

The fat area involved more time and effort to compute than did the width of fat. Thus, it appears that the width of fat would be more useful in practical application than determining the fat area.

### Summary and Conclusions

An investigation involving 117 yearling cattle over a two year period was conducted to evaluate two external fat measurements taken at the 12th rib. Primary emphasis was placed on the relationship between a linear fat measurement, and area of fat to the percent separable fat in the 9-10-11th rib section. One may conclude the following relative to these fat measurements.

1. The fat area appears to be more variable within a group than does the width of fat.
2. The linear measurement of fat seems to be an indicator of total carcass fatness. The correlations were significant at the one percent level.
3. Variation in correlation values between each measure of external fat and the percent of fat in the 9-10-11th rib section was considerable between groups. The evidence that one fat measurement is more highly associated with the percent fat in the 9-10-11th rib cut than another is not conclusive.
4. The fat area measurement involves a great deal more time and effort to compute than does the linear measurement.
5. The linear fat measurement appears to be a more practical method for expressing carcass fatness. It takes less time to compute and study thus far indicates that it is just as applicable as the area measurement.

### Performance Records on Relatives As Aids in Selecting Boars

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The boar contributes half the inheritance of all the pigs he sires. Furthermore, more intense selection is possible among boars than among gilts, because fewer boars are needed for replacement. For these reasons the selection of the boar is a critical and important decision. Performance test records are increasing in availability from swine evaluation stations and "on the farm" tests. Although some of these tests may give direct information on the boar himself, much of the information is on his relatives. Thus, it is important to consider the usefulness of such data on relatives in selecting the boar.

Relatives can furnish important information for appraising the breeding worth of a boar. This is true because a boar's own performance is not a perfect guide to his breeding value; and because it is not possible to directly measure a boar's performance in certain traits. The association of individuality or individual merit with breeding value varies with different traits and different circumstances. The best criterion of the degree of association between individuality and breeding value is the heritability of the trait. If heritability is high, then individual merit is a good and perhaps the best single indication of a boar's breeding worth. On the other hand, if heritability is low, individuality is a relatively poor measure of breeding worth of the individual. For traits of low heritability records on relatives become important sources of selection information.

The economically important traits that should be considered in a complete swine selection program are sow productivity, gaining ability, efficiency of gain, meat type, carcass merit, and soundness. These are not listed in any order of importance, and some of these traits are associated with others. Carcass merit, sow productivity, and efficiency of gain are generally the traits for which performance records on relatives are most successful.

### Carcass Merit of Relatives

Traits associated with carcass merit such as backfat thickness, loin lean area, percentage of lean cuts, and length are the most highly hereditary traits in hogs. Average heritability estimates on these carcass traits range from 35 to 60 percent. These relatively high heritabilities suggest that selection on individual merit should be reasonably successful. However, most of these traits cannot be measured directly on the live animal. Backfat thickness is an exception. It can be measured with reasonable accuracy by probing the live animal. It is also probable in the near future that ultrasonic measurements may be used to estimate muscling in the live hog. Direct carcass measurements and appraisal, however, can only be made on slaughtered hogs and consequently these measurements must be made on the relatives of breeding stock.

A good group of relatives from which to get carcass data are pigs by the same sire and out of several different dams. Data from such a sire group can be used in two ways in selection. First, they can be used as a progeny test on the sire and a partial progeny test on the dams of the pigs slaughtered. Secondly, data on such a sire group can be used in the selection of full and half brothers and sisters of the carcass individuals. This is called a *sib test*. It can be used very effectively in selecting young boars whose sibs are on a slaughter test.

If the carcass data from sire groups is to be accurate and effective in progeny test and sib test selection, the following items should be considered in planning the test.

1. *The sires of the different groups of pigs should be mated to comparable sows.* This is especially important if the carcass data on the group

are to be used in progeny test selection. Many sires can be made to look good if mated to a selected group of sows.

2. *The pigs in the different sire groups should be fed and managed alike.* Preferably they should be full fed the same ration, in the same season, in the same year, and at the same location. This is necessary in order to reduce environmental differences between groups and thus increase the selection accuracy based on group differences. Comparing the carcasses of pigs fed in different herds where one group may be full fed and another group limited fed does not give reliable evidence of hereditary differences in carcasses.

3. *An adequate number of pigs should be slaughtered from each sire* in order to get a reliable evaluation of the sire's transmitting ability and the hereditary worth of the pigs. Carcasses from one or two pigs from a sire give no more than an interesting lead. The minimum number from a sire group should be six from at least four different sows. Ten or 12 carcasses from at least five or six sows would make an even better test.

4. *The pigs to be slaughtered should be an unselected sample of pigs by each sire.* Choosing the best pigs for a carcass test may greatly bias the results. Such a procedure automatically favors sires that are used most extensively and have the largest number of pigs. If sire groups are from different herds this procedure also biases the results in favor of the sire group from herds whose owners are the best judges of meat type hogs. This is a weakness in the meat type certification program which was not of much importance when the program was young, but will be of greater importance in the years ahead when tests must be made more critical to continue improvement.

