backfat thickness and body weight in SWINE SELECTION

PUBLICATION 1383 1970

Agriculture Canada

Copies of this publication may be obtained from
INFORMATION DIVISION
CANADA DEPARTMENT OF AGRICULTURE
OTTAWA
K1A 0C7

This publication replaces publication 1211, PROBING FOR BACK-FAT THICKNESS IN HOGS, 1964.

Printed 1970
Reprinted 1972
10M-0105-36106-7:72
Cat. No.: A53-1383

backfat thickness and body weight in SWINE SELECTION

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An effective selection program is the key to building a herd of swine with superior productive efficiency. It must be based on sound evaluation of performance traits and produce genetic change in the herd in the direction of increased economic merit. It is an asset to have a simple program involving the minimum number of essential traits that will respond to selection.

The purpose of constructive breeding is to guide genetic change in a herd toward carefully planned goals. Genetic change in a breeding herd is inevitable because to maintain the herd size animals have to be added to replace those removed by death or by culling. Progress can be made if the breeder selects the replacements on the basis of superiority in the desired traits. This publication presents the essentials of a practical swine selection program.

IMPORTANT ECONOMIC TRAITS

The following traits are economically important in swine production, but they should not be given equal consideration in a selection program.

- Pigs marketed per sow (influenced by fertility, litter size, and survival rate)
- Weaning weight
- Age at market (growth rate)
- Carcass quality
- Feed efficiency

Factors such as soundness of feet and legs, udder development, number of teats, and freedom from inherited defects contribute to overall soundness.

Traits associated with reproduction and lactation, such as litter size at birth, number of pigs weaned, and weaning weight, are extremely important in efficient production. But these traits are not highly heritable and cannot be improved to any extent by selection. For example, selecting replacement boars and gilts out of the largest litters produces little increase in litter size in the next generation. Therefore, do not attempt improvement of litter size by selection, but use it as a basis for appraising the relative level of management, nutrition, and disease control in your herd and for culling sows that are nonproductive. The breeding system and management procedures (housing, health, nutrition) are important in improving the number of pigs marketed per sow and in maintaining the health and vigor of the growing pigs. Maximum litter size and vigor can best be achieved through the use of a planned program of crossbreeding, combined with good nutrition and management. Such a program will maximize the expression of these traits through heterosis. Breeders of purebred stock must recognize that the basic herd potential for litter size is determined by the breed with which they choose to work. If the number of pigs marketed per sow (as a result of levels of fertility, litter size, and survival) is a big problem after management, nutrition, and health are in order, you should consider changing breeds.

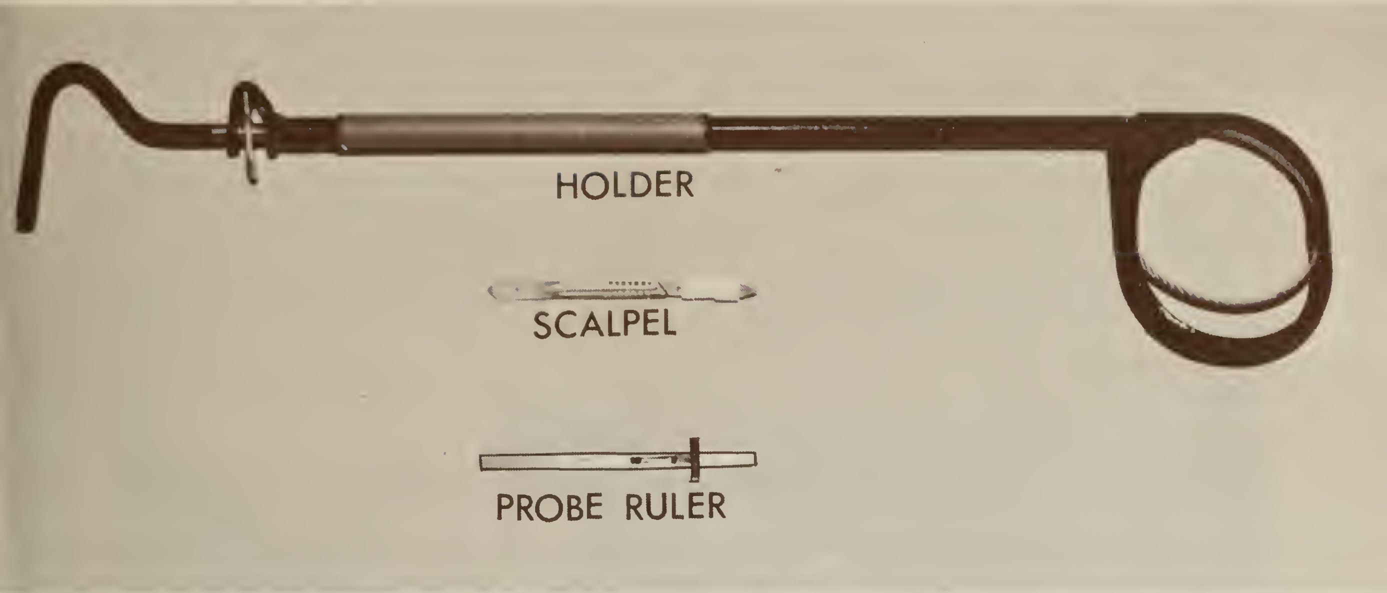
The effectiveness of selection is directly influenced by the number of traits included in the selection program. Do not waste time collecting information you don't intend to use effectively. If you record information on many traits, it is important to reduce to a minimum those on which selection is based. These must be traits of real economic merit for which heritability is high. Otherwise, you will weaken the effectiveness of selection and can expect little progress in any trait.

