


BEEF CATTLE PERFORMANCE SELECTION IN CANADA

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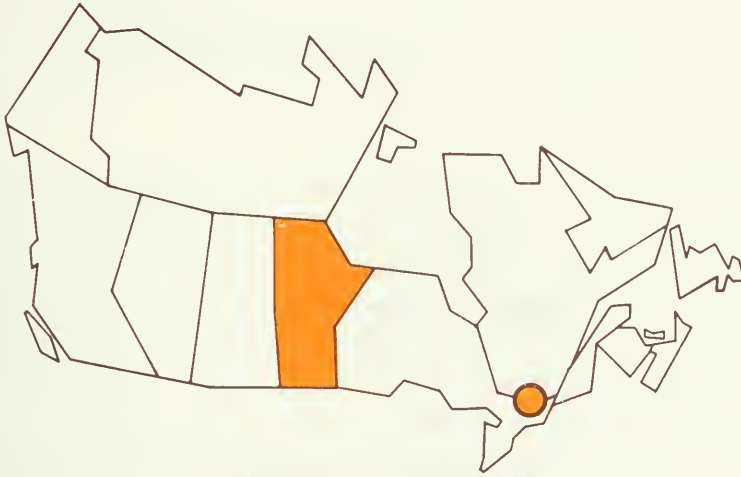


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CANADA / MANITOBA

BEEF CATTLE PERFORMANCE SELECTION

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To obtain further information on enrolling herds in a recording and selection program, contact your local agricultural representative

BEEF CATTLE PERFORMANCE SELECTION

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More pounds to market in less time and at less cost is the challenge of the future for the beef cattle industry. Beef producers are faced with tremendous pressures from such things as labor problems, large capital requirements and alternative uses for lands resources, as well as improvements in other classes of livestock and in grain production. They can no longer afford 75 percent calf crops averaging 400 pounds, with an average feedlot gain of only 2 pounds a day.

Improving the genetic profit potential of the cow-calf operation must become the major concern of the beef cattle industry. Although improvement of rations and other aspects of animal management will be important, the extent to which they will increase production depends, primarily, on the inherited capacity of the cattle to reproduce and develop. Only by improving the genetic potential to produce more and better beef on less feed will the industry make lasting improvement and be able to keep pace with the future.

WHAT IS RECORD OF PERFORMANCE?

The primary purpose of a herd improvement program is to help you improve the performance of your herd in terms of your needs and those of the cattle feeder and the beef consumer. Herd improvement is based on the long-established practice of selecting superior bulls and mating them to the best cows available. Future success will depend more and more on improved accuracy in

identifying superior animals. Research has shown that systematic measurement of performance and evaluation of the records give the necessary information for more accurate identification of superior bulls and cows.

Performance is the sum total of all traits that are of economic value. These include:

- fertility;
- rate of gain;
- mothering or nursing ability;
- efficiency of gain;
- carcass desirability; and
- longevity.

Record of Performance is the systematic measurement and recording of these traits that contribute to the efficient production of good beef. Lesser traits such as hair color, shape of head or leg length may be considered. However, selection for these lesser traits slows progress in improving characteristics that are more important economically.

FACTORS THAT DETERMINE RATE OF IMPROVEMENT FROM SELECTION

The rate of improvement from selection is determined by:

- heritability;
- selection differential;
- genetic association between the traits; and
- generation interval.

Heritability is the proportion of the differences measured or observed between animals that are transmitted to the offspring. The higher the heritability for any trait, the greater the rate of genetic improvement or the more effective selection will be for that trait.

Selection differential is the difference between the selected individuals and the average of all animals from which they were selected. The degree of differential is influenced by the proportion needed for replacement, the number of traits that are considered in selection, and the differences or variations that exist among the animals.

Genetic association between traits refers to the relationship, or correlation, between inherited characters, such as feed conversion, to rate of growth.

Generation interval is the average age of all parents when their progeny are born. Generation interval averages 5 years in many beef cattle herds.

The expected rate of genetic improvement in beef cattle is relatively slow. This is mainly because of the low reproductive rate, the large number of traits of economic value and the long generation interval. The low reproductive rate (which makes it necessary to keep a high proportion of the offspring, especially females, as replacements) and the large number of traits involved limit the amount of selection that can be practiced (selection differential). The major encouraging feature is that most of the economically important traits seem to have reasonable high heritabilities (fertility being the most notable exception).