5. *Sex differences in carcasses must be taken into account.* Gilts are longer and leaner than barrows. This can be taken care of by slaughtering equal numbers of each sex, or by slaughtering pigs of the same sex, or by correcting the carcass data for sex differences if unequal sex ratios exist in different groups.

## Efficiency of Gain

Individual feeding is necessary to measure efficiency of feed conversion on the individual boar. This is a rather expensive test because of the facilities and labor required. A sire group of pigs that are to be slaughtered for a carcass test could also be used for a rate and efficiency of gain test. Sire groups can be separately fed. The feed conversion record on such a group can be used as a progeny test of the sire and also as a sib test for the half brothers of the group. The feed conversion record of the sibs along with the boar's rate of gain gives a fairly effective selection tool for rate and efficiency of gain.

In conducting feeding tests it is essential to keep feed wastage to a minimum. The physical nature and palatability of the test ration and

the proper adjustment of self feeders have marked effects on feed wastage. Tests in which there is considerable feed wastage are not worth the trouble of keeping the feed records. Under such conditions, differences in the amount of waste in different lots make it impossible to obtain useful measures of feed efficiency.

### Sow Productivity

Sow productivity, measured by pigs per litter and litter weaning weight, has a low heritability. Only about five to 10 percent of the differences in litter size are attributable to heritable differences among sows. Selection of boars for this trait must be based entirely on the performance of relatives. Sow productivity cannot be measured directly on the boar. Litter size is largely a maternal effect dependent on the dam. A boar of normal fertility has little if any effect on the size of litter he sires. The size of litter is chiefly determined by the number of eggs ovulated and the successful implantation and development of the embryos. These are properties of the sow.

The boar does transmit inheritance to his daughters which affect their ability to produce large litters, and, consequently, this trait should be considered in boar selection. The productivity of a boar's dam, his sisters, and his daughters furnish the most useful information on sow productivity in selecting boars. In the initial selection of a young boar the production record of his dam and perhaps his granddams are the only indications of his breeding value for his trait. Although no selection procedure for this trait is highly effective because of the low heritability, selection on the basis of the dam's total production improves the accuracy of selection. All the production records on the boar's dam should be considered and not just the one litter in which the boar is raised. The average production records of the boar's full and half sisters should also be considered when such records are available. When the boar is old enough to have daughters with production records, these probably give the best measure of his breeding worth for sow productivity. Probably at least 10 daughters are needed to give a highly accurate progeny test on the boar for sow productivity.

Although the appraisal of the potential and actual breeding worth of a boar is a continuous procedure, there are three distinct ages when boars should be carefully appraised and some selection and culling decisions made. The first age at which selection decisions are normally made is the initial selection of young boar pigs at four to eight weeks of age. The second age and a more critical selection time is when boars are about six months of age and final decisions are made on herd boars. The third age for selection is on mature boars after they have been proven by progeny tests. Many breeders fail to utilize opportunity for selection at this time to its fullest extent. Obviously, selection at all of these ages is most effective when adequate performance records are available on the boar and his near relatives.

### **Selecting the Boar Pig**

In the initial selection of the young boar pig considerable weight must be given to the relatives (ancestors) in his pedigree. The boar is too young to express much of his potential for growth rate and meat type. Certain unsoundness may not show up until later in life and of course he can never express his potential for sow productivity. Consequently, this is the age at which the performance of relatives should be given considerable weight in selection. Boar pigs should be selected from productive sows that have been evaluated on the basis of all of their litters. The young boars should be sound, healthy, and vigorous pigs with a minimum of 12 nipples. They should show evidence of length and muscling. The meatiness of their sires and dams should be considered. Progeny tests of their sires for rate and efficiency of gain and for carcass merit should be considered for those sires old enough to have such tests. Selection at this age is primarily on pedigree. About twice as many boars should be selected as one expects to use or sell. This will permit additional culling of the boars after performance of the boars and their sibs has been appraised at six months of age.

### **Selecting the Six Month Old Boar**

At about six or seven months of age sound, rapid gaining, meaty boars should be selected whose sibs have made rapid and efficient gains and have yielded desirable, meaty carcasses. Unsound boars should be culled and there should be some discrimination against those boars with sibs exhibiting unsoundness as hernias, cryptorchidism, and crooked legs. Although most of the selection for dam's productivity should have already been made in the initial selection of the boar pig, there may still be some opportunity to select further for this trait among six month old boars.

### **Selecting the Proven Sire**

At this stage the pedigree information and the individuality of the mature boar are of secondary importance to the progeny test information. If the progeny test is accurate and adequate, it is a true measure of breeding worth. Rate and efficiency of gain, carcass merit, and soundness of the progeny should now be the primary basis for selecting the proven boar for further service. If a boar is proven to be of superior transmitting ability in the desired traits, every effort should be made to extend his use. Proven superior boars are not often found. When one is located, a breeding program should be planned for such a boar that will retain his use for a long period of time.