SELECTION PROGRAM

This program emphasizes the performance traits associated with efficient muscle development. The most important of these are minimum backfat and maximum growth rate. The former is a measure of carcass leanness and the latter is associated closely with efficiency of growth. They are both of economic importance, and because they are also high in heritability they can be improved by selection. Their improvement through breeding will likely pay extra dividends in the form of better feed efficiency, heavier weaning weights, and more rapid development of gilts for breeding. Selection is made on the basis of performance of each pig tested in comparison with all pigs of equivalent age in the herd, fed and managed under the same conditions. In selection for backfat thickness and growth rate, progeny tests are less important than individual performance. But they may be used to provide supplementary information on carcass quality of progeny of boars used in the breeding herd.

Backfat thickness and growth information has no meaning unless used as a base for constructive selection. In applying selection, it is essential to have a clear objective of the improvement that is required. You will achieve these goals only if selection is applied consistently and continuously. Take measurements on all animals eligible for selection. Because these animals come from all the litters in the herd, they should be tested under uniform conditions of feeding and management and should be in groups of similar ages, born preferably over a range of 6 weeks.

Selection must be based on actual measurements of the important traits of the animals on test. The tools needed are accurate and inexpensive. They are the weigh scale and the backfat probe. Visual appraisal of



Equipment used to probe for backfat thickness.

animals is not precise enough to be of significant value in a breeding program. You must use judgment, but it should be in conjunction with measurements.

Carcass quality, which is a composite of several factors such as backfat thickness, loin eye area, and percentage lean in the face of ham, is highly heritable. Backfat thickness measured by the probe is a reliable indicator of carcass quality and is almost as accurate in predicting cutout value as the more complex measurements of carcass quality obtainable only after slaughtering the pig. It has the advantage that it can be measured on the live pig by means of a probe, which does not impair the animal's usefulness as a breeder. Fairly rapid progress can be made through selection based on individual performance because breeding animals can be selected at market age and used in their first breeding season.

