. This is not as desirable as obtaining individual

animal feed efficiency, but determining individual feed efficiency can be done only when the feed consumed by each animal is known. Individual feed efficiency is determined at Oregon State University on purebred animals going into breeding herds.

Work at several universities indicates considerable difference in feed efficiency during the growth period of young cattle. Usually rapid gainers are the most efficient users of feed. When steers are fed to the same degree of fatness, these differences are much reduced.

Carcass Merit

Carcass merit is of economic importance to the total cattle industry because it determines desirability of product. Much research throughout the U.S. indicates most consumers desire beef of high quality with little fat. A high percentage of lean in comparison to fat is preferred. The lean must be palatable, that is, tasty, tender and juicy.

In selecting for improved carcass merit, all carcasses from cattle fed at this station are graded by a USDA meat grader. In addition to quality grade, "cutability" of carcasses translated into the commercial meat trade indicates that a carcass in the middle of yield grade 2 can yield \$60 more retail meat than a similar weight carcass in the middle of yield grade 4. Most of the industry is striving to produce USDA Choice carcasses in yield grade 2. Such carcasses usually are well muscled with less than .4 inch of outside fat.

Progress Made at This Station

A summary of eight years progeny testing for average daily gain, live-weight per day of age and carcass weight per day of age is shown in the following table:

Year	Average daily gain, lb		Liveweight/day, lb		Carcass weight/day lb	
	Heifers	Steers	Heifers	Steers	Heifers	Steers
1969-70	2.39	2.60	2.08	2.22	1.24	1.34
1970-71	2.42	2.67	2.22	2.31	1.32	1.41
1971-72	2.69	2.76	2.24	2.40	1.32	1.46
1972-73	2.38	2.56	2.15	2.34	1.33	1.42
1973-74	2.15	2.79	2.23	2.45	1.32	1.46
1974-75	2.46	2.76	2.21	2.44	1.33	1.49
1975-76	2.50	2.81	2.16	2.37	1.30	1.43
1976-77	2.68	2.84	2.37	2.53	1.44	1.56

Since these trials were begun in 1968 there has been a gradual but positive increase in frame size of cattle in most progeny groups. Increased weight per day of age points this out.

Progeny Testing Rations

From the time the test was started in 1968 through 1977, cattle were on the ration shown in the following table:

Progeny Test Ration (from 1968-75 a beginning ration slightly higher in protein was fed up to 650 pounds)

Ingredients	to 850 lbs. %	850 lbs. to slaughter %
Alfalfa	15.00	10.00
Beet pulp	10.00	10.00
Steam rolled barley	59.25	66.75
Trace mineralized salt	.75	.75
Limestone	.50	.50
Molasses	7.00	7.00
OSU (40% protein)	7.50	5.00

The 1978 ration used corn silage as the roughage base, and the current ration is again alfalfa. These changes in feed are not too significant.

Compare Sires with Caution

Use caution when comparing different sires potential value, especially between herds. Also, crossbred progeny may benefit slightly from heterosis and indicate a higher value than expressed by straight-bred progeny. Breed differences also must be considered. Not all environments will support extremely large cattle.

Unfortunately, some cattlemen think performance means only growth rate. This is only one characteristic of economic importance. Fertility of breeding stock is most important.

Even though progeny testing has been conducted nationwide for a number of years, there is still much variation in total productivity within each breed and between breeds. Variation is good. It means that productivity can still be improved. Seedstock breeders, producing for other breeders and for the commercial industry can still improve many inherited characteristics.

Participation

During the last 10 years 2,460 cattle have been progeny tested at this station by 72 breeders. The station has provided a valuable service not otherwise available. We recommend the program to all breeders.

Specifications for entering cattle are shown below:

1978-79 ENTRANCE REQUIREMENTS AND INSTRUCTIONS FOR HERMISTON PROGENY TEST

Columbia Basin Ag. Res. Center Phone 503-567-6337; P.O. Box 105 Hermiston, OR 9783

Age: Only calves born from January 1 to May 31 will be accepted. Preferably the calves will have been born February 15 to April 30.

