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**Abstract**
Records on 4,355 boars sold from 1973 to 1978 at central test stations in Ames, Ida Grove and Lisbon, Iowa, and Clarkson, Nebraska, were evaluated for the relative economic emphasis buyers place on performance traits. Performance traits included days to 104 kg, average daily gain, feed efficiency, backfat thickness and loineye area. Average sale prices were highest for Landrace ($457) and lowest for Berkshire ($340) boars. Highest prices were paid for boars sold at the Ames Station. R2 values from models used to predict sale price for the different breeds ranged from .21 to .49, indicating that variation in sale price was affected by factors other than performance, year-season or location of the test. Relative importance of performance traits varied, with buyers placing more emphasis on backfat and average daily gain than on feed efficiency. Comparison of relative economic weights used in selection indexes against the economic emphasis shown by buyers demonstrated that buyers are placing considerably less emphasis on feed efficiency relative to the other traits than the index suggests. Swine producers could make more progress in improving performance traits if they placed more emphasis on performance traits when purchasing centrally tested boars.

**Keywords**
Boar Performance, Selection Index, Economic Value

**Disciplines**
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**Comments**
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# COMPARISON OF SELECTION INDEX ECONOMIC WEIGHTS AND PRICES PAID FOR PERFORMANCE-TESTED BOARS[1]

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## Summary

Records on 4,355 boars sold from 1973 to 1978 at central test stations in Ames, Ida Grove and Lisbon, Iowa, and Clarkson, Nebraska, were evaluated for the relative economic emphasis buyers place on performance traits. Performance traits included days to 104 kg, average daily gain, feed efficiency, backfat thickness and loineye area. Average sale prices were highest for Landrace ($457) and lowest for Berkshire ($340) boars. Highest prices were paid for boars sold at the Ames Station. $R^2$ values from models used to predict sale price for the different breeds ranged from .21 to .49, indicating that variation in sale price was affected by factors other than performance, year-season or location of the test. Relative importance of performance traits varied, with buyers placing more emphasis on backfat and average daily gain than on feed efficiency. Comparison of relative economic weights used in selection indexes against the economic emphasis shown by buyers demonstrated that buyers are placing considerably less emphasis on feed efficiency relative to the other traits than the index suggests. Swine producers could make more progress in improving performance traits if they placed more emphasis on performance traits when purchasing centrally tested boars.

(**Key Words:** Boar Performance, Selection Index, Economic Value.)

## Introduction

Central swine testing stations were established in the mid 1950's, with 40 public stations testing by 1976 (Bereskin, 1977). Evaluation of factors affecting production data has been described by Neville *et al.* (1976a), Bereskin (1977) and Drewry (1979). Neville *et al.* (1976b) examined factors affecting sale price of boars sold at test stations and found that final age, backfat thickness and feed efficiency influenced the price.

Recent interest by scientists has centered around more rapid improvement of performance traits. Recommended guidelines were developed by the National Swine Improvement Federation (NSIF) in 1976 and updated in 1981 (Hubbard, 1981). The guidelines recommend that boars be measured and indexed for backfat thickness, feed efficiency and average daily gain. Relative economic weights have been suggested for these traits. Iowa test stations, however, have continued to use the index developed by L. Hazel (*unpublished data*). Relative economic weights for the Iowa index are unknown.

The purpose of this study was to examine factors affecting sale price of boars sold at test stations and to compare those prices with relative economic weights used in selection indexes at test stations.

