

FEET AND LEGS SOUNDNESS

Ben Bereskin^{1/}

Major increases in feet and legs (F-L) problems in swine have developed with the shift to confinement rearing on hard-surfaced floors over the past 25 years. For example, because of feet and legs problems, 10% or more of otherwise acceptable boars at central testing stations in this country are being disqualified from sales. In recent national breed registry boar tests, as many as 30% of tested boars were disqualified from sales because of F-L problems. Over 15% of tested barrows at the National Barrow Shows have been disqualified because of F-L unsoundness. On the farm, producers are suffering serious economic losses because of F-L problems in boars, sows and growing-finishing pigs.

Condemnation of parts of swine carcasses at packer plants because of arthritic symptoms is also believed to be closely related to F-L problems. Numbers of such condemned arthritic parts under USDA inspection increased from 41 parts per million carcasses inspected in 1957 to 1327 parts per million carcasses inspected in 1975. This is a 32-fold increase in 18 years, with no major changes in proportionate numbers of inspectors or in procedures. Obviously, the economic importance of F-L problems in swine is real.

Classification of F-L Disorders

Feet and legs disorders in pigs may be classified into two main categories - arthritis and osteochondrosis. Arthritis is described as inflammation of the skeletal joint capsules and surrounding tissues (Bailey, 1976). Arthritis may vary greatly in severity and in symptoms of joint stiffness and enlargement and often becomes chronic in effect. Arthritis may be due to infectious agents or to non-infectious causes. The best insurance against such infections is to follow a comprehensive herd health program on the farm, in cooperation with a veterinarian.

Osteochondrosis is described as a generalized skeletal ailment that affects growth plates and joint cartilages, but is not thought to be caused by infectious agents (Reiland, 1976). This is the condition most commonly associated with the typical symptoms of F-L problems in swine up to 18 months of age. Osteochondrosis is considered to be the most common cause of non-infectious arthritis.

Causes of F-L Problems in Swine

Some European researchers have suggested that increased secretion of growth hormone in today's faster growing pigs may be a causative agent in F-L ailments (Reiland, 1976). Dietary levels of Ca and P have been suggested as important factors affecting F-L soundness. However, Pond et al. (1978) reported no significant differences in bone structure or lameness of pigs fed otherwise balanced diets but varying widely in Ca and P.

Floor surfaces are universally recognized as a critical factor in F-L problems in swine. Dr. Bob Fritschen of the University of Nebraska

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has pioneered in research in this field. He showed that rough floors can result in severe claw injury, leading to abnormal F-L movement and structure, as well as crippling bacterial infections of joints (Fritschen and Zoubek, 1975).

Conformation of body and feet and legs is emphasized by some observers as a critical factor in the incidence of F-L problems in swine. Dr. Howard Miller of Mississippi State University has been a leading advocate of visual appraisal as a key to less F-L problems. Based on whole body x-ray studies, he advised selection of breeding stock that is more level in the topline, including the rump, longer and more sloping in the front and rear pasterns and having even toe size on each foot (Miller, 1978).

Other possible predisposing factors include lack of exercise and various forms of stress. Thus, problems associated with F-L soundness reflect extremely complex anatomical and physiological conditions.

Beltsville Study

The main objective of the USDA study at Beltsville was to determine key genetic factors involved in F-L soundness and thereby evaluate the prospects for improving the F-L condition by selection practices (Bereskin, 1979).

General. Experimental animals were part of ongoing selection studies at the Beltsville Research Center. Foundation animals were purchased from reputable herds of the Duroc and Yorkshire breeds in 1973. Litters were farrowed in the spring and fall, in pens with solid concrete floors in a central farrowing barn. Litters were moved to pasture lots at 2 weeks of age, where creep feed was available. After weaning at 6 weeks of age, test gilts were placed 2 to 4 litter mates per pen, where they were kept until taken off test at 200 lb. All pens had an outside run, solid concrete floors inside and out, and nipple waterers.

A 16% protein corn-soybean meal-alfalfa meal diet was provided in a self-feeder in each pen. The diet met or exceeded minimum standards for all nutrients according to 1973 National Research Council recommendations. Pigs were injected with lincomycin at 2 weeks of age and vaccinated with mixed strains at Erysipelothrix before being put on test at 8 weeks of age.

Scoring. All pigs were scored for F-L soundness by the herdsman when taken off test at 200 lb. They were scored again by the author as groups were assembled and moved to pasture lots. Scores used in the analysis were a combination of the separate scores.

Movement was allotted from 0 to 5 points, structure from 0 to 4 points and toes either 0 to 1 point, for front and rear F-L separately. The more desirable condition received a higher score. Thus, a pig that appeared sound in F-L could be allotted up to 10 points for front F-L and up to 10 points for rear F-L.