Weight: Minimum weight for heifers will be 350 pounds and for steers 400 pounds. Maximum weight will be 700 pounds.

Marketing: Hereford Association cattle will be marketed at the following weights:

	Full	Shrunk 4%
Steers	1070 - 1135 (approximately)	1027 - 1090
Heifers	970 - 1035	931 - 994

All other cattle will be marketed when it is thought they will grade choice.

Dehorning - Castration: Horned calves will not be accepted. Dehorning should be done no less than 2 weeks prior to delivery at the station. No sign of recent castration should be evident when calves are delivered.

Delivery Dates: October 2, 3, 1978 November 13, 14, 1978 January 15, 16, 1979

Shots: The shots that must be given are as follows:

BVD (Bovine Virus Diarrhea) this should be Jen-Sal or other vaccine made with other than Bovine culture.

PI³ (Parainfluenza-3)

IBR (Bovine Rhinotracheitis)

Septobac (A Fort Dodge product that gives immunization against Pasteurella Multicida Type A & D and Pasteurella Hemolytica Type 1.)

Jen-Sal. Electroid-7 which immunizes against Clostridium Chauvoei, C. septicum, C. novyi, C. sardelli & C. perfringens type C & D.

These shots should be given three (3) weeks before delivery and no later than two (2) weeks before delivery. A second series of shots will be given after delivery.

Calves will not be accepted if they have not been given the necessary shots. A veterinarian's certificate must accompany the calves.

Pen Size: Pens are designed to hold 12 animals. Heifers will not be penned with steers.

Charges: Yardage is 12 cents per day per head. Minimum charge per pen is 72 cents per day. Charges are also made for feed consumed and veterinary expenses, transportation to slaughter house, selling expense and expense of obtaining carcass information.

Feed and yardage will be billed at monthly intervals for first 5 months.

Reservations: Reservations should be accompanied by \$100 deposit which will be applied to feed costs.

T. P. Davidson, A. T. Ralston, J. E. Oldfield and D. W. Weber

Top productive performance by beef cattle is a combined result of a number of things: animals with the inherent ability to produce, an economical and nutritious daily ration and an effective management program. The Umatilla Experiment Station has contributed research to the improvement of all three. The basis for efficient beef production is top quality animals and these are assured through selection programs involving techniques like progeny testing and complete record-keeping, which have been described elsewhere on this program. But the potential for maximum growth only can be achieved if the animals are provided with adequate nutrition, which is measured both by the nutrient requirements of the animals and the nutrient content and availability of the feedstuffs provided. Over the years, changes have taken place in both these criteria. Animal requirements have increased as growth rates and production levels of the animals have increased. At the same time, new basic feedstuffs have become available along with a never-ending array of supplementary and additive materials that have provided a continuing target for nutrition research. This has been accomplished at the Umatilla Station through a series of feeding trials with beef cattle, largely planned by Dr. A. T. Ralston and conducted by Tom Davidson and his staff. These have involved investigations of various grains and hays as basic ration ingredients, and such supplementary materials as proteins, vitamins and mineral mixes, antibiotics and hormones. The trial just completed is number 32 in the series, and dealt with a major, currently available feedstuff—potato waste slurry.

Materials and Methods

A group of 100 yearling steers was stratified according to beginning weight and then randomly assigned to pens of 10 each and placed on ration treatments as follows (Table 1):

TABLE 1. TREATMENT GROUPS - POTATO SLURRY TRIAL

Pen no.	Ration identification	Supplementary treatment
1	Potato slurry ¹ : OSU Supplement ²	10 mg DES/head/day, orally
2	Potato slurry : OSU Supplement	10 mg DES/head/day, orally
3	Potato slurry : Commercial Supplement ³	10 mg DES/head/day, orally
4	Potato slurry : Commercial Supplement	10 mg DES/head/day, orally
5	Barley control ⁴ : OSU Supplement	10 mg DES/head/day, orally
6	Potato slurry : OSU Supplement	none
7	Potato slurry : OSU Supplement	none
8	Potato slurry : Commercial Supplement	none
9	Potato slurry : Commercial Supplement	none
10	Barley control : OSU Supplement	none

¹The potato slurry ration was composed as follows: potato slurry 60%, corn silage 15%, steam-rolled barley 19%, protein supplement (40%) 5% and limestone flour 1%.

