Selection for Feet and Leg Soundness – Pork Industry Handbook
Michigan State University Cooperative Extension Service
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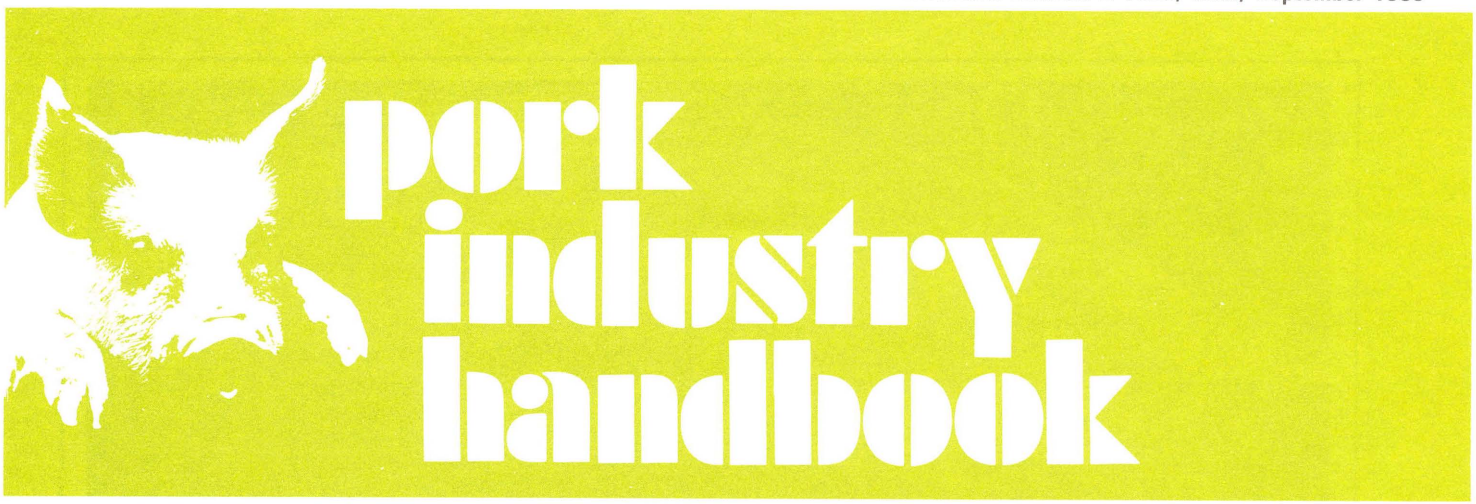

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

Selection for Feet and Leg Soundness

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The swine industry needs more sound, durable breeding animals capable of a high level of productivity in present day housing and facilities. Seedstock producers commonly consider unsoundness to be caused by some modern housing systems. However, in most cases modern housing rearing merely expresses those defects already present. A pig, sound on feet and legs and reared on pasture or dirt lot, may be a structurally unsound pig in some modern systems. Other factors that may affect structural soundness include genetics, level of production, sex, nutrition, disease, floor surface, equipment location, and space available for exercise. Boar test stations and on-farm testing facilities provide an excellent opportunity to visually detect sound and unsound pigs that are fed and managed similarly.

Selection for feet and leg soundness is a subjective, visual process that is a necessary part of a progressive pork production scheme. Improvement through selection is possible, since recent studies report soundness to be medium in heritability. Several factors affecting feet and leg soundness are discussed here.

Skeletal Structure

Feet and leg soundness problems may occur in front and rear legs in all ages and sex classes of pigs. Boars are generally evaluated to be the poorest in leg structure. Poor rear leg structure may prevent a boar from successfully staying mounted on a female during mating. Unsound front legs may limit a boar's desire to mount a female. Affected pigs assume a posture of flexion of the front legs at the knee (buck knees) and elbow. The rear legs may be partially flexed and carried under the body to maintain stability. Affected pigs are straight-legged on rear legs and gait is peggy, short-strided, and painful. These signs are common with young boars aged 5-8 months when moved to new premises.