Measuring Backfat Thickness

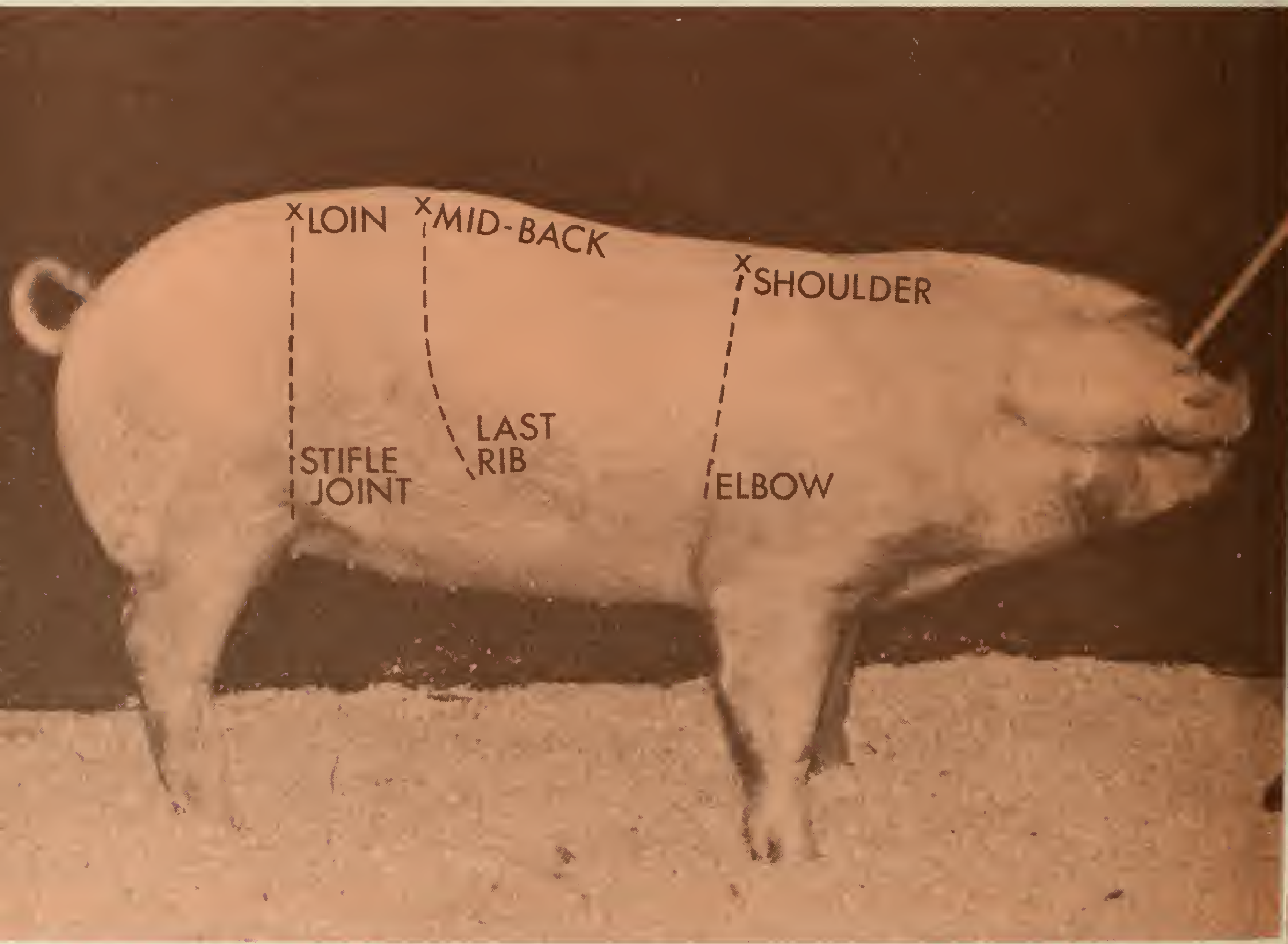
Anyone accustomed to working with pigs can measure backfat thickness with a probe. The equipment is inexpensive and easy to obtain. You need a holder or snare to restrain the animal, a scalpel to make the incisions, and a 6-inch metal ruler with 1/10-inch graduations. Your provincial swine improvement council should be able to assist you in procuring these items.

Take measurements at three sites: Shoulder—just behind the shoulder directly above the elbow joint; Mid-back—where the last rib meets the back; Loin—directly above the stifle joint. These three probes will give a reliable measure of the fat cover. All measurements are taken 1.5 to 2 inches off the midline. At each location make a small incision in the skin just large enough to permit easy entry of the metal ruler, insert the ruler, and push it through the fat until it contacts the firm muscling underneath. Little practice is required to recognize when the ruler has gone through the fat cover. Read the depth of fat from the ruler for each site and record it. The shoulder and loin measurements usually present the greatest difficulty. The fat cover actually consists of two, sometimes three, distinct fat layers that are separated by membranous connective tissue of varying strength depending on anatomical location. This membranous tissue is commonly referred to as false lean. Extra pressure is required to penetrate this membrane. Some operators are "heavy" probers and others "light" probers but they tend to rank pigs in essentially identical order. This is the most vital point. As the operator gains experience he will gain confidence and find probing very simple.

Pigs should not be probed at the mid-back line because the midline measurements are subject to greater errors of measurement. Also, they relate to fat only, whereas those taken 1.5 to 2 inches off the midline measure both the fat cover and the extent to which the muscle bulges into the fat. Since you want to increase lean at the same time as you reduce fat, probing off the midline is essential.