The average heritability estimates obtained from many research herds for some of the economically important traits are shown in Table 1. These heritability estimates are the part of the difference between the selected individuals and the average of the population from which they were selected that is actually transmitted to the offspring of the selected individuals. For example, if the selected bulls and heifers were 30 pounds above herd average in weaning weight, their progeny would be expected to average 9 pounds heavier than if no selection had been practiced for this trait ($30\% \times 30 = 9$).

TABLE 1. ECONOMICALLY IMPORTANT TRAITS *

Trait	Heritability (%)
Calving interval	not heritable
Weaning weight	30
Feedlot gain	45
Efficiency of gain	40
Yearling weight	50
Carcass traits: carcass cut-out	25 - 50
rib-eye area	70
tenderness	60

* Breeding for Beef Production, Publication 1373, C.D.A.

PERFORMANCE TRAITS, THEIR INHERITANCE AND IMPORTANCE

REPRODUCTIVE PERFORMANCE OR FERTILITY

A high level of reproductive performance or fertility is basic to efficient beef production. No single factor in commercial cow operations has a greater bearing on production costs than weaning age and percentage calf crop do. Because of the importance of fertility to efficient production, it must command some attention in a breeding program, even though research results indicate that heritability is low and rate of improvement will be slow. The management practice of a limited breeding season and culling open cows, combined with adequate bull-cow ratios, nutrition, and disease control, will improve fertility faster than will selection as a heritable trait.

Time of conception is extremely important. Analysis of the information collected under the R.O.P. program indicates 1.75 pounds per day can be used as an average gain to weaning for most herds. For every heat cycle a cow does not conceive, it

TABLE 2. RELATIONSHIP OF WEANING WEIGHT, PERCENTAGE CALF CROP PER COW BRED AND NECESSARY SELLING PRICE TO MEET OPERATING COSTS

Weaning wt in lb		500	450	425	400	375	350
% Calf crop 90	a)	450	405	382	360	337	315
	b)	15.5	17.2	18.3	19.4	20.7	22.2
	c)	20.0	22.2	23.6	25.0	26.7	28.5
80	a)	400	360	340	320	300	280
	b)	17.5	19.4	20.5	21.8	23.3	25.0
	c)	22.5	25.0	26.4	28.1	30.0	32.1
70	a)	350	315	297	280	262	245
	b)	20.0	22.2	23.5	25.0	26.7	28.5
	c)	25.7	28.5	30.3	32.1	34.3	36.7

Lines (a)—pounds of calf weaned per cow bred ;

(b)—calf selling price per pound required to meet operating cost of \$70 per cow ;

(c)—calf selling price per pound required to meet operating cost of \$90 per cow.

Explanation—When the average weaning weight of the weaned calf crop is 500 pounds, and the percentage calf crop per cow bred is 90 percent, the actual weight of calf weaned per cow in the herd is 450 pounds. With an operating cost of \$70 per cow, calves must sell for 15.5 cents per pound. With an operation cost of \$90 per cow, calves must sell for 20.0 cents per pound.

means her calf will be 21 days × 1.75 pounds, or 37 pounds, lighter at weaning.

Mothering or Nursing Ability

Weaning weight of the calf is used as a measure of mothering ability. Selection of bulls and replacement heifers that have heavy weaning weights relative to the herd average will lead to genetic improvement in mothering ability. Selection for heavy weaning weight also selects for the calf's own ability to grow. Selection for mothering ability is reasonably effective as cows weaning calves heavier than average in 1 year tend to wean calves heavier than average in succeeding years. Review of the information collected in the herds enrolled on R.O.P. programs shows that calves from cows in the top one third of the herd are able to gain $\frac{2}{3}$ pound more to weaning than calves from the bottom one third of the

TABLE 3. GAINS TO WEANING—1970-71 R.O.P. PROGRAM

Preweaning	No. of calves	205-day wt * top $\frac{1}{3}$	205-day wt * all calves	205-day wt * bot-tom $\frac{1}{3}$	Difference between top and bottom
			pounds		
Males	16,350	575	498	422	153
Females	18,082	519	453	387	132
Sex difference		56	45	35	

*Adjusted weight.

herd. At 7 months, or 210 days of age, this represents nearly 140 pounds of beef.