Skeletal structures in Figures 1 and 2 were drawn, in part, as the result of radiologic examination of live pigs. Emphasis was placed on angles formed at (M) front legs and (N) rear legs.

Undesirable front and rear leg structure is indicated in Figure 1; whereas "desirable" bone conformation is illustrated in Figure 2. The rear leg structure in Figure 1 has a rump that is too steep and the tail setting is too low. The angle (N) is larger in Figure 1 than in Figure 2. The hip, stifle, and hock joints (E, F, and G, respectively) lock in a straightline position with each step or in the breeding-mounted (boar) position. Boars that are too straight in the rear legs will occasionally fall backwards (sit down on the ground) during breeding. The rear feet may exhibit excessive sole wear with subsequent swelling of the pads and lameness. UNDESIRABLE.

The spine (Figure 1) is arched very high; the angle (M) is greater than 90 degrees, which positions the shoulder blade bone more directly over the front leg bones. Additional pressure may be applied at the elbow joint (B) and at the knee joint (C). The front leg knee joints often buckle. The abnormally straight front leg posture in Figure 1 results in abrasive wear of the pads and toes as shown in Figure 3. UNDESIRABLE.

In Figure 2 skeletal side view, note the flatter top, more level rump, and higher tail setting. The front legs slope from the shoulder, as you view them from the side (resembling a curved sickle blade). The angle (M) allows the normal shock-absorbing effect at the elbow joint (B). The angle (N) in Figure 2 is smaller than in Figure 1; the rear leg joints are properly angled to allow the hip, stifle, and hock joints to absorb pressure equally. The pasterns (D) are sloping and long to provide a cushioning effect,

