

TWO-WAY SELECTION FOR CARCASS TRAITS BY COMPUTERISED TOMOGRAPHY

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Abstract - With the help of CT based selection three rabbit groups were formed (progenies of the weakest « - sel », the best « + sel » and the second generation of the best bucks « ++ -sel ») on the basis of their L-value (average surface of the m. longissimus dorsi between the 2nd and 3rd and 4th and 5th lumbar vertebra. The difference was 5% in the L-value and 2% in the dressing percentage between the two extremes (« - sel » and « ++ sel ».). The warm carcass, the intermediate part and the hind part weight increased with 35, 22 and 14 g res. in the above mentioned order. The weight of the skin and the full gastrointestinal tract decreased with 17 and 23 g resp. There were no differences in the case of the fore part and edible organs. As a result of the two-year selection by CT the L-value (18.4, 20.7 cm²) and the dressing percentage (61.8, 63.8 %) increased with 11 and 2 % resp.

INTRODUCTION

The high dressing percentage and the amount of valuable meat parts of the carcass are on the focus of the consumers, slaughter houses and export-import companies. While successful selection is going on to get better weight gain there are no data available about selection for carcass traits. This is interesting because the dressing percentage is the feature which isn't improved under domestication. In contrast to the increase of the daily weight gain the dressing percentage decrease from 1965, reported by JENSEN (1983) based on the data of the Danish progeny test station.

Traditionally the carcass traits could be determined by experimental slaughtering, while up to now the selection based on progeny tests only. This partly need an expensive test-stock, partly reduce the progress of the selection because the long generation interval. New in vivo methods were developed in the last years to predict the carcass traits and body composition. One of these is the X-ray computerised tomography (CT) which is a powerful tool for the individual examination of different tissues.

In previous experiments SZENDRŐ et al., (1992) were found correlations (≈ 0.7) between the main carcass traits and the surface of the m. longissimus dorsi. The first reports were published by SZENDRŐ et al., (1994) and ROMVARI et al., (1995) about the use of CT scanning in rabbit selection.

MATERIAL AND METHODS

The experiment and the continuous selection were carried out at the Faculty of Animal Science of Pannon Agricultural University using Pannon White rabbits. The animals were kept indoors in flat-deck wire cages. They were fed ad libitum commercial diet. The rabbits were weaned at the age of 6 weeks, their weight gain was measured between 6 and 10 weeks of age.

In the first step of the selection experiment 61 male growing rabbits were chosen with a selection limit of 42 g/day weight gain (avg.= 47.6 g/day) from among 216 animals (avg.= 38.6 g/day) (Figure 1).

With the help of CT scanning the best (« + sel ») and the weakest (« - sel ») 5-5 rabbits were selected on the base of their L-value, which is the average surface of the m. longissimus dorsi. It was measured at two anatomical points i.e. between 2nd and 3rd and 4th and 5th lumbar vertebra accordig to ROMVARI et al., (1996).

Figure 2. shows L-values of the 61 growing rabbits selected according to their weight gain (2.4-3.4 kg body weight). The dots indicating every single animal are scattered around the regression curve $Y = 4.1452 + 0.0048 * X$ where X = weight of growing rabbits, g, Y= L-value, cm². The best 5 and the weakest 5 bucks located farthest from the curve were selected (+sel and -sel) (see squares and triangles darkened in the Figure).

Figure 1 : Distribution of growing rabbits according to their daily weight gain between 6 and 10 weeks (selection limit = 42 g/day)

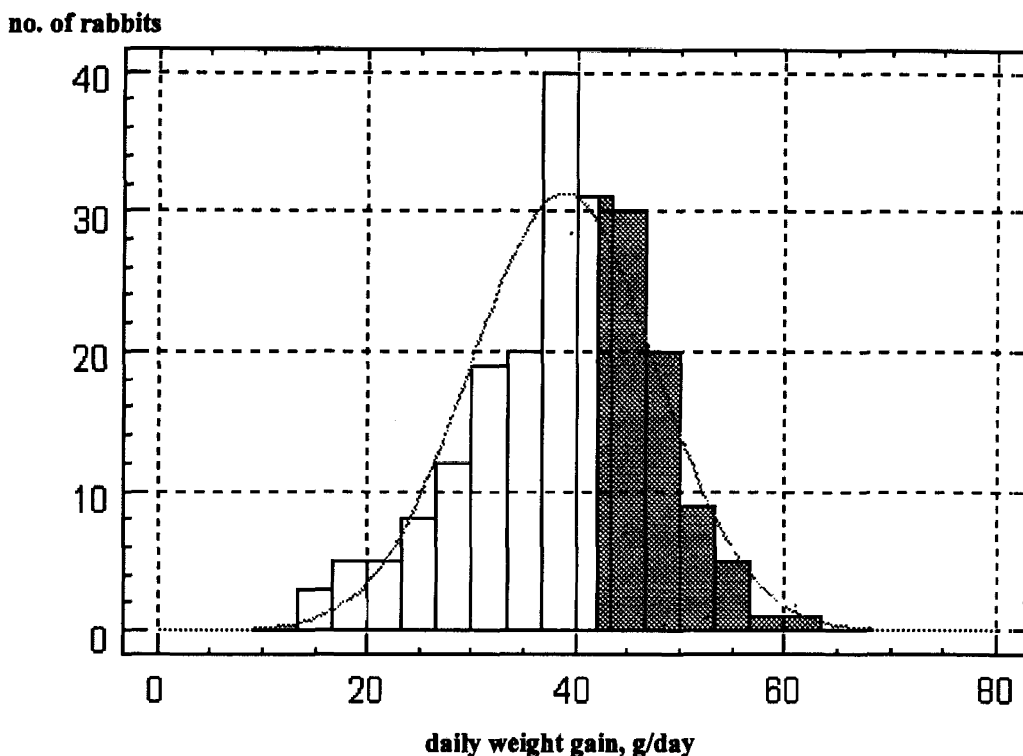