²The OSU Supplement consisted of: ground peas 74%, ground alfalfa 5%, soybean oil meal 9%, urea 7%, tricaphos 2%, muriate of potash 2%, salt 1%.

³The Commercial Supplement included: ground barley, urea, tricalcium phosphate, potassium sulfate, limestone flour, trace mineral mix, organic iodide, vitamins A, D and E and choline chloride.

⁴The Barley Control ration was composed: steam-rolled barley 74%, corn silage 20%, protein supplement (40%) 5% and limestone flour 1%.

It will be noted that the trial provided for replication of each ration treatment, i.e. a total of 20 steers were fed each ration variation. Four groups, totalling 40 animals, were fed the potato slurry-based ration supplemented with either the OSU or commercial protein supplement mixes. All of these were compared with a conventional, barley-based control ration which was fed to 20 animals. The barley control ration included the OSU protein supplement only. Initially, all cattle were implanted with Synovex S. Again, all cattle were implanted with Synovex S after 48 days on feed. Trace-mineralized salt and water were available free choice at all times. The feeding trial continued for 109 days.

Feed costs were assigned on the basis of currently prevailing prices. These included, on a ton basis: potato slurry \$7, corn silage \$30, steam-rolled barley \$97, OSU Supplement \$137.85, commercial supplement \$150.60 and limestone flour \$45.40.

Results and Discussion

All cattle were weighed at the start of the trial and at 4-week intervals thereafter. Continuing records were kept on feed consumption. Data on daily gains of the steers and feed conversion efficiency are presented in Table 2.

TABLE 2. CATTLE PERFORMANCE - POTATO SLURRY TRIAL

Pen no.	Ave. daily gain lb.	Feed conversion efficiency lb. feed/lb. gain	Cost/100 lb. gain
1	3.61	6.78	30.90
2	3.55	6.71	30.70
3	3.61	6.53	30.39
4	3.26	6.81	31.70
5	3.41	6.70	33.32
6	3.34	6.89	31.39
7	3.42	6.92	31.50
8	3.35	6.93	31.85
9	3.46	6.53	30.55
10	3.31	7.12	35.30

Generally speaking, as expected, feed conversion and costs followed the animal gain pattern. In other words, the fastest-gaining steers were most efficient in converting feed and did so at the lowest feed costs.

The basic objective of the trial was to investigate the suitability of potato waste as a feed, anticipating that this material will be a continuing feed resource in Umatilla County. The apparent results, which will have to be confirmed by statistical analysis, generally were encouraging, and suggested that potato waste can be a useful and productive ration energy source for fattening cattle if properly supplemented.

One of the important supplementary materials is protein, and, as is usual with ruminant rations, the critical issue is to supply sufficient nitrogen rather than any concern about protein source. The average daily gains for the 8 potato-fed groups (1-4; 6-9) were 3.45 pounds per head as compared with 3.36 pounds per head for the two groups (5, 10) fed the control ration based on steam-rolled barley. Comparable feed conversion efficiency figures were 6.91 pounds and 6.76 pounds respectively for the control and potato-fed lots. The two sources of protein supplementation performed very similarly. Both these supplements have received widespread usage in the north-central Oregon area. The average daily gains and feed conversion efficiencies for the four groups fed the OSU Supplement were, respectively, 3.48 and 6.82 pounds, as compared to 3.42 and 6.70 pounds for the groups fed the commercial supplement.

As might be expected, a fairly consistent response was obtained to administration of diethylstilbestrol (DES). Those lots receiving 10 mg DES/head/day averaged 3.49 lb./head/day gain and 6.71 lbs. feed/lbs. gain, as compared to 3.38 and 6.88 pounds respectively for those lots receiving no continuing hormonal stimulation. These comparative data are summarized in Table 3.