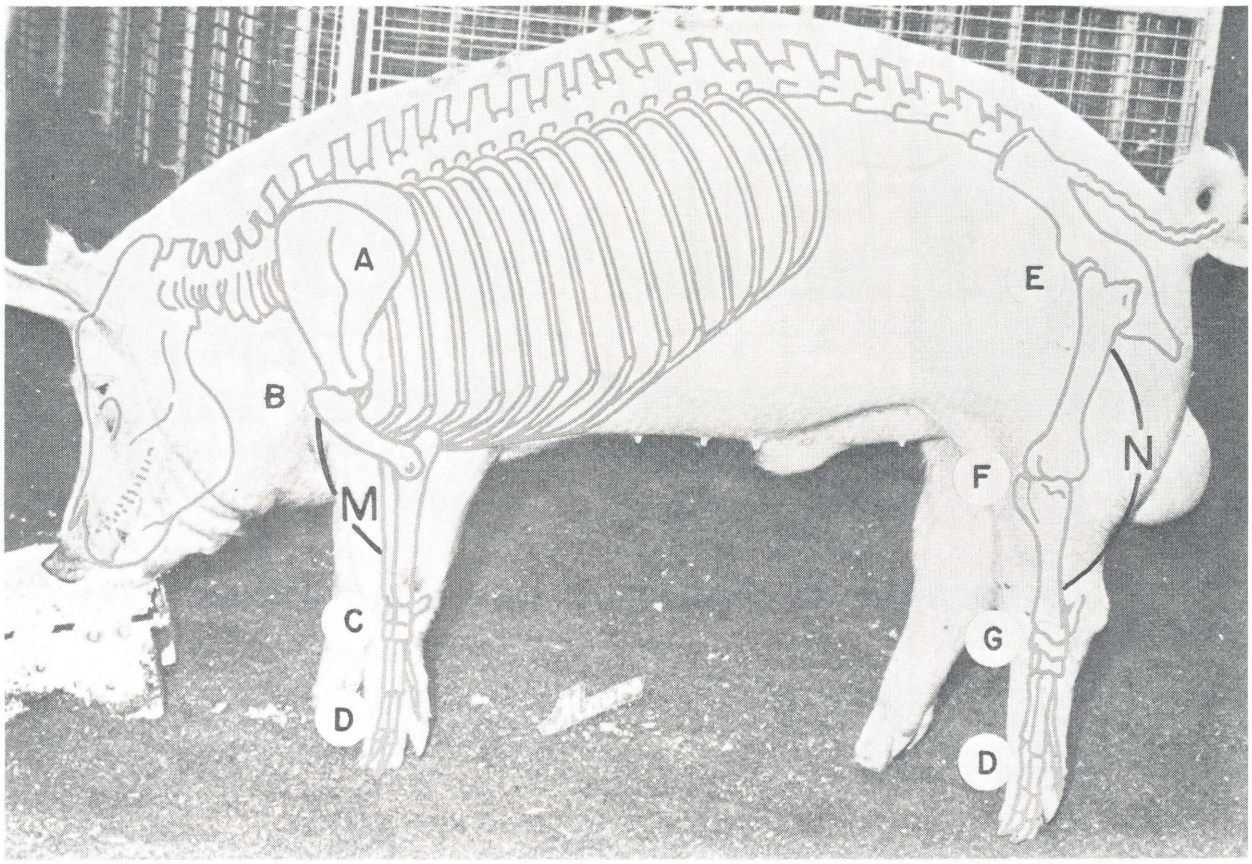

Figure 1. Undesirable front and rear leg structure.