## Materials and Methods

Data for this study consisted of performance records on boars sold from 1973 to 1978 at test stations in Ames, Ida Grove and Lisbon, Iowa, and Clarkson, Nebraska. No boars were removed prior to sale unless they were unhealthy or unsound. Only records for boars that sold at auction for at least the minimum sale price were included. Minimum sale price ranged from $150 in 1973 to $300 in 1978 and was constant across stations and breeds. A maximum of four boars was in each pen and all boars were required to have the same sire. Boars were started on test when pen weight averaged 31 kg and taken off test when pens averaged 104 kilograms. Performance records included days

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TABLE 1. VALUES USED IN COMPUTING SELECTION INDEXES[a]

| Trait | Heritability, % | Phenotypic standard deviation | Relative economic value, $ |
|---|---|---|---|
| Avg daily gain | 30 | .091 kg/day | 4.00 |
| Feed Efficiency | 35 | .260 kg feed/kg gain | −9.00 |
| Backfat | 50 | .457 cm | −3.50 |

[a]Bereskin (1977).

to 104 kg (DYS), backfat thickness (BF), kilograms feed/kilogram gain [feed efficiency (FE)], average daily gain (ADG) and loineye area (LEA). DYS, BF and LEA were adjusted to 104-kg equivalents according to guidelines developed by NSIF (Hubbard, 1981). Sonoray® was used to measure LEA, while FG was measured by probe or Sonoray®. FE was measured on a within-pen basis for all boars in the pen and, therefore, may not have been an extremely accurate measure of individual boar FE.

Indexes used at test stations vary. The index suggested by NSIF (Hubbard, 1981) for boars in pens of two or more is

$$I = 100 + 60(ADG - \overline{ADG}) - 75(FE - \overline{FE}) - 70(BF - \overline{BF}), \quad (1)$$

while the index used at Iowa test stations is

$$I = 250 + 50(ADG) - 50(FE) - 50(BF), \quad (2)$$

where ADG and BF are individual boar performance records and $\overline{ADG}$, $\overline{FE}$ and $\overline{BF}$ are group averages for all boars on test. FE represented pen average FE.

Relative economic weights and variances and covariances used to compute the NSIF index are listed in tables 1 and 2. Since relative economic weights for the Iowa index are unknown, they were calculated from variances and covariances listed in tables 1 and 2 with equation (3),

$$\underset{\sim}{G}^{-1}\,\underset{\sim}{P}\,\underset{\sim}{b} = \underset{\sim}{a}, \quad (3)$$

where $\underset{\sim}{G}$ and $\underset{\sim}{P}$ are the genetic and phenotypic variance-covariance matrices and $\underset{\sim}{b}$ is the vector of index weights of 50, −50 and −50.

Residual correlations were computed between sale price, ADG, BF, FE, LEA and DYS after adjustment for the fixed effects of breed, year-season and location of the test. Sale price of boars was estimated initially with a model that included breed, year-season and location of the test and the continuous variables ADG, BF, LEA, FE and DYS. Least-square means, representing main effects averaged equally over other effects, were computed for this model. To determine which traits were most important for each breed, a separate analysis of sale price for each breed was undertaken. The effects of year-season and location of the test were included in the within-breed analysis, along with the continuous variables ADG, BF, LEA, FE and DYS. Only those continuous variables significant for each breed were retained in each model. Final analyses were completed to

TABLE 2. GENETIC AND PHENOTYPIC CORRELATIONS[a] USED IN COMPUTING SELECTION INDEXES[b]

| Trait | Avg daily gain | Feed efficiency | Backfat |
|---|---|---|---|
| Avg daily gain | . . . | −.50 | .25 |
| Feed efficiency | −.70 | . . . | .15 |
| Backfat | .25 | .30 | . . . |

[a]Genetic correlations are below the diagonal, phenotypic are above the diagonal.

[b]Bereskin (1977).

TABLE 3. MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE TRAITS

| Trait | Mean[a] | SD | Range | |
|---|---|---|---|---|
| | | | Minimum | Maximum |
| Backfat, cm[b] | 2.070 | .267 | 1.529 | 3.129 |
| Days to 104 kg | 154.371 | 11.073 | 123.000 | 207.000 |
| Loineye area, $cm^2$ [b] | 36.155 | 3.013 | 27.096 | 49.550 |
| Avg daily gain, kg | .993 | .095 | .586 | 1.387 |
| Feed efficiency | 2.423 | .162 | 1.980 | 2.930 |

[a]N = 4,355 boars.

