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A STUDY INTO THE RELATION OF CARCASS MEASUREMENTS TO MEAT PRODUCTIVITY OF YOUNG BEEF CATTLE

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SUMMARY

The purpose of this work was to study a possibility of predicting the composition of beef carcasses by the interrelations of the weight of certain parts of a carcass to their measurements.

The authors measured the length, width, round girth, muscle and fat thickness of every side. Sufficiently high correlation coefficients were found among meat and side weights, the distance from withers to the end of the breastbone, round girth, side length. The mathematical processing of the results obtained yielded regression equations which allow to predict the meat productivity of beef cattle and the morphological composition of carcasses without boning.

INTRODUCTION

At present in many Socialist and some capitalist countries different methods for evaluating the quality of cattle and their carcasses based on measurable and descriptive characteristics are applied.

The system of farm animals evaluation and payments to suppliers for the derived meat quantity and quality are more perfect than the determination of the finish of the live animals; though, this system does not completely satisfy increased requirements to the evaluation of live cattle and carcasses as it does not eliminate descriptive characteristics.

Nowadays, carcass shape and fat thickness are estimated visually, but the visual method cannot be standardized and is not objective, therefore efforts are being made in many countries to find measurable, objective features to predict carcass composition. The efforts are aimed at establishing an interrelationship between indirect characteristics and carcass morphological composition.

The objective methods of carcass evaluation include the determination of carcass density and specific weight, measuring different parts of a carcass, thermographing (finding differences in the temperature of fat and muscle tissues), recording the outlines of subcutaneous fat, measuring individual parts of a carcass relative to the whole carcass, etc.

Various devices and instruments applied for this include the use of a small metallic ruler and of counters to measure the natural radioactive potassium (K-40).

As an example, we can mention a study of Hungarian researchers who determine bone percentage in a carcass by the product of the length and height of the 3rd lumbar vertebra. French scientists revealed a close connection not only between carcass weight and length, but between carcass weight and weight-to-length ratio.

The scientists from the Zootechnical Institute (Holland) claimed that meat quality is best expressed as an index derived by dividing warm carcass weight by the product of carcass length and breast depth.

American scientists developed a system of videoanalyzing the cut surface at the 12th rib; the analyzer gives directly the data on carcass area, fat and muscle areas (%%), fat thickness and meat colour.

The quality of slaughter cattle and their carcasses is first of all determined with boning yields. The contents of muscle tissue in a carcass and its ratio to fat and bone predetermine carcass quality. Thus, the total muscle percentage should not be the ultimate characteristics with which other features are compared. And vice versa, the total fat percentage which grows with lower muscle percentage may also be used as the ultimate characteristics.

MATERIALS AND METHODS

The results to be presented are a part of a study aimed at developing an evaluation procedure for live cattle and carcasses which, when based on accurate measurements, can estimate the yield of a carcass and individual cuts and their meat contents proper.

The development of a procedure using measurable parametres will serve the basis to design a device to be used under the commercial conditions in accordance with the standards, this, in particular, ordering the stock-taking and rational utilization of meat, stimulating the raising and finishing of cattle of a high meat productivity.

Experiments were performed at the Shyaulyay meat packing plant in Lithuania. All together 45 carcasses of young beef animals having the liveweight of 105 kg and over were tested.

According to the experimental design the following measurements were taken on trimmed sides prior to loading into a chill cooler: length, round girth, distance from withers to the end of the breastbone and from withers to the keel bone, distance from neck-end to the end of the keel bone, fat thickness between the 2nd and the 3rd segments of the breastbone, l.dorsi muscle thickness at the 9th rib; in addition, warm carcass weight was accounted for.

Chilled sides were weighed, their morphological composition was determined by means of boning and separating meat, fat, bones, sinews and tendons.

RESULTS AND CONCLUSIONS

The results obtained were mathematically processed in a SM-3 Computer. Eleven variables were introduced, including:
1. warm carcass weight (T); 2. round girth (A); 3. side length (l); 4. distance from withers to the end of the breastbone (Б); 5. distance from withers to the keel bone (B); 6. distance from neck to the keel bone

(Г); 7. muscle thickness at the 9th rib (Д); 8. fat thickness (Е); 9. side weight before boning (М); 10. meat weight (Р); 11. bone weight (К).

The correlation matrix, prepared for left sides, aloowed to establish the extent of connection among the mentioned parametres. A study into the correlation of meat weight to different side measurements indicated that the highest correlations were observed for side weight (r=0.994), round girth (r= 0.879), distance from withers to the end of the breastbone (r=0.873), distance from withers to the keel bone (r=0.857).

After mathematical calculations the computer selected four measurements (1,2,3,4), based on which a regression equation was derived to estimate the quantity of meat in left sides:

$$P=16.34+0.877T-0.0604A-0.1221-0.083Б,$$

where
T and P are given in kg; A, l and Б - in cm.

A comparison of estimated and actual meat quantities after deboning showed that the error constituted from -3.527 to +7.226.

The analysis of the correlation matrix prepared for right sides indicated the closest relation of meat weight to side weight (r= 0.994), to the distance from withers to the end of the breastbone (r=0.932), to round girth (r=0.907), to the distance from withers to the keel bone (r=0.859), to side length (r=0.844).

On the basis of mathematical calculations the computer selected the following variables, most strongly related to meat yields: 1,7,6,4 , for right sides. The regression equation was derived:

$$P=-4.341+0.791T+0.15Б-0.1395Г+0.398Д,$$

where P and T are expressed in kg; Б, Г and Д - in cm.

The estimation error ranged from -7.213 to +4.638.

The analysis of the data for the right and the left sides resulted in two coinciding features, viz., side weight (T) and the distance from withers to the end of the breastbone (Б), and non-coinciding ones, viz., side length (l), muscle thickness at the 9th rib (Д), round girth (А), the distance from neck to the keel bone (Г).

This can be attributed to the measurement error or to a difference in side dimensions due to their assymetric sawing.

Taking into account that meat quantity is highly correlated to round girth and side length, the computer was loaded with the same variables as in the regression equation for the left sides, and another equation was derived to estimate meat weight in the right sides:

$$P=-14.0+0.79T+0.0993A-0.009791+0.041Б.$$

The estimation error, as compared to the actual figures, ranges from -6.624 to +5.656.

The analysis of the experimental data showed that it is possible to predict meat yields using the selected measurable characteristics without boning.