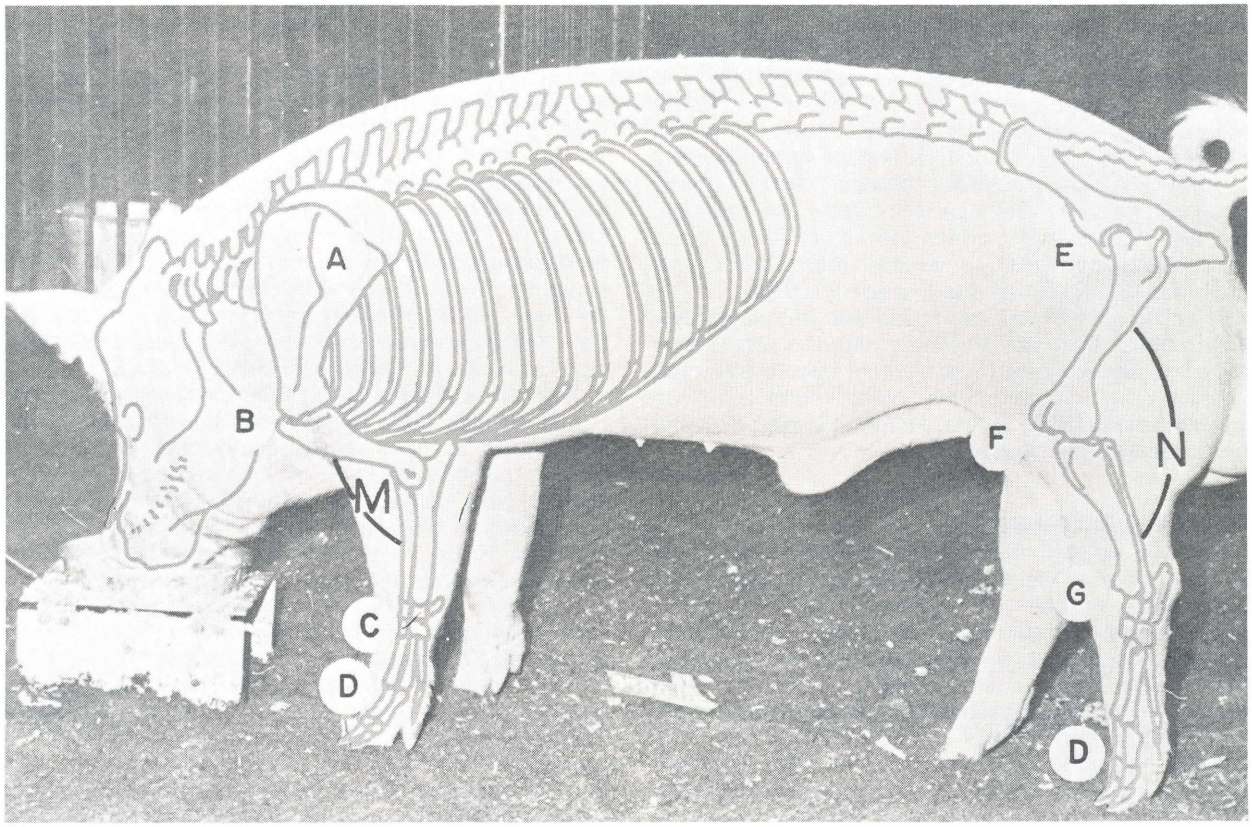

Figure 2. Desirable front and rear leg structure.

Figure 3. Abrasive wear of the pads and toes resulting from abnormally straight front leg posture.

and toes rest squarely on the floor surface. DESIRABLE.

In addition to structural differences noted in Figures 1 and 2, several other characteristics have to be considered in a soundness selection program.

1. Muscle—Extremes of muscle development that impair free movement or cause abnormal stance should be avoided. The desired muscling as viewed through the ham should be long and thick to facilitate free movement and desirable stance of feet and legs.

2. Skeletal Size—Extremely tall, flat, deep-sided breeding hogs have difficulty surviving on a solid concrete floor. Many boars (not all) described as extreme in their leg length and skeletal height have difficulty rising from concrete floors day after day. The process of getting up would normally include folding the legs to the underside of the body, rolling over to the belly, and then rising. Some tall, flat, deep-sided boars show an inability to easily fold the legs under their body and roll onto the belly. They will lie and flail with their legs until they contact something that will allow them to roll onto the belly, which increases the possibility of injury to already stiffened legs. Current standards would include visual selection for moderate length of leg combined with appropriate body length in both boars and gilts. Extremes in leg length are to be avoided.

3. Mobility—This is the ability to rise easily from the concrete and move freely with a long, easy stride. Lack of mobility can contribute to the presence of concrete blisters, calluses, or abrasions on leg joints. Note the open sore abrasion and concrete calluses (Figure 4) on the legs of an unsound sow.

4. Toe Size—The most common defect is small inside toes (Figure 5). As a pig gets older and heavier, leg conformation tends to conform to the shape and size of the toes. The ideal foot should include two even-sized toes; the toes should be big and slightly spread to improve ease of movement and stability. The outside toe is normally slightly wider and longer than the inside toe. Breeding age pigs with toe lengths on the same foot exceeding 1/2 in. difference are unacceptable (or should be

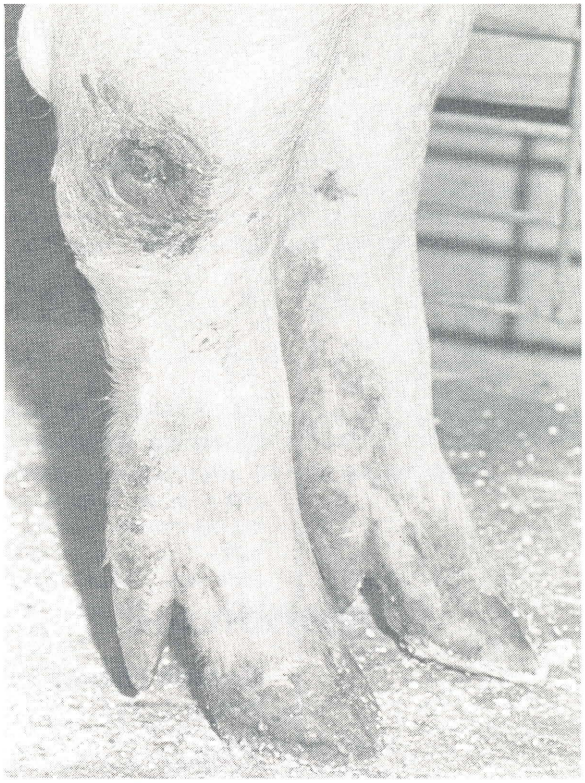

Figure 4. Abrasion on the leg of an unsound sow.