For all practical purposes the weight of 500 pounds adjusted to the 205-day weight can serve as a national average for male calves to weaning, and 455 pounds adjusted 205-day weight for female calves. This 45 pounds difference is due to sex influence alone. In a commercial herd where steer calves replace the male calves, the average daily gain to weaning will be lower.

For a calf to weigh 475 pounds at 205 days of age he must weigh 75 pounds at birth and gain 1.95 pounds per day. Less than half the cows in the herds are producing at this rate at the present time.

The two cows illustrated (Figure 1) are three-quarter sisters from the same calf crop and have been managed as nearly alike



Figure 1. The differences in lifetime production of cows are large. Cow A (top) produced six calves with an average weaning weight of 470 pounds; Cow B (bottom) produced six calves with an average weaning weight of 370 pounds.

as possible. Both calved first as 2-year-olds and have calved each year since. Cow A has produced 2,820 pounds of calf. Cow B has produced 2,220 pounds. This is a total difference of 600 pounds in six calves. If these cows produce four more calves each this difference will reach 1,000 pounds which, if valued at 35 cents per pound, is \$350.

Growth Rate

Growth rate is usually measured in a post-weaning feeding test. Research has shown ability to grow is highly heritable and can be improved by selection. Feeding tests on the ability to grow have shown wide differences between individual animals and sire groups fed and managed under uniform conditions. The following examples indicate some of these differences and the importance of having test information available when selecting a herd sire.

Results of the R.O.P. home test program show a $\frac{2}{3}$ pound average variation in gain during the feeding period between the calves in the top third of the herd and those in the bottom third. In a 168-day feeding period this amounts to over 100 pounds of beef. Combined with the over 100 pounds difference to weaning, this means at 1 year of age well over 200 pounds difference in production between the top and bottom one third of the cowherd.

TABLE 4. DIFFERENCES BETWEEN HIGHEST- AND LOWEST-GAINING BULLS AT AN INDEXING CENTER

	1966	1967	1968	1969	1970
	lb/day	lb/day	lb/day	lb/day	lb/day
Highest-gaining bull	4.09	4.04	3.89	4.07	4.16
Lowest-gaining bull	1.82	2.18	1.61	1.87	1.80
Difference	2.27	1.86	2.28	2.20	2.36
Difference in beef produced in 140 days	319 lb	260 lb	319 lb	308 lb	330 lb

TABLE 5. DIFFERENCES BETWEEN HIGHEST- AND LOWEST-GAINING ONE THIRDS OF HERD AT AN INDEXING CENTER

	1966	1967	1968	1969	1970
	lb/day	lb/day	lb/day	lb/day	lb/day
Top third	3.17	3.26	3.23	3.36	3.46
Bottom third	2.39	2.55	2.42	2.48	2.64
Difference	0.78	0.71	0.81	0.88	0.82
Difference in beef produced in 140 days	109 lb	99 lb	113 lb	123 lb	115 lb

Not only has the indexing center noted marked differences in gains among individual test bulls but also among sire groups, indicating differences in the ability of herd bulls to sire fast-gaining cattle. A comparison of 12 Hereford sire groups (1966-67) follows:

Top-gaining sire group—average daily gain	3.42 lb/day
Lowest-gaining sire group—average daily gain	2.40 lb/day
Difference	1.02 lb/day

On the 140-day test period this difference of 1.02 pounds per day means 143 pounds difference per bull, or a total of 715 pounds for the five animals in the top-gaining sire group over the gains of bulls in the lowest-gaining sire group. These gains have been consistently close to those in tests conducted since 1967.

Efficiency of Gain

Efficiency of gain and growth rate are closely related. Cattle that gain rapidly usually produce more-economical gains.

Since rate of gain is a good indication of economy of gain, breeders may depend on differences in rate of gain as an indication of economy of gain.