Scoring Guidelines. Movement, front and rear: Look for free and easy movement. Downgrade stiffy, choppy and short strides. Severely downgrade buckled knees. Downgrade goose-stepping in rear. Structure, general: Look for adequate spring and cushion in feet and legs without going to extremes. Front: Refers to shoulders, legs and pasterns. Extra straight set, viewed from side, is to be downgraded. Rear: Refers mainly to set of hocks and pasterns. Extra straight and stiff hocks and pasterns, as well as sickle hocks, are to be downgraded. Front and rear: Downgrade swollen joints, tendons and ligaments. Toes: Downgrade noticeably uneven toe lengths on the same foot, mainly over 1/2 inch difference.

Results

Records of 554 gilts, representing 202 dams and 113 sires and made during four different seasons were included.

Heritability of F-L scores was estimated by two different methods with the following results (\pm standard errors):

	Method 1	Method 2
Front F-L scores	27 \pm 20%	28 \pm 11%
Rear F-L scores	15 \pm 24%	39 \pm 11%

Based on this analysis, the heritability of front F-L scores is likely on the order of 25 to 30%. The heritability of rear F-L scores is more uncertain, but probably ranges from about 15 to 40%, and is more likely on the order of 20 to 30%. Based on these results, breeders can expect slow to moderate rates of improvement in F-L soundness by direct selection based on careful appraisal of animals used for breeding.

Genetic Correlations. In addition to F-L scores, data on four other traits were included in the study: weight per day of age at start of test (W/A); average daily gain on test (ADG); average backfat thickness (BF); and loin eye area (LEA). BF and LEA were measured from ultrasonic photos of pigs when taken off test at 200 lb. Estimates of genetic correlations (\pm standard errors) were as follows:

	W/A	ADG	BF	LEA	Rear F-L score
Front F-L score	.04 \pm .16	.33 \pm .17	.35 \pm .21	-.33 \pm .21	80 \pm .14
Rear F-L score	.09 \pm .14	.09 \pm .16	.05 \pm .17	-.19 \pm .19	---

The estimated genetic correlations indicate essentially zero association of F-L scores at 200 lb. with early growth of pig (W/A). The moderate positive genetic correlation (.33) of ADG with front F-L scores indicates no hindrance to improving F-L soundness by selecting for rapid gains. The moderate positive genetic correlation of BF with front F-L scores (.35) and the negative correlations of LEA with both front (-.33) and rear (-.19) F-L scores suggests that breeders likely will have some difficulty in selecting for leaner and more muscular pigs while simultaneously

selecting for improved F-L soundness. Compromise will be needed. Finally, front and rear F-L scores apparently are genetically closely linked.

Discussion. Based on careful observation, it was consistently noted that most F-L soundness problems, especially in front, were substantially reduced within 3 to 5 weeks after pigs were placed in dirt lots or on pasture, upon completing their test, even though growth continued at a high level during that period. This observation lends credence to the view that a primary triggering mechanism to many F-L problems is the hard-surface floors now used in most confinement-type swine production facilities.

In former years, when pasture rearing and finishing systems were the general rule, the stress exerted by the environment on structure and movement of F-L was minimal. However, with the shift to confinement rearing, F-L structure, acceptable on dirt or pasture, simply could not stand up to the severe stresses induced by the hard-surface floors. The result is the well-known symptoms of osteochondrosis, arthritis and varying degrees of lameness. Bone structure and configuration definitely appear to be important factors in the etiology of F-L problems.

Other possible causative factors also need to be investigated. These include other forms of stress such as crowding and temperature extremes, abrasive floor surfaces, pathological agents and extremes in muscling.

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General Comments

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There definitely appears to be inherited differences among pigs in their ability to withstand the stress of hard-surface floors in confinement. However, before feet and legs (F-L) problems can be properly evaluated, producers first need to do the following:

- (1) Test animals under uniform housing and management
- (2) Avoid stressful conditions
- (3) Provide an adequate balanced diet
- (4) Follow a comprehensive health program

Then, producers should visually appraise or score all tested pigs for F-L condition at the end of a uniform test period.

Visual appraisal is also necessary to properly evaluate underlines and other reproductive anatomy of tested boars and gilts.

Taking external body measurements is not a practical or useful substitute for obtaining reliable data on performance traits such as daily gain, feed conversion or backfat thickness.

Another consideration in the selection process is type. In my opinion, the main emphasis the swine breeder should put on type is in the visual appraisal of F-L soundness, underlines and reproductive anatomy in both boars and gilts. The net result will be to select longer, more sound and more functional animals. At the same time, the breeder will probably also prefer animals that show more body capacity and natural vigor.

Considerations on muscling should depend on whether the animal is in a specialized sire or dam line or in a general purpose line. Of course, the purebred breeder will also need to consider breed type in the selection process. I believe breed type can largely be evaluated at the time animals are selected to be put on test.

However, I strongly believe that visual appraisal should not be over-emphasized at the expense of measurable economic traits.

In the final analysis, I believe the master swine breeder is the person who successfully combines the use of performance data and visual appraisal in the proper balance to produce the modern meat-type hog.