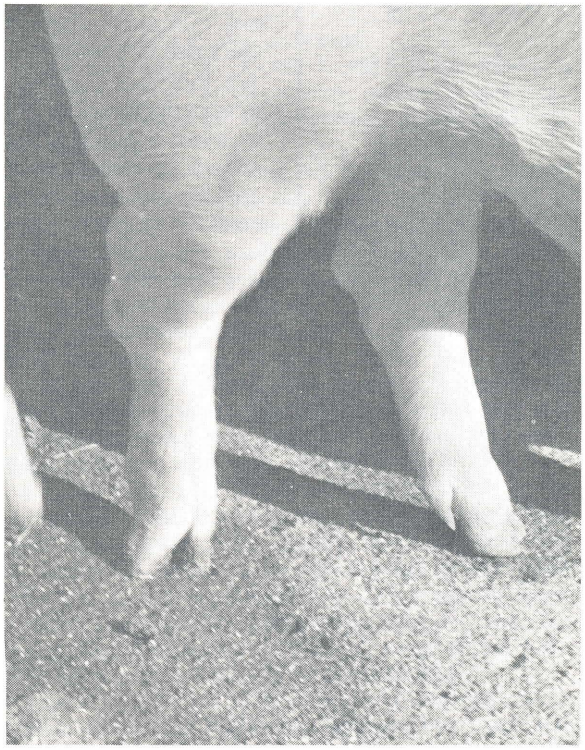

Figure 5. A pig with a common defect—small inside toes.

discriminated against). Figure 6 illustrates several desirable major feet and leg characteristics as follows: 1)note the even-sized toes (T) on the foot with moderate spacings between the toes; b) analyze the excellent slope and cushion to the pastern (P) in the leg on the right; subsequently, the sole (0) of the hoof rests squarely on the concrete floor surface. These rear feet and legs belong to a mature boar maintained and used for breeding on concrete for two years.

5. Nutrition—The most emphasis, nutritionally, has centered on calcium and phosphorus mineral levels in rations. Pig growth rate appears to maximize at a lower dietary mineral intake than does bone mineralization followed lastly by bone breaking strength. Low dietary intakes of calcium and phosphorus will result in poor performance and bone tissue that is osteoporotic (low mineralization), bending when weight is placed on it. Structural soundness is affected. Soft tissue and/or muscle formation continues at the expense of bone mineralization. Dietary levels of calcium and phosphorus over recommended National Research Council (NRC) requirements have been shown to increase breaking strengths of certain long bones with an increase in mineral content of bones. A positive relationship between increased (above NRC) levels of calcium and phosphorus in the diet and improved soundness has not been established. Calcium and phosphorus requirements of the young, growing boar are higher than those of gilts and barrows because of their more rapid growth rate, increased skeletal size, and improved feed efficiencies. The National Swine Improvement Federation recommends dietary levels of .90% and .70% for calcium and phosphorus, respectively, for young, growing boars.

Vitamin deficiencies rarely cause a structural soundness problem in the pig. However, a vitamin D deficiency results in a disturbance of calcium-phosphorus absorption and metabolism, causing a reduction in calcification of bones. A vitamin (B-group) called biotin has been suggested as a nutrient that will decrease foot problems. In experimentally induced biotin deficiency and from field reports, the hoof horn becomes soft and rubbery and much more susceptible to damage if pigs are kept on rough and abrasive floors. Cracks and ulcers appear on the bearing surface of the foot (Figure 7). Abrasive floor surfaces alone can cause lesions very similar in appearance to those described for a biotin deficiency. These lesions can be invaded by bacteria which produce infections in the foot and hock and result in lameness. Normal swine rations, supplemented with vitamins and minerals as recommended in Pork Industry Handbook fact sheets 2 and 52 should be adequate to maintain structural soundness.