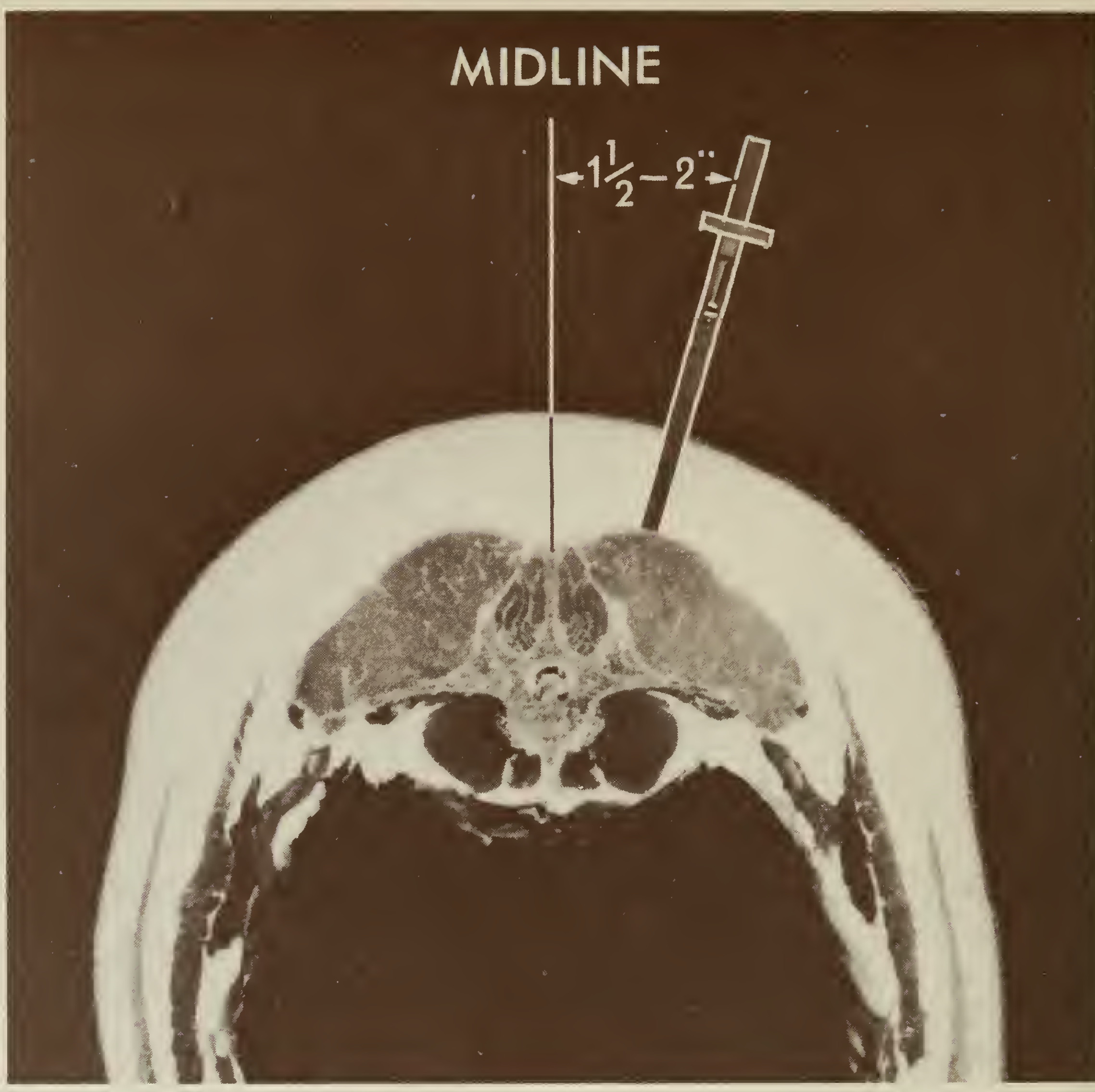
It is impractical from the standpoint of labor and management to probe animals within a very narrow weight range or at a constant age, but measurements taken at different weights cannot be compared directly. Therefore, it is necessary to have a convenient method for adjusting the backfat measurements to a standard weight. Animals should be compared only after the adjustments have been made.

Probing sites. Take the measurements at points marked X, 1½ to 2 inches on one side of the midline.



Measure the backfat thickness when the pigs weigh approximately 200 pounds. Weigh each pig before probing. You can obtain an estimate of the average backfat thickness at 200 pounds by using the backfat conversion table (Appendix 2). Use the total of the three fat measurements for estimating the average backfat at 200 pounds. Thus, if the total probe is 3.20, find this figure along the top of the table, and then move down *that column* until you reach the row appropriate to the weight of the pig. If the weight is 192 pounds, the average *weight-adjusted* probe is 1.11 inches. If the weight is 200 pounds, the average is 1.07 inches. If 226 pounds, the probe average is 0.94 inch.

Probing a pig. Ruler is held at right angle to skin.



Probe $1^1/_2$ to 2 inches from the midline. Measurements taken at the midline relate only to fat. Measurements off the midline relate to both fat and the extent to which the muscle bulges into the fat.