In the Bassano Test the feed conversion difference between the high and low Hereford sire progeny group was 1.56 pounds of feed per pound of gain, or a difference in feed cost of 4 cents per pound. As in previous years, the sire group with the best

A.D.G. (average daily gain) on feed also had the best feed conversion.

	A.D.G. lb/day	Feed/lb gain, lb	Feed cost/lb gain
Top-gaining group	3.00	6.16	15.5¢
Lowest-gaining group	2.48	7.72	19.5¢

Carcass Desirability

Carcass merit is of fundamental importance to the beef cattle industry. It is highly heritable and rapid improvement can be made through selection. Selecting for conformation should give maximum emphasis to development of muscling in the regions yielding higher-priced cuts—the back, loin, rump and round. Recent research information indicates that selection for increased rate of gain will result in increased carcass value.

Longevity

This is not a highly heritable trait but still should be considered. The fewer replacements that are needed, the greater the selection pressure that can be applied. Cost of producing replacement heifers must be figured in production costs. Every calf a cow produces reduces this overhead cost against her.

Average age of the cow herd influences the weaned weight of the calf crop. It is important that the average age of the herd be near the peak production age of 6 or 7 years.

PERFORMANCE PROGRAMS

FEDERAL-PROVINCIAL R.O.P. HOME TEST PROGRAM

This program, sponsored by the federal and provincial departments of agriculture, is designed for beef cattle producers interested in developing a set of production records on their cow herds. The information from these records to be used in culling poor-producing cows and selecting replacement heifers.

The procedure for establishing these records is to weigh and calculate the gain of each calf at weaning and after a 168-day feeding period. These gains are then compared, or indexed, against the rest of the calves within the same herd that are born within 90 days and managed alike. No attempt to compare herds can be made under this program. Examples of the information obtained are shown in figures 2, 3 and 4.

Use Your Records

Many producers are not keeping cow sheets up to date. Some are not keeping them at all. The result is that you make limited progress or none at all. The following two charts are actual situations. The two breeders involved have not changed breeds and have not changed management techniques, i.e., creepfeeding.

NAME OF COW		
GAIN-Fast Asset		
REGISTRATION NO.	DATE OF BIRTH	TATTOO
439270	March 1, 1961	XYZ 1S
BRED BY		
GAIN-FAST FARMS INC.		
PURCHASED FROM		

FEDERAL - PROVINCIAL

H. OF A. NO.	HORN BRAND
	10

RECORD OF PERFORMANCE FOR BEEF
CATTLE BREEDING AND PROGENY
PERFORMANCE RECORD

TEST RECORD OF COW						
WEANING INDEX	RATE OF GAIN INDEX	CONFORMATION SCORES		BIRTH TO END OF TEST		
		A	B	A.O.G.	INDEX	RATING (e.g. 3/10)
110	114	2	2	2.22	112	2/20

SIRE		DAM		CALF													
NAME	REGISTRATION NO.	TATTOO	DATE OF SERVICE	DATE OF BIRTH	SEX	TATTOO NO. AND YEAR LETTER	NAME	REGISTRATION NO.	WEANING INDEX	SCORE A	SCORE B	RATE OF GAIN INDEX	CONFORMATION SCORES	A.O.G.	INDEX	RATING (e.g. 3/10)	REMARKS
Gain-Fast Prince	397641	XYZ 1T	Pasture	1 4 63	M	1U	Gain-Fast Prince	105	2	104	3	2.00	104	7/20			good calf, no problems
Gain-Fast Prince	397641	XYZ 1T	1963	25 3 64	F	7V	Gain-Fast Prince	109	2	106	2	2.03	107	5/16			good calf-replacement
Gain-Fast Prince	397641	XYZ 1T	1964	26 3 65	M	8W	Gain-Fast Prince	103	1	110	1	2.10	107	3/12			good calf
Gain-Fast Prince	397641	XYZ 1T	1965	15 3 66	F	3X	Gain-Fast Prince	100	2	105	3	2.01	103	8/18			replacement heifer
Gain-Fast Prince	397641	XYZ 1T	1966	30 3 67	F	10Y	Gain-Fast Prince	104	3	104	2	2.00	104	7/17			" "

AGE	CONDITION	HEALTH	SOLO FOR	RETURNS	GENERAL REMARKS (Treatment, ease of calving etc.)	SCORE A Conformation score of weaning	COW NO.
DISPOSAL OF COW						SCORE B Conformation score of approx. 1 year old	
PL 149							

Figure 2. The type of record common on the top producing cows in a herd. These are the calibre of cows from which heifers and herd bulls should be selected.