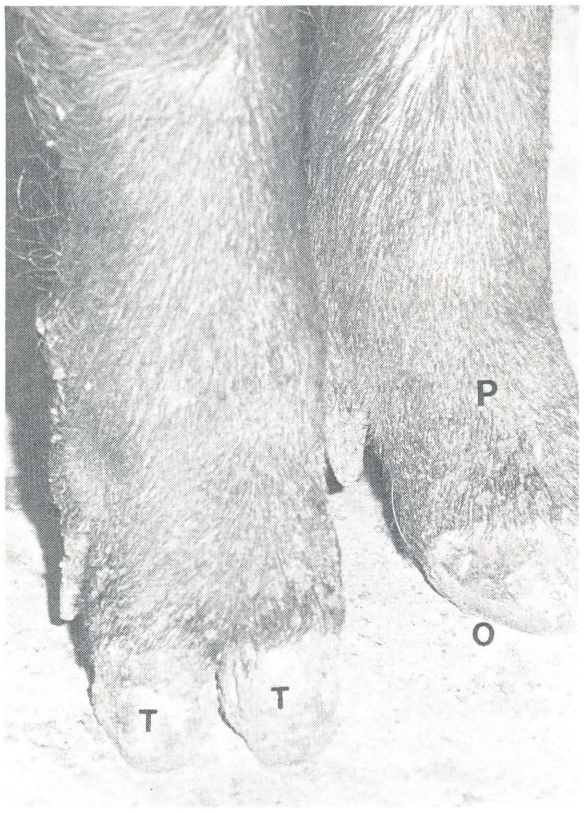

Figure 6. Desirable feet and leg characteristics. Even-sized toes (T); excellent slope and cushion to the pastern (P); a sole (O) of the hoof that rests squarely on the concrete floor surface.

Figure 7. Cracks and ulcers on the bearing surface of the foot.

6. Bone Abnormalities—Several bone disorders cause serious structural soundness problems. These disorders include rickets, osteomalacia, and osteoporosis (lack of bone). Rickets (growing animals) and osteomalacia (mature animals) are caused by vitamin D deficiency and/or a deficiency or imbalance in calcium and phosphorus. These bone disorders are not a serious problem where well-balanced diets are used.

In many studies where unsound pigs have been dissected to determine a cause for improper flexion of joints and abnormal movement, osteochondrosis (OC) and osteochondrosis dissecans (OCD) conditions and lesions have been found. Unfortunately, in just as many studies, pigs classified as sound have, upon dissection, displayed just as many OC and OCD lesions. For this reason, the presence of OC and OCD alone cannot be the primary causes for bucked forward knees and uneasy movement. OC and OCD may, however, play a role in the total syndrome of leg unsoundness.

Osteochondrosis (OC) is an abnormality of bone and cartilage that occurs in young animals whose bones are growing rapidly. There is degeneration of bone and cartilage at the places where bones grow (the growth plate) and also the cartilage and underlying bone that form joints (especially larger joints with free range of movement such as the elbow and stifle). It should be noted that there is no inflammation associated with OC. OC is a generalized condition occurring in many locations of growth in the body including those of the limbs, vertebral column, ribs, etc. It is characterized by increased thickness of joint cartilage and widening or distortion and sometimes premature closing of the growth plate. The changes are due to inadequate blood supply resulting from blood vessel damage (often traumatic) rather than excessive cartilage growth. The condition may undergo satisfactory repair or it may persist and progress to severely crippling degenerative arthritis (osteoarthritis). If joint cartilage separates from the bone the condition is referred to as osteochondrosis dissecans. In severe cases the cartilage may become free floating inside the joint. In many cases, the whole cycle of separation, necrosis, and regeneration may occur without any defect in the joint cartilage.

In studies involving large numbers of pigs, 80 to 90% of all the pigs have evidence of some type of OC or OCD lesion. Fast-growing animals and boars do have a greater incidence of OC and OCD. OC and OCD are moderate to high in their heritability and have little or no genetic correlation to visual scores of unsoundness.

7. Bone Size—Larger bone size is reputed to be important for durability. Larger bone should be preferred, but not at the expense of structural correctness.