TABLE 3. SUMMARIZED PERFORMANCE DATA - POTATO SLURRY TRIAL

Treatments compared	Weight gains lb./head/day	Feed conversion lb. feed/lb. gain	Cost/100 lb. gain, \$
Control (barley fed)	3.36	6.91	34.31
All potato-fed lots	3.45	6.76	31.12
OSU supplement-fed	3.48	6.82	31.12
Commercial supplement-fed	3.42	6.70	31.12
DES-fed	3.49	6.71	31.40
0 DES	3.38	6.88	32.11

The semi-liquid state of the potato waste caused difficulties during periods of extremely cold weather experienced during this trial. The potato slurry froze and for a 37-day interval December 31 until February 6 the lots normally receiving potato waste were switched to the control ration. The comparisons are felt to be valid because this substitution was consistent across all lots. Moreover, during the first two weigh periods, terminating on December 28, before any ration substitutions were made, the comparisons were similar to those for the complete trial. During the initial 56-day period, the average daily weight gains and feed conversion efficiencies were, respectively, 3.58 and 6.34 pounds for the control groups vs. 3.82 and 5.84 pounds for the potato-fed groups.

The "bottom line" in a feedlot operation is heavily influenced by feed costs. In this trial, the feed cost per 100 pounds gain showed an advantage for potato feeding: \$31.12, as compared to \$34.31 for the barley-fed control lots. The use of the two protein supplements did not influence feed costs, and resulted in identical feed costs per 100 pounds gain of \$31.12. The use of DES improved the cost/gain figures from \$32.11 when no DES was provided to \$31.40 when it was.

Summary

To summarize, the feeding of potato waste slurry, as practiced in this feeding trial, suggests that this feedstuff can provide a practical alternative to grain feeding in the Umatilla County area. This is a different feed from conventional dry rations, however, and requires special handling. The difficulties with its use during periods of prolonged cold weather have been noted.

Cattle response to supplementation of potato rations, and the usefulness of supplementary protein and or orally administered DES are documented in this report.

PROGRAMMABLE CALCULATORS OFFER POTENTIAL

William McReynolds

During the last 10 years, the small electronic calculators have gone from expensive luxuries to inexpensive necessities for anyone making economic decisions. Mrs. Housewife carries one in her purse to calculate the "best buy." By using a pocket calculator, the cattle buyer knows what each animal crossing the scales has cost. The cow-calf producer quite often carries one in the glove compartment of his pickup.

An innovation of the calculator age proving useful to many is the "programmable calculator." These calculators can be programmed to perform a series of mathematical computations in sequence which will provide immediate answers to rather complex problems. The programs, once written can be stored on magnetic cards and re-entered into the calculator when again needed. When combined with a printer, these calculators provide a verification of data entered and print the answer obtained from the question posed.

The programmable calculator is not a computer. It does not have the capability of sorting series of numbers or ranking them in order. Its primary value is for performing series of mathematical computations which will be used repeatedly throughout the year. The programmable calculator without the printer is small enough to be carried around in a jacket pocket. The calculator with a printer can be purchased for less than \$500.

Several companies manufacture programmable calculators. Probably the two leading the field are Texas Instruments and Hewlett Packard. The programming of these two brands is somewhat different so anyone wanting to use one of the programmable calculators would do well to become familiar with one make and concentrate on it.

Several animal scientists and agricultural economists at Washington State University have been investigating the use of these calculators to assist agricultural producers in solving problems which they face on a day-to-day basis. For the most part, we at Washington State University have been working with the Texas Instruments Model 59 programmable calculator.

For Adjusting Performance Records

Programs, both simple and complex, can be answered using the programmable calculator. One of the relatively simple programs which has been programmed at

WSU is for adjusting beef performance records. Calves are different ages when weaned and their dams are different ages. Because of these differences, adjustments must be made to compare the calves had they been the same age and to compensate for weaning weight variation related to milk production.