[b]Adjusted to 104 kilograms.

compare the economic values of the indexes with the prices paid for the performance traits. These analyses were within breed for the most populous breeds—Durocs, Hampshires, Spotted and Yorkshires—and included the effects of year-season and location of the test and only the continuous variables ADG, BF and FE.

#### Results and Discussion

Means and standard deviations for the performance traits are shown in table 3. Drewry (1979) found boars to have greater BF (2.41 cm), smaller LEA (35.2 $cm^2$), lower ADG (.91 kg/day) and poorer FE (2.66 kg feed/kg gain) than the boars in this study. Standard deviations for BF and FE were considerably smaller than those used in the indexes, suggesting that selection of boars for the test by producers at the farm has reduced variability. Residual correlations between price and performance traits are presented in table 4. ADG and DYS were the traits most highly correlated with sale prices. Relationships among ADG, FE and BF generally were lower than those found by Bereskin (1977).

The effects of breed, year-season and location of the test and of the continuous variables ADG, BF, LEA, FE and DYS were all significant. Least-square means representing each breed, station and season are presented in table 5. Landrace had the highest average sale price, $457, and Berkshire the lowest, $340. Boar sale prices were highest at the Ames station ($491) and lowest at Clarkson ($313). Spring sales prices were higher than fall sales by an average of $20. These differences in prices probably reflect the usual upswing in hog prices and the greater demand for boars to sire spring-farrowed pigs. Neville *et al.* (1976b) found fall tests to be higher by $55.

The relationships between performance traits and sale prices for the various breeds are listed in table 6. Entries are partial regression coefficients and reflect what a change in one trait would mean in sale price if all other traits remained constant. Validity of the results for Berkshires and Poland Chinas is questionable because of small numbers of these boars. Increases in BF of .254 cm resulted in de-

TABLE 4. RESIDUAL CORRELATIONS BETWEEN PERFORMANCE TRAITS AND SALE PRICE[ab]

| Trait | Days to 104 kg | Loineye area | Avg daily gain | Feed efficiency | Sale price |
|---|---|---|---|---|---|
| Backfat | −.05 | −.08 | .15 | .08 | −.13 |
| Days to 104 kg | | −.06 | −.61 | .11 | −.25 |
| Loineye area | | | .02 | .00 | .12 |
| Avg daily gain | | | | −.17 | .31 |
| Feed efficiency | | | | | −.24 |

[a]Residual correlations calculated after the effects of breed, year-season and location of test were removed.

[b]$|r| > .04$, $P<.05$.

TABLE 5. MEAN SALE PRICES BY BREED, STATION AND SEASON[a]

| Item | No. | Least-squares means[b], $ | Standard error |
|---|---|---|---|
| Breed | | | |
| Berkshire | 43 | 340 | 43 |
| Chester White | 169 | 421 | 22 |
| Duroc | 1,624 | 412 | 8 |
| Hampshire | 882 | 365 | 10 |
| Landrace | 90 | 457 | 30 |
| Poland China | 65 | 445 | 35 |
| Spotted | 496 | 398 | 13 |
| Yorkshire | 986 | 451 | 10 |
| Station | | | |
| Ames, IA | 1,932 | 491 | 11 |
| Ida Grove, IA | 902 | 410 | 13 |
| Lisbon, IA | 856 | 431 | 13 |
| Clarkson, NE | 665 | 313 | 15 |
| Season | | | |
| Fall | 2,085 | 401 | 7 |
| Spring | 2,270 | 421 | 8 |

[a]Model included the effects of breed, year-season and location of the test and the continuous variables ADG (average daily gain), BF (backfat), LEA (loineye area), FE (feed efficiency) and DYS (day to 104 kg). All effects and variables were significant (P<.05).

[b]Least-squares means represent estimable functions of main effects averaged equally over the other effects.

creases in sale price ranging from $30 to $68. An increase in ADG of .045 kg resulted in an increase in sale price of $19 to $55. Responses in FE were similar in magnitude to those in ADG but opposite in sign. DYS was important only for Durocs. These results differ from those reported by Neville *et al.* (1976b), who found DYS to be more useful in predicting sale price than ADG. LEA was not important for Chesters or Hampshires.