Weight and *total* probe are the only measurements required to use this table.

If the total probe and weight values fall outside the limits of the conversion table, the average weight-adjusted probe can be calculated as follows:

$$\text{Average weight-adjusted probe} = \frac{\left(\text{Actual total fat probe}\right)(200 \div \text{actual weight})}{3}$$

Example: The total fat probe of a pig is 4.80 inches and its weight is 236 pounds.

$$\text{Average weight-adjusted probe} = \frac{(4.80)\ (200 \div 236)}{3}$$

$$\text{Average weight-adjusted probe} = 1.36$$

Rate of Gain

Heritability of rate of gain is moderately high; therefore, reasonable improvement by selection is possible. Age at 200 pounds is the most convenient way to measure rate of gain. It takes into account both pre- and post-weaning gains.

Feed efficiency is related to rate of gain and age at 200 pounds. Rate of gain determines the length of time the pig must be fed and influences the feed requirements for daily maintenance. A selection program that measures feed efficiency with accuracy is much more complex and costly than one that simply measures weight for age. If you select for rapid growth, you receive a bonus because of the favorable correlation between rapid gains and improved feed efficiency. To keep the selection program simple, age at 200 pounds (weight for age) is used in place of post-weaning rate of gain and feed efficiency.

You can obtain age adjustments to a standard weight of 200 pounds by using the age conversion table (Appendix 3). Thus, if the age in days is 146, find this figure along the top of the table, and then move down *that column* until you reach the row appropriate to the weight of the pig. If the weight is 192 pounds, the adjusted age is 149 days. If the weight is 218 pounds, the adjusted age is 139 days.

Age and weight are the only measurements required to use this table.

If the age and weight values fall outside the limits of the conversion table, the age adjustment to a standard weight of 200 pounds can be calculated as follows:

Example: Weight of pig (W) = 240 pounds
Age (A) = 208 days

(1) Calculate average daily gain (A.D.G.) A.D.G. = $W \div A$,
Calculated A.D.G. = 240 ÷ 208 = 1.15

(2) Determine estimated A.D.G. (X) during period of correction by using average daily gain conversion table (Appendix 1). Enter this table at the calculated A.D.G. from (1) and read the estimated A.D.G. Estimated A.D.G. = 2.1 when calculated A.D.G. = 1.15.

(3) Calculate corrected age from:

$$Y = \frac{(200 - W)}{X} + A$$

Where Y = adjusted age to a standard weight of 200 pounds. The adjusted age is

$$Y = \frac{(200 - 240)}{2.1} + 208$$

$$Y = \frac{(-40)}{2.1} + 208$$

$$Y = -19 + 208$$

$$Y = 189 \text{ days}$$

Example: Weight of pig (W) = 190 pounds
Age (A) = 120 days

(1) Calculated A.D.G. = 190 ÷ 120 = 1.58

(2) Estimated A.D.G. = 3.0 when calculated A.D.G. = 1.58

(3) Calculated corrected age is

$$Y = \frac{(200 - 190)}{3.0} + 120$$

$$Y = \frac{(10)}{3.0} + 120$$

$$Y = 3.3 + 120$$

$$Y = 123.3 \text{ days, or } 123$$

Recording Performance

The most valuable records are those collected on individual animals. Records on close relatives such as litter mates or parents may be of some use as selection guides. Pedigrees or records on grandparents or remote relatives are of little value.

A sound record-keeping system is absolutely essential in an effective selection program. The system must be easy to maintain and limited to essential items of identification and performance. Each pig must be identified by ear notching* or other means so that a reliable record of ancestry and performance can be maintained. Dependence on memory alone, even where few traits are involved, can lead to costly errors.

Minimum records should include:

Identifications of sire and dam
Breeding date of dam
Date farrowed
Number farrowed
Individual pig identification
Sex
Weight for age
— Date weighed
— Actual weight
— Estimated age at 200 pounds

Backfat probe
— Probe weight
— Total backfat thickness from three probes
— Estimated average backfat at 200 pounds

Remarks concerning cull factors (such as abnormalities, soundness of feet and legs, and number of teats)

Appraising Performance Records

If records of performance are to be of value, it is essential that all the animals being considered be fed the same and raised under the same management. Differences in climate, housing, feeding, and management can affect performance. Every attempt should be made to minimize environmental differences within the herd so that decisions based on herd records will likely reflect actual differences in performance. Selection should be carried out among pigs that have been grown under the same management practices. This emphasizes the importance of selection decisions being made within and not between herds. When you introduce breeding stock from an outside source, the performance of its progeny provides the first valid comparison with performance in your own herd.

