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Conference paper

APPLICATION OF DIGITAL IMAGE PROCESSING TO ESTIMATE SLAUGHTER VALUE OF BULLS

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The Aim of investigation

The main aim of our reseach was to prove that Video Image Analysis is useful for the evaluation of carcass composition in live cattle.

The application of microcomputer, where an image for a Video camera is processed, is not new in anial science. Cross et al. (1) tried to predict composition of the 9-10-11th rib sector in beef cattle using a video image analyzing system. Misztal (3) used a picture processing system for the estimation of carcass composition in live cattle.

New possibilities in computing allowed for much more strict accuracy in this method, its lower cost and much higher speed of processing of the digital images of animals than in the former researches. Our experiment schould result in fully automated estimation method of breeding value of live animals, which could be calculated on the basis of predicted value of carcass cutability, cold carcass weight and valuable cuts.

Material and Methods

Our research demanded the following equipment: Cannon Still Video Camera, IBM PC 486 DX, Frame Grabber and original Software.

First, all 99 live bulls at ca. 500 kg live weight were photographed. The animals were of different breeds and crosses.

Three images of each animal were taken: first form the top of the animal, second from the right side of the animal and third from the rear of the animal (see pictures above).

The images were digitized into TIFF standard and filtered afterwards. The filtering was processed by filter of contrast enhancement.

Our software programme allows to measure 24 different characteristics of body shape on the well prepared image of animal.

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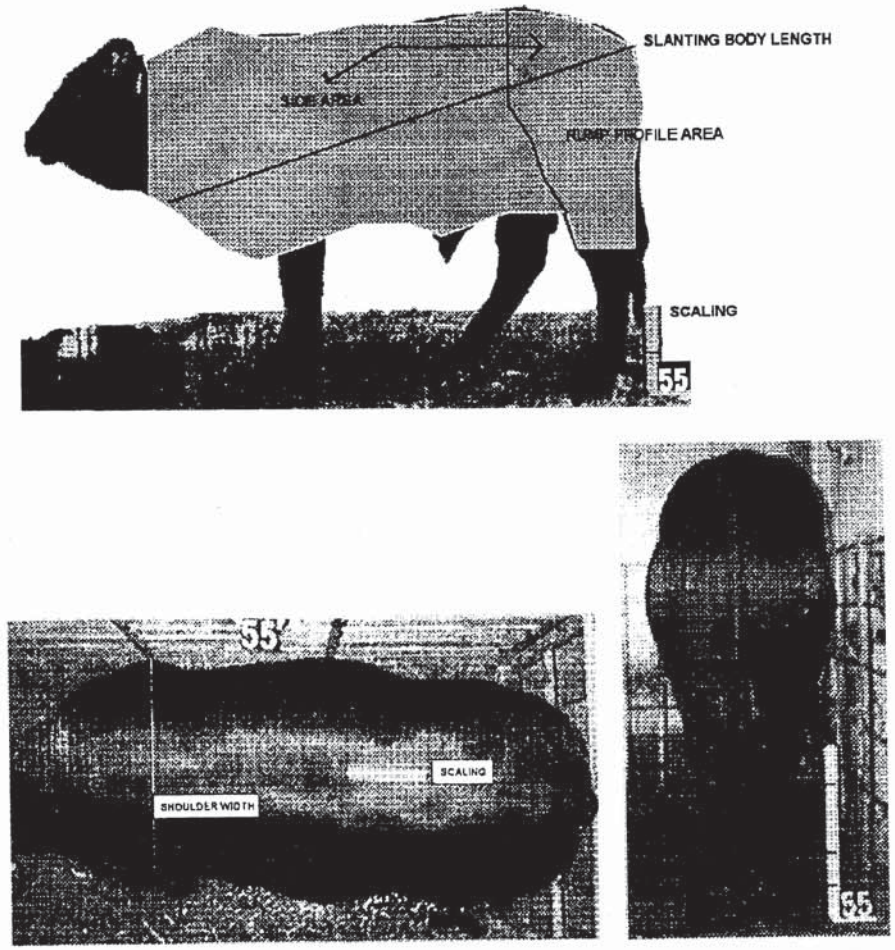
AN EXAMPLE OF BODY MEASUREMENTS ON DIGITIZED IMAGE OF ANIMAL



Results and Discussion

Based on 99 bulls photographed and slaughtered and the same body weight there were found highly significant correlation between carcass characteristics (body weight, cold carcass weight, valuable cuts, meat in valuable cuts) and the following four body measurements (slanting body length, right side shape profile area of animal, right side rump profile area and shoulder width) made on digitized image of an animal. (tab. 1)

The results were similar to those reported by Jankowski et al. (2), Misztal (3) and Stouffer et al. (4).