The percentage of variation accounted for by these performance traits and the effects of station and year-season were .21 (Spotted), .24 (Duroc), .25 (Yorkshire), .34 (Hampshire) and .42 (Landrace). These values agree with the results of Neville *et al.* (1976b). It appears that buyers were influenced by other information such as soundness, conformation and pedigree, since the models used accounted for less than one-half of the variation in sale price.

Relative economic values for the Iowa index and the NSIF index are listed in table 7. Also listed are the relative economic values that buyers were willing to pay for tested Hampshire,

TABLE 6. RELATIONSHIP OF PERFORMANCE TRAITS[a] TO SALE PRICE

| Breed | Avg change in sale price per: 1-day increase in days to 104 kg | .254-cm increase in backfat | .645-cm² increase in loineye area | .045-kg increase in ADG[b] | .045-unit increase in feed/gain | $R^2$ |
|---|---|---|---|---|---|---|
| Berkshire | NS[c] | NS | NS | NS | NS | .36 |
| Chester White | NS | −34.05 | NS | 18.90 | −28.29 | .36 |
| Duroc | −3.32 | −48.48 | 7.90 | 38.17 | −38.70 | .24 |
| Hampshire | NS | −32.31 | NS | 46.50 | −25.78 | .34 |
| Landrace | NS | −30.63 | 8.62 | 32.78 | −34.65 | .42 |
| Poland China | NS | −151.10 | NS | 95.36 | NS | .49 |
| Spotted | NS | −37.80 | 8.56 | 44.10 | −36.40 | .21 |
| Yorkshire | NS | −67.70 | 11.60 | 55.10 | −53.40 | .25 |

[a]Analysis was within breed and included the effects of year-season and location of test.

[b]Average daily gain.

[c]NS = not significant (P>.05). All other coefficients were significant (P<.05).

TABLE 7. RELATIVE ECONOMIC WEIGHTS AND SALE PRICES FOR INDEX TRAITS

| | Relative economic values | | | | | |
|---|---|---|---|---|---|---|
| | | | Sale price[c] | | | |
| | Recommended[a] | Iowa index[b] | Durocs | Hampshires | Spotted | Yorkshires |
| Backfat | −3.50 | −3.50 | −3.50 | −3.50 | −3.50 | −3.50 |
| Avg daily gain | 4.00 | 6.15 | 3.16 | 5.04 | 4.00 | 2.69 |
| Feed efficiency | −9.00 | −5.48 | −2.60 | −2.78 | −3.34 | −2.73 |

[a]Recommended by National Swine Improvement Federation (NSIF; Hubbard, 1981).

[b]Calculated from estimates of variances and covariances in NSIF (Hubbard, 1981) with the equation $\underset{\sim}{a} = \underset{\sim}{G}^{-1} \underset{\sim}{P}\, \underset{\sim}{b}$ (equation 3).

[c]Relative economic values calculated from partial regression coefficients for only backfat, average daily gain and feed efficiency after adjustment for year-season and location of test. All values are in relation to backfat.

Duroc, Spotted and Yorkshire boars. These economic values were computed for only those four breeds and the traits BF, ADG and FE. The economic values are relative to BF. Results indicate that Iowa index values place more emphasis on ADG and less on FE than do those recommended by NSIF. Buyers placed considerably less emphasis on FE than recommended by either index; they also placed less emphasis on ADG than suggested in the Iowa index for all four breeds, and less emphasis on ADG than recommended by NSIF for Durocs and Yorkshires.

Results suggest that maximum improvement in all performance traits is being impaired because buyers are putting relatively little emphasis on performance traits when purchasing boars. Changes in Iowa index weights may have to be made to reflect NSIF guidelines. In addition, buyers should be educated about the need to place more weight on performance traits. This education might include information on the advantages of buying tested boars and the emphasis that producers should place on individual traits to increase efficient pork production.

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