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*See Canada Department of Agriculture Publication 1127.

Development of an Improvement Program

Building a herd with real genetic identity for performance must feature a "closed herd" operation. However, the door must be kept open for the introduction of breeding stock that appear capable of improving the herd performance. Introductions must be made carefully. If boars are introduced, bring in at least two and make the new boars earn their way in. Breed each new boar to a small group of test sows and compare their progeny with the progeny of your own herd sires. If the progeny from the new boars outperform progeny from your herd sires, they are ready for extensive use in your breeding program.

A breeding program designed to make genetic progress should be based on a minimum of 5 boars and 45 to 50 sows. This provides freedom of selection among the progeny of several boars and also minimizes inbreeding in a closed herd operation. If the matings are carefully controlled to avoid full brother–sister and half brother–sister matings, inbreeding remains minimal. Some genetic progress can be made in smaller herds (3 boars and 15 to 20 sows), but much greater control of mating is required to avoid excessive inbreeding.

Genetic progress depends on the generation interval, which is the average age of the parents when their offspring are born. The shorter the interval the more rapid the progress. Thus, it is important to make maximum use of superior top-performing young animals each year. Replace all boars annually and 20 to 25 percent of the sows. This is a rapid replacement rate, but if parents are really outstanding they should leave progeny with the potential for even better performance. Genetic progress is based on letting animals make their contribution and move on.

Genetic advance is built generation upon generation. Thus, it is slow and can be realized only if the program is practiced consistently over successive generations. If the objectives of the program are clear, and if selection is planned carefully and based on reliable records, permanent progress in productive efficiency will be realized.

SAMPLE BREEDING PROGRAM

The following breeding plan may not fit all needs, but it contains the essentials of a practical selection program.

1. ***Identification:***
   a) Identify all pigs at birth by ear notching (see Canada Department of Agriculture Publication 1127)
   b) Record date farrowed, number farrowed, and sex
   c) Record identification of sire and dam

2. ***Standardize management:***
   a) Farrow and grow pigs under the same management. This allows you to make accurate comparisons.

3. ***Traits to select for:***
a) Age at 200 pounds
b) Backfat thickness

4. ***Objectives for selecting breeding stock:***
a) Age at 200 pounds—150 days or less
b) Backfat thickness—1.00 inch or less (average of three measurements)
In selection of gilts these would be reasonable objectives that should not be difficult to obtain. For boars the best is none too good. Records of 0.80 average fat and 120 days for an individual have been attained. These are the kind of boars you should use in your herd.

5. ***Breeding and selection:***
a) Select the fastest-growing, leanest boars and gilts. Select replacements at or near market weight.
b) Use a minimum of five boars per year. The boars should be primarily homebred and should be replaced annually.
c) Replace 20 to 25 percent of the sows annually. Let them make their contribution and move on. This is a matter of turning generations rapidly as the basis for maximum genetic progress.
d) Use outside males only after they have earned their way into the herd. They should be purchased only from herds of superior performance, based on adequate testing procedures. They should be superior to their contemporary herd average, but should also be tested by breeding to a sample of gilts from the new herd, before a decision is made to use them.
e) Minimize inbreeding. Carefully controlled matings (avoiding full brother–sister and half brother–sister mating) minimizes inbreeding.

6. ***Plan the work and work the plan:***
a) Keep the program simple, otherwise it won't be practical.
b) Set your objectives high by having something to strive for.
c) Be consistent — it takes courage to stick with one program.
d) Base your program on written records as reliable proof.

APPENDIX 1

AVERAGE DAILY GAIN CONVERSION TABLE

Calculated A.D.G. *W* ÷ *A*	Estimated A.D.G. during correction period (*X*)
1.0	1.8
1.05	1.9
1.1	2.0
1.15	2.1
1.2	2.2
1.25	2.3
1.3	2.4
1.35	2.5
1.4	2.6
1.45	2.7
1.5	2.8
1.55	2.9
1.6	3.0
1.65	3.1
1.7	3.2
1.75	3.3
1.8	3.4
1.85	3.5
1.9	3.6
1.95	3.7
2.0	3.8

APPENDIX 2

BACKFAT CONVERSION TABLE*

Converting *total* probe to *average fat* corrected to standard liveweight of 200 pounds