Tab. 1. - SIMPLE CORRELATIONS BETWEEN SLAUGHTER TRAITS AND SOME MEASUREMENTS ON DIGITIZED IMAGE OF ANIMAL

Variable	Right side shape profile area	Right side rump profile area	Shoulder width	Slanting body engthh
Body weight	0.72	0.69	0.69	0.73
Cold carcass weight	0.72	0.75	0.62	0.78
Valuable cuts	0.73	0.78	0.67	0.79
Meat in valuable cuts	0.68	0.74	0.68	0.75

There were also found highly significant correlations among some body measurements on digitized images of animal (table 2) and investigated slaughter characteristics (table 3).

Tab. 2. - THE BEST SIMPLE CORRELATIONS AMONG BODY MEASUREMENTS ON DIGITIZED IMAGE OF BULLS

Variable	Right side rump profile	Shoulder width	Slanting body length
Right side shape profile area	0.82	0.52	0.92
Right side rump profile area		0.58	0.84
Shoulder width			0.59

Tab. 3. - SIMPLE CORRELATIONS AMONG SLAUGHTER TRAITS OF INVESTIGATED BULLS

Trait	Cold carcass weight	Valuable cuts	Meat in valuable cuts
Body weight	0.95	0.91	0.88
Cold carcass weight	-	0.98	0.96
Valuable cuts		-	0.98

Stepwise linear regression at probability level 0.05 was used to calculate multiple correlation coefficients between every slaughter trait and measurement vector.

Using the best relations between slaughter traits and measurements on digitized images of animal the following overall stepwise regression linear model was constructed:

$$Y - \overline{Y} = b_1(b_1 - \overline{x}_1) + b_2(x_2 - \overline{x}_2)\, b_3(x_3 - \overline{x}_3) - b_4(x_4 - \overline{x}_4) + b_5(x_5 - \overline{x}_5)$$

where

b_1 = slanting body length,
b_2 = shoulder width,
b_3 = right side rump profile area,
b_4 = right side shape profile area,
b_5 = body weight before slaughter

The partial regression coefficients of every model were 0.96 Se = 6.0 for cold carcass weight, 0.94 Se = 6.0 for valuable cuts, and 0.92 Se = 6.0 for meat in valuable cuts and were slightly higher than those obtained by Jankowski et al. (2) (R = 0.48 - 0.94) and Misztal (3) (R = 0.86-0.91)

Conclusions

The high partial regression coefficient (R) of every model showed that there is the possibility to make use of this method as selection criteria, based on individual performance test, for predicting slaughter productivity of live bulls of beef breed.

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PRIMJENA DIGITALNE OBRADE SLIKE ZA PROCJENU KLAONIČKE VRIJEDNOSTI BIKOVA

Sažetak

Glavna svrha našeg istraživanja bila je dokazati da se analiza video slike može upotrijebiti za procjenu sastava polovica u žive stoke. Primjena mikrokompjutora, gdje se obrađuje slika video kamere, nije novost u znanosti o životinjama. Cross i sur. (1) pokušali su predvidjeti sastav područja 9., 10. i 11. rebra u goveda služeći se analiziranjem video slike. Misztal (3) je upotrijebio obradu slike za procjenjivanje sastava polovica u žive stoke. Nove mogućnosti izračunavanja dale su mnogo veću točnost u ovoj metodi, te manje troškove i mnogo bržu obradu digitalnih slika životinja nego u ranijim istraživanjima. Naš bi pokus morao dati potpunu automatiziranu metodu procjenjivanja uzgojne vrijednosti živih životinja, što bi se mogla izračunati na osnovi predviđene vrijednosti rasjecanja polovica, težine hladnih polovica i dijelova vrijednog mesa. Djelomični koeficijenti regresije svakog pojedinog modela bili su 0.96 Se=6.0 za težinu hladnih polovica, 0.94 Se=6.0 za vrijedno meso i 0.92 Se=6.0 za meso u vrijednim dijelovima, te su bili neznatno viši od onih što su ih dobili Jankowski et al (2) (R=0.48 - 0.94) i Misztal (3) (R=0.86 - 0.91). Visoki djelomični koeficijent regresije (R) svakog modela pokazuje da postoji mogućnost primjene ove metode kao kriterija selekcije, što se temelji na pojedinom testu performance, za predviđanje klaoničke produktivnosti mesne pasmine.

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