The formula used for computing weaning weight is:

$$205 \text{ Day Adjusted Weight} = \frac{\text{Actual weaning weight} - \text{Birth weight}}{\text{Days of Age}} \times 205 + \text{Birth weight} + \text{Age of dam adjustment}$$

This formula adjusts calves to a common days of age. The additive age of dam factor makes adjustments related to the age of the cow. Performance records can be adjusted by hand or this can be done with a calculator. When hand calculations are made, or for that matter when information is entered into a calculator, there is a chance that errors might be made. By using the programmable calculator, once the formula is programmed, unless errors are made in entering the data, the calculations always will be made accurately and in exactly the same manner. By programming the printer to print the input data, verification easily can be made. An example using the adjusted 205-day weight formula is the case of a bull calf born February 6 from a 2-year old dam, weaned October 1 weighing 538 pounds. The procedure for calculating this is as follows:

$$205 \text{ Day adjusted weight} = \frac{538 - 76}{237} \times 205 + 76 + 60$$

The number of days between the birth date and weaning date can be obtained by the use of a chart where the calendar days are numbered in consecutive order and subtraction made between the two dates. Actual birth weights are desired but average birth weights recommended by the breed association usually are used since most cattlemen do not weigh calves at birth. For the age of dam adjustment factors, those recommended by the breed associations are used when available. Those breeds which have not recommended specific age of dam adjustment factors are using those recommended by the Beef Improvement Federation.

In calculating adjusted weaning weights with the programmable calculator, the weaning weight, birth weight and age of dam adjustment factors are entered in the calculator storages. This is done by entering the numbers and indicating where they are to be stored. The weaning and birth dates are entered and the adjusted weight is printed on a tape. The weight per day of age is also computed and printed. (See sample tape). Alphabetical labeling is used to identify the input and computed items. In calculating the adjusted weaning weight of the next calf, only the individual weight information and birth date need be entered as the weaning date can be left constant for all animals

in one weaning group. By using this calculator, a cattleman could weigh the calves from a 50-cow herd and in less than an hour make the necessary calculations for comparing them. The same information can be obtained by participating in a computerized performance program through the breed associations or the Beef Cattle Improvement Association but a delay of at least a week is required for mailing and processing these records.

Print Out of Adjusted Weaning Weight

1001.1978	
206.1978	
237.	D
538.	WM
76.	BM
60.	ADD
476.	AWM
536.	AAWM
2.27	WDA

For Other Types of Programs

Several other types of programs have been developed by Washington State University faculty members. One question often asked by cattlemen is "why the big price differential between steer and heifer calves." A program developed considers the feed efficiency differential (based on research) and the price differential which usually exists between slaughter heifers and steers. Calculations are made indicating the value of heifers based on current steer prices.

R. L. Preston, chairman of the Animal Sciences Department, developed a method where if the composition of a feed is known, the value relative to other feeds can be calculated. The feed value is based on the cost of energy, protein, calcium and phosphorus in the feed relative to the price of obtaining these nutrients from basic feeds used in the area.

Another program which is a time-saver, is a ration composition program. The quantities and compositions of up to eight ingredients can be entered into the storages and the energy, protein, calcium, phosphorus and price of the ration

will be computed. An operation which would otherwise require at least a half hour can be done in less than five minutes. If the ration as calculated is low or high in one nutrient, an adjustment can be made by changing the quantity of one or more feeds and recalculating.

Bill Pietsch, Extension economist, developed a "Break Even Price Analysis Worksheet" for helping producers decide whether to retain calves for marketing in the spring or to sell them in the fall. This can be computed by going through the indicated procedure in the break even price analysis worksheet or the programmable calculator can be used and the computations made, based on the assumptions used in the program. The price of feed, the quantity required or any of the other assumptions can be changed by entering the desired changes in the indicated storages and recomputing.

What Does the Future Hold?

Some producers are thinking about the possibility of the mini computers. Perhaps in future years innovative livestock producers will own their own computers. The programmable calculator could be of a good deal of assistance to those who would like a greater degree of sophistication than the regular pocket calculator but are intimidated by the mini computer. The programs which could be developed are about as numerous as the imagination of the person doing the programming. All programs developed by Washington State University faculty members are available to those interested in obtaining them.