	Total fat in inches									
Weight	2.50	2.60	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
170	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.25	1.29	1.33
172	0.97	1.01	1.05	1.09	1.12	1.16	1.20	1.24	1.28	1.32
174	0.96	1.00	1.03	1.07	1.11	1.15	1.19	1.23	1.26	1.30
176	0.95	0.98	1.02	1.06	1.10	1.14	1.17	1.21	1.25	1.29
178	0.94	0.97	1.01	1.05	1.09	1.12	1.16	1.20	1.24	1.27
180	0.93	0.96	1.00	1.04	1.07	1.11	1.15	1.19	1.22	1.26
182	0.92	0.95	0.99	1.03	1.06	1.10	1.14	1.17	1.21	1.25
184	0.91	0.94	0.98	1.01	1.05	1.09	1.12	1.16	1.20	1.23
186	0.90	0.93	0.97	1.00	1.04	1.08	1.11	1.15	1.18	1.22
188	0.89	0.92	0.96	0.99	1.03	1.06	1.10	1.13	1.17	1.21
190	0.88	0.91	0.95	0.98	1.02	1.05	1.09	1.12	1.16	1.19
192	0.87	0.90	0.94	0.97	1.01	1.04	1.08	1.11	1.15	1.18
194	0.86	0.89	0.93	0.96	1.00	1.03	1.07	1.10	1.13	1.17
196	0.85	0.88	0.92	0.95	0.99	1.02	1.05	1.09	1.12	1.16
198	0.84	0.88	0.91	0.94	0.98	1.01	1.04	1.08	1.11	1.14
200	0.83	0.87	0.90	0.93	0.97	1.00	1.03	1.07	1.10	1.13
202	0.83	0.86	0.89	0.92	0.96	0.99	1.02	1.06	1.09	1.12
204	0.82	0.85	0.88	0.92	0.95	0.98	1.01	1.05	1.08	1.11
206	0.81	0.84	0.87	0.91	0.94	0.97	1.00	1.04	1.07	1.10
208	0.80	0.83	0.87	0.90	0.93	0.96	0.99	1.03	1.06	1.09
210	0.79	0.83	0.86	0.89	0.92	0.95	0.98	1.02	1.05	1.08
212	0.79	0.82	0.85	0.88	0.91	0.94	0.97	1.01	1.04	1.07
214	0.78	0.81	0.84	0.87	0.90	0.93	0.97	1.00	1.03	1.06
216	0.77	0.80	0.83	0.86	0.90	0.93	0.96	0.99	1.02	1.05
218	0.76	0.80	0.83	0.86	0.89	0.92	0.95	0.98	1.01	1.04
220	0.76	0.79	0.82	0.85	0.88	0.91	0.94	0.97	1.00	1.03
222	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.96	0.99	1.02
224	0.74	0.77	0.80	0.83	0.86	0.89	0.92	0.95	0.98	1.01
226	0.74	0.77	0.80	0.83	0.86	0.88	0.91	0.94	0.97	1.00
228	0.73	0.76	0.79	0.82	0.85	0.88	0.91	0.94	0.96	0.99
230	0.72	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.96	0.99

* Table courtesy of H.T.Fredeen, G.M.Weiss, and A.H.Martin, Research Station, Lacombe, Alberta.

3.50	3.60	3.70	3.80	3.90	4.00	4.10	4.20	4.30	4.40	4.50
1.37	1.41	1.45	1.49	1.53	1.57	1.61	1.65	1.69	1.73	1.76
1.36	1.40	1.43	1.47	1.51	1.55	1.59	1.63	1.67	1.71	1.74
1.34	1.38	1.42	1.46	1.49	1.53	1.57	1.61	1.65	1.69	1.72
1.33	1.36	1.40	1.44	1.48	1.52	1.55	1.59	1.63	1.67	1.70
1.31	1.35	1.39	1.42	1.46	1.50	1.54	1.57	1.61	1.65	1.69
1.30	1.33	1.37	1.41	1.44	1.48	1.52	1.56	1.59	1.63	1.67
1.28	1.32	1.36	1.39	1.43	1.47	1.50	1.54	1.58	1.61	1.65
1.27	1.30	1.34	1.38	1.41	1.45	1.49	1.52	1.56	1.59	1.63
1.25	1.29	1.33	1.36	1.40	1.43	1.47	1.51	1.54	1.58	1.61
1.24	1.28	1.31	1.35	1.38	1.42	1.45	1.49	1.52	1.56	1.60
1.23	1.26	1.30	1.33	1.37	1.40	1.44	1.47	1.51	1.54	1.58
1.22	1.25	1.28	1.32	1.35	1.39	1.42	1.46	1.49	1.53	1.56
1.20	1.24	1.27	1.31	1.34	1.37	1.41	1.44	1.48	1.51	1.55
1.19	1.22	1.26	1.29	1.33	1.36	1.39	1.43	1.46	1.50	1.53
1.18	1.21	1.25	1.28	1.31	1.35	1.38	1.41	1.45	1.48	1.52
1.17	1.20	1.23	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50
1.16	1.19	1.22	1.25	1.29	1.32	1.35	1.39	1.42	1.45	1.49
1.14	1.18	1.21	1.24	1.27	1.31	1.34	1.37	1.41	1.44	1.47
1.13	1.17	1.20	1.23	1.26	1.29	1.33	1.36	1.39	1.42	1.46
1.12	1.15	1.19	1.22	1.25	1.28	1.31	1.35	1.38	1.41	1.44
1.11	1.14	1.17	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43
1.10	1.13	1.16	1.19	1.23	1.26	1.29	1.32	1.35	1.38	1.42
1.09	1.12	1.15	1.18	1.21	1.25	1.28	1.31	1.34	1.37	1.40
1.08	1.11	1.14	1.17	1.20	1.23	1.27	1.30	1.33	1.36	1.39
1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.35	1.38
1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.36
1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35
1.04	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.34
1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27	1.30	1.33
1.02	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32
1.01	1.04	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.30