8. Floor Surface—Raising pigs on concrete has increased the number of lameness problems. Type of flooring within housing facilities has affected feet and leg soundness. Pigs grown on total slats have more problems than those on partial slats. Wider slats with rounded edges produce fewer problems than narrower slats with sharp edges. Aluminum and some other bare metal slats produce more lameness problems than plastic, concrete, or coated metal slats. The prevalence of footpad lesions increases on rough as compared to smooth concrete. Extremely smooth, wet concrete flooring presents areas for potential injury to feet and legs due to slippage accidents.

9. Exercise (Pen Space)—Researchers have observed that exercise will increase muscle tone and coordination. In one study, nonexercised pigs were the least sound, and unsoundness increased with age. Space per pig and pen dimensions may indirectly affect the amount of exercise a pig obtains. A long, narrow pen (length:width of 2.5:1) affords more exercise opportunity and should be considered desirable for breeding boars.

10. Genetic Control of Structural Soundness—Recent research studies report several important results to consider as follows:

    a. Feet and leg soundness is moderate in heritability; thus, selection for feet and leg soundness combined with selection for important economic traits will result in improved performance of a herd over time.

    b. Average daily gain is lowly but positively correlated with feet and leg soundness, so fast-growing pigs that will stay sound can be produced.

    c. The genetic correlation between backfat thickness and front feet and leg soundness is moderately positive; the genetic correlation of backfat thickness with rear feet and leg soundness scores is low but positive; the genetic correlation of loin eye area with front and rear feet and leg soundness scores is moderately negative. These findings indicate that fatter, less muscled pigs are more likely to be sound on their feet and legs than are leaner, meatier pigs. These unfavorable genetic correlations can cause problems in selecting for leaner and more sound pigs. However, progress can be made by careful and persistent selection practices including use of a selection index composed of average daily gain and backfat thickness, along with visual appraisal and scoring of tested pigs for feet and leg soundness, in selecting both boars and gilts for breeding purposes.

Guidelines for Herd Improvement in Feet and Leg Soundness

1. Seedstock producers should use a structure and movement scoring system to evaluate all breeding herd candidates at a standard age or weight in the selection process. (See suggested scoring system.)

2. Commercial producers should purchase sound breeding stock from producers with a soundness scoring-culling system and with facilities that are similar to their own.

3. When possible, study the soundness of the dam, sire, and littermate pigs of those candidates you wish to purchase.

4. Avoid the use of adverse environmental conditions, i.e.; rough floors, inadequate pen space.

5. Feed nutritionally balanced diets.

6. Provide consistent management practices on a daily basis to all pigs.

7. Separate lame or injured pigs from the group and place them in a well-bedded pen. A veterinarian can provide diagnostic effort and can make medical recommendations which should be helpful. In animals of value, radiographs are very helpful in determining the nature and extent of an injury or lameness, thus providing a basis for making a reliable prognosis. Culling should be considered for crippling lameness that persists for more than 4 weeks.

8. Recognize that it may take several generations of selection to attain the goal of acceptable structural soundness in the herd. Structural soundness is just one trait that should be considered in the selection process. Thus, it may not be possible to select animals with the best soundness scores in all cases. Compromise is usually required in the selection process in order to improve the herd in overall merit.

Feet and Leg Soundness Scoring System

The scoring system suggested below is from 1 to 10 (10 is best). Emphasis in the scoring system should be on (a) mobility—5 pts.; (b) structure—4 pts.; (c) even toe size—1 pt. Scoring may be done separately on front and rear legs (10 pts. each) or combined for front and rear legs.

Scores (Boars and Gilts)

9-10 Indicates a boar or gilt is largely free of feet and leg soundness problems and can be successfully used in modern facilities.

7-8 Indicates minor structure, movement and/or even toe size problems, but animal should be able to perform satisfactorily under any management system or facilities.

4-6 Indicates moderate soundness problems that restrict use of animal to dirt or pasture lots.

1-3 Indicates severe soundness problems that are unacceptable under any management system or facility.

From a practical standpoint, potential breeding stock should be ranked using a performance index, and only animals with a soundness score of 7 or higher should be selected to improve the breeding herd.

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