Figure 3. The type of record often made by the poor producing cows in a herd. The production ability of this cow was apparent in her first calf and she could have been culled at that time.

NAME OF COW		
GAIN-FAST LIABILITY		
REGISTRATION NO.	DATE OF BIRTH	TATTOO
439275	April 15, 1961	XYZ 17S
BRED BY		
GAIN-FAST FARMS INC.		
PURCHASED FROM		

FEDERAL - PROVINCIAL

H. OF A. NO.	HORN BRAND
	17

RECORD OF PERFORMANCE FOR BEEF
CATTLE BREEDING AND PROGENY
PERFORMANCE RECORD

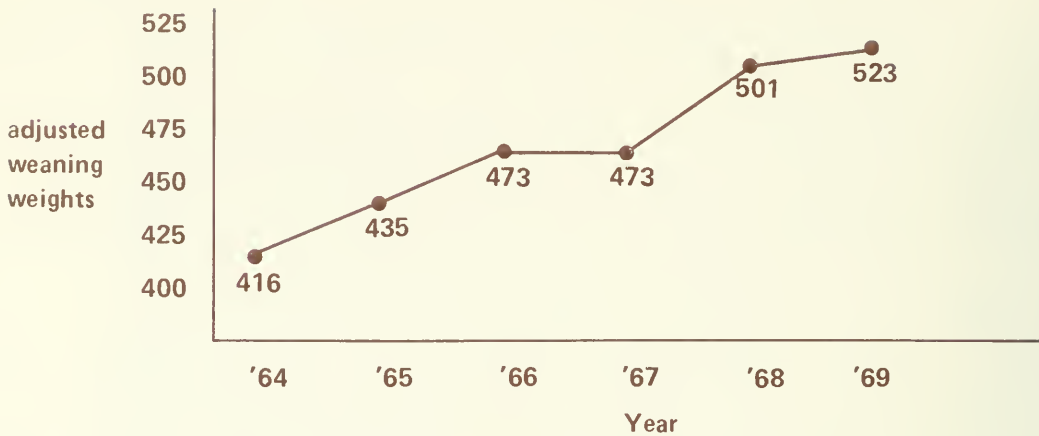
TEST RECORD OF COW						
WEANING INDEX	RATE OF GAIN INDEX	CONFORMATION SCORES		BIRTH TO END OF TEST		
		A	B	A.O.G.	INDEX	RATING (e.g. 3/10)
98	103	3	3	1.98	100	11/20

SIRE		DAM		CALF													
NAME	REGISTRATION NO.	TATTOO	DATE OF SERVICE	DATE OF BIRTH	SEX	TATTOO NO. AND YEAR LETTER	NAME	REGISTRATION NO.	WEANING INDEX	SCORE A	SCORE B	RATE OF GAIN INDEX	CONFORMATION SCORES	A.O.G.	INDEX	RATING (e.g. 3/10)	REMARKS
Gain-Fast Prince	397641	XYZ 1T	Pasture	1 5 63	M	19U	Gain-Fast Prince	89	3	97	3	1.80	95	15/20			calving problem
Gain-Fast Prince	397641	XYZ 1T	1963	19 4 64	M	21V	Gain-Fast Prince										died at birth
Gain-Fast Prince	397641	XYZ 1T	1964	13 6 65	F	27W	Gain-Fast Prince	78	4	89	4	1.50	80	19/20			very poor calf-culled
Gain-Fast Prince	397641	XYZ 1T	1965	1 4 66	F	17X	Gain-Fast Prince	90	3								Sold for beef with mother

AGE	CONDITION	HEALTH	SOLO FOR	RETURNS	GENERAL REMARKS (Treatment, ease of calving etc.)	SCORE A Conformation score of weaning	COW NO.
DISPOSAL OF COW	5	fat	good	slaughter	poor producer	SCORE B Conformation score of approx. 1 year old	
PL 149							

Average weaning weights, 1964-69
All adjusted to 205 days (No creepfeed)

PRODUCER 1



PRODUCER 2

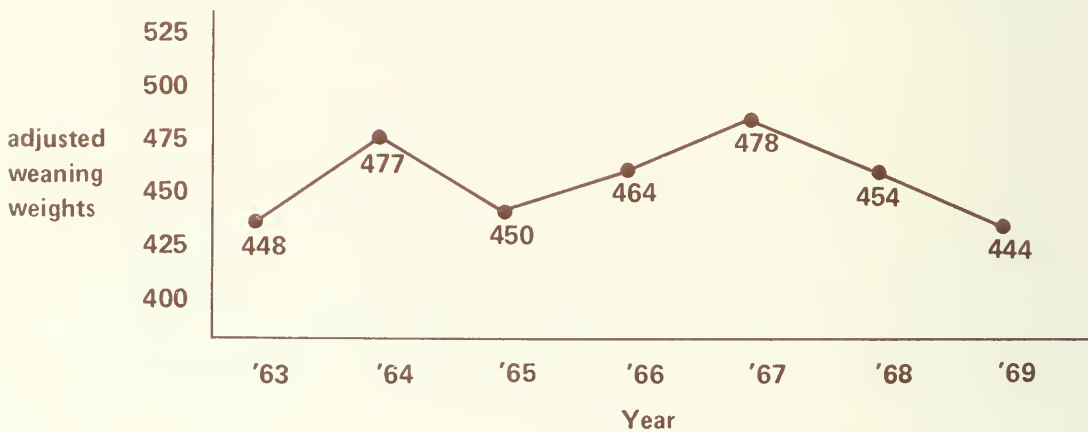


Figure 4 Producer No. 1 (upper graph) uses his records for culling and selection of cows. Producer No. 2 (bottom graph) has kept poor producing cows in spite of consistently below-average indices.

Central Bull Test¹

The testing program conducted at a Central Bull Testing Station, or Indexing Center, is designed to provide a breeder with the opportunity to compare the gainability of a sample of his herds' offspring with calves from other breeders' herds.

¹In Manitoba this program is sponsored by the Manitoba Beef Cattle Performance Association Inc. in cooperation with the federal and provincial departments of agriculture and National Feeds.

Under this program a group of bull calves, preferably five, sired by one bull and born within 90 days, are fed and managed under uniform conditions for 168 days to measure their rate of gain. The information collected on the sire group provides a breeder with the opportunity to assess his herd sires' ability to transmit the characteristics of economic importance.

TABLE 6. COMPARISON OF TWO SIRE GROUPS,
MANITOBA BEEF CATTLE INDEXING CENTER, 1967-68

Lot No.	Birth date	On test wt, lb	Off test wt, lb	140-day gain, lb	A.D.G., lb/day	Index	wt/day of age, lb	Index
Sire Group A								
1	Mar 13	675	1060	385	2.75	95	2.66	103
2	Apr 8	605	1043	438	3.13	108	2.80	109
3	Mar 31	658	1095	437	3.12	108	2.87	112
4	Apr 7	603	1100	497	3.55	122	2.94	114
5	Apr 24	498	980	482	3.44	119	2.74	107
Sire Group B								
6	Mar 9	650	1055	405	2.89	100	2.62	102
7	Mar 23	618	940	322	2.30	79	2.42	94
8	Mar 21	648	1013	365	2.61	90	2.59	101
9	Apr 15	540	870	330	2.36	81	2.38	93
10	May 3	533	925	392	2.80	96	2.66	103

The bulls in sire group A gained an average of 85 pounds more per bull, and a total of 425 pounds more for the group, than the bulls in sire group B.

As research tells us that about a quarter of this superiority can be expected in the offspring, the value of this information to the breeders who owned sires A and B and to individuals wishing to purchase bulls from these groups is rather obvious.

Commercial Cattle Program

This program is designed as a home test program for the commercial cattle industry. Sponsored by the provincial Department of Agriculture and the provincial Beef Cattle Performance

Association, it provides participants with the opportunity to develop a set of individual production records of their cow herds. The procedure is for the owner to identify each cow and calf, weigh the calves at weaning, and provide this information to the Department of Agriculture for processing. If calves are available at 12 months they can be reweighed.

The key to this program is to use R.O.P. tested sires. The greatest portion of improvement possible in a commercial herd must come from the bulls. Cow records indicate poor producers, whose elimination gives immediate improvement, but lasting genetic improvement must come from the sires.

Further information concerning this commercial program can be obtained from your local agricultural representative.

UNDERSTANDING PERFORMANCE PROGRAMS

As cattlemen become more conscious of performance testing programs, and place more emphasis on them, it becomes extremely important that they have a good understanding of these cattle and what they can do for them.

The purebred breeder has the responsibility of making a thorough study of the program to enable him to make maximum use of the information he receives. This information will help him produce bulls that will continue to increase the genetic profit potential of the commercial cattle industry.

The commercial cattleman has the responsibility of realizing that by all odds the bull is the most effective way to make genetic progress. Over a period of years, 90 percent of the genetic improvement in a commercial herd will come from the bulls used. The producer must understand enough about the information available on tested cattle to be able to tell which breeders are doing a good job of performance selection and which of their bulls have the most potential to improve his herd.

It is important to understand and remember that:

Performance testing does not change a bull. He is exactly the same bull as he would be if he wasn't tested, except that there is a record of how the animal has performed on a test designed to measure his potential in the traits of economic importance.

- A performance-tested bull will not work miracles, or make up for bad management.
- The home test program information applies only to the one herd and cannot be used to compare herds.

The Indexing Center program allows comparison of the bulls' rate of daily gain. Differences in preweaning environment can make weight-per-day-of-age comparisons misleading.

INDEX—WHAT IT MEANS

In order to understand the information available on performance-tested cattle, the meaning of the word "index" must be understood. "Index" is used to indicate how much a bull or female differs from the other individuals in a herd of the same age-group and sex, fed and managed under the same conditions. The index is expressed as a percentage. An index of 100 means that the animal is equal to the average of the group for whatever trait the index is calculated. An index of 110 means that animal is 10 percent better than the average of the group in which it is tested. An index of 85 means that the animal is 15 percent below the average of the group.

PURCHASING PERFORMANCE-TESTED CATTLE

Performance bulls are more numerous now than ever. The big problem when purchasing them is in deciding how they'll work in your herd.

First, you need to review the economically important traits, which have been discussed on previous pages. This is especially important now with the costs of producing a calf at an all-time high.

It is essential that the bulls you use will sire calves that continue to grow to 1100 or 1200 pounds without excessive fat cover. The most important trait to the cowman's profit is gaining ability, or the genetic power to grow fast and add pounds more efficiently.

Many cattlemen think that they can't find growthy bulls that will sire fast-gaining calves, while maintaining or increasing conformation or type. This isn't true. The bulls that will do both jobs aren't easy to find, but they are available if you look long enough and have records to check.

SOURCES OF TESTED CATTLE

Indexing Center

Cattlemen wishing to purchase tested bulls with records and conformation will find them available at the numerous indexing centers located across North America. The bulls at an indexing center have been fed and managed under the same conditions since they arrived there. Consequently, their average daily gain index makes a sound basis for selection. By referring to Table 6, a sample of the information available on these test bulls can be studied.

Home Test Cattle

Indexing centers will not be able to supply enough tested bulls to meet more than a small part of the demand from the cattle industry. Cattlemen will have to become used to buying most of their tested bulls and all tested females from herds on the home test program.

It is extremely important to remember that on a home test program the cattle are fed and managed under a different set of conditions on each farm. The gains recorded apply only to the cattle on that farm. There can be no comparison between herds. The important thing is how these animals have compared in their management group and this is what the index tells you.

Much of this home test information is of interest only to the breeder of the cattle, and is not of great concern to the individual interested in purchasing the cattle. Only the weaning index, the rate-of-gain index and yearling index are of real importance to the prospective purchaser.

It can be seen that bull 25V performed 20 percent above the average of this group from birth to end of test. If he meets the visual requirements of the purchaser he definitely would be the bull to buy.

Bulls 27V, 57V and 18V were well above the average of the test group from birth to end of test. There are some small differences in their weaning and rate of gain indexes, and the choice of bull would depend on the buyer's herd requirements. In the interest of producing heavy weaning calves, 27V should probably be considered as the poorest choice of the three.

Bull 39V had an excellent weaning index but has a 12

TABLE 7. IMPORTANT INFORMATION IN BULL SELECTION

Calf tattoo	Weaning index	Rate of gain index	Yearling index	Rating
25V	119	125	120	1
27V	102	115	108	2
57V	111	102	107	3
18V	112	105	106	4
39V	113	88	101	5
29V	109	101	100	6
35V	97	92	95	7
32V	91	96	91	8
58V	92	86	90	9
12V	80	89	82	10

percent below average rate of gain index.

Bull 29V had a 9 percent above average index at weaning and was average in the other indexes and probably would be useful in some herds.

Bulls 35V, 32V, 58V and 12V should not be used in herds interested in the traits of economic importance.

SUMMARY

Record of Performance is an additional tool to be used in a cattle breeding program leading to more economical production of more desirable beef. It is simply a record-keeping program designed to identify superior-producing animals in the herd. In no way does the program change the animal; it simply gives us a record of the individual's performance on a test studying the traits of economic importance.

Heritability and relative economic importance determine the attention each trait should receive in selection. The greater the number of traits selected, the less progress that can be made for any one trait. Maximum selection should be used for the traits of greatest economic value.

The accumulated information from tested herds shows the tremendous differences in production of individuals fed and managed under uniform conditions. When it is realized that a portion of these differences, depending on the heritability of the trait, is

passed from parent to offspring, the value of records when selecting breeding stock becomes readily apparent. With the present programs available, both purebred and commercial cattlemen have the opportunity to use performance selection in their herds.

It must be remembered that lasting genetic improvement must come from the bulls used. Cow record-keeping programs will identify poor producers, but each new herd sire must have superior performance to the previous sire if continued genetic progress is to be made. Rate of genetic improvement is slow, yet it tends to be permanent in nature and accumulates from year to year and is transmitted to future generations. Thus, over a period of years, production in a herd or breed subjected to systematic selection should be superior to that where no such effort is made.



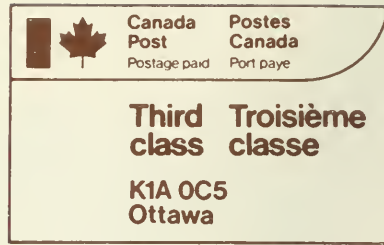
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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:
LINEAR		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
AREA		
square inch	x 6.5	square centimetre (cm ²)
square foot	x 0.09	square metre (m ²)
acre	x 0.40	hectare (ha)
VOLUME		
cubic inch	x 16	cubic centimetre (cm ³)
cubic foot	x 28	cubic decimetre (dm ³)
cubic yard	x 0.8	cubic metre (m ³)
fluid ounce	x 28	millilitre (mℓ)
pint	x 0.57	litre (ℓ)
quart	x 1.1	litre (ℓ)
gallon	x 4.5	litre (ℓ)
bushel	x 0.36	hectolitre (hℓ)
WEIGHT		
ounce	x 28	gram (g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (t)
TEMPERATURE		
degree fahrenheit	°F-32 x 0.56 (or °F-32 x 5/9)	degree Celsius (°C)
PRESSURE		
pounds per square inch	x 6.9	kilopascal (kPa)
POWER		
horsepower	x 746 x 0.75	watt (W) kilowatt (kW)
SPEED		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
AGRICULTURE		
bushels per acre	x 0.90	hectolitres per hectare (hℓ/ha)
gallons per acre	x 11.23	litres per hectare (ℓ/ha)
quarts per acre	x 2.8	litres per hectare (ℓ/ha)
pints per acre	x 1.4	litres per hectare (ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare (mℓ/ha)
tons per acre	x 2.24	tonnes per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

Examples: 2 miles x 1.6 = 3.2 km; 15 bu/ac x 0.90 = 13.5 hℓ/ha

INFORMATION
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IF UNDELIVERED, RETURN TO SENDER

EN CAS DE NON-LIVRAISON, RETOURNER À L'EXPÉDITEUR