APPENDIX 3

AGE CONVERSION TABLE*

Age adjustment to a standard weight of 200 pounds

	Age in days										
Weight	126	128	130	132	134	136	138	140	142	144	146
170	139	141	143	146	148	150	152	154	157	159	161
172	138	140	142	144	147	149	151	153	155	158	160
174	137	139	141	143	146	148	150	152	154	156	159
176	136	138	140	142	144	147	149	151	153	155	157
178	134	137	139	141	143	145	148	150	152	154	156
180	134	136	138	140	142	144	146	149	151	153	155
182	133	135	137	140	142	144	146	148	150	152	154
184	132	134	136	139	141	143	145	147	149	151	153
186	131	133	135	137	140	142	144	146	148	150	152
188	131	133	135	137	139	141	143	145	147	149	151
190	130	132	134	136	138	140	142	144	146	148	150
192	129	131	133	135	137	139	141	143	145	147	149
194	128	130	132	134	136	138	140	143	145	147	149
196	127	129	131	134	136	138	140	142	144	146	148
198	127	129	131	133	135	137	139	141	143	145	147
200	126	128	130	132	134	136	138	140	142	144	146
202	125	127	129	131	133	135	137	139	141	143	145
204	125	127	129	131	133	135	136	138	140	142	144
206	124	126	128	130	132	134	136	138	140	142	144
208	123	125	127	129	131	133	135	137	139	141	143
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212	122	124	126	128	130	132	134	136	137	139	141
214	121	123	125	127	129	131	133	135	137	139	141
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218	120	122	124	126	128	130	132	134	136	138	139
220	120	122	123	125	127	129	131	133	135	137	139
222	119	121	123	125	127	129	131	132	134	136	138
224	118	120	122	124	126	128	130	132	133	135	137
226	118	120	122	124	125	127	129	131	133	135	137
228	118	119	121	123	125	127	129	131	133	134	136
230	117	119	121	123	125	126	128	130	132	133	135

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148	150	152	154	156	158	160	162	164	166	168	170
163	165	167	169	173	175	177	179	181	183	185	187
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158	161	163	165	167	169	171	174	176	178	180	182
157	159	162	164	166	168	170	172	175	177	179	181
156	158	161	163	165	167	169	171	173	176	178	180
155	157	159	162	164	166	168	170	172	174	177	179
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153	155	157	159	161	164	166	168	170	172	174	176
153	155	157	159	161	163	165	167	169	171	173	175
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151	153	155	157	159	161	163	165	167	169	171	173
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148	150	152	154	156	158	160	162	164	166	168	170
147	149	151	153	155	157	159	161	163	165	167	169
146	148	150	152	154	156	158	160	162	164	166	168
145	147	149	151	153	155	157	159	161	163	165	167
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143	145	147	149	151	153	155	157	159	161	163	165
143	145	147	148	150	152	154	156	158	160	162	164
142	144	146	148	149	151	153	155	157	159	161	163
141	143	145	147	148	150	152	154	156	158	160	162
140	142	144	146	148	150	152	154	156	158	160	161
140	142	144	146	148	150	151	153	155	157	159	161
139	141	143	145	147	149	151	152	154	156	158	160
139	141	142	144	146	148	150	151	153	155	157	159
138	140	142	143	145	147	149	151	152	154	156	158
137	139	141	142	144	146	148	150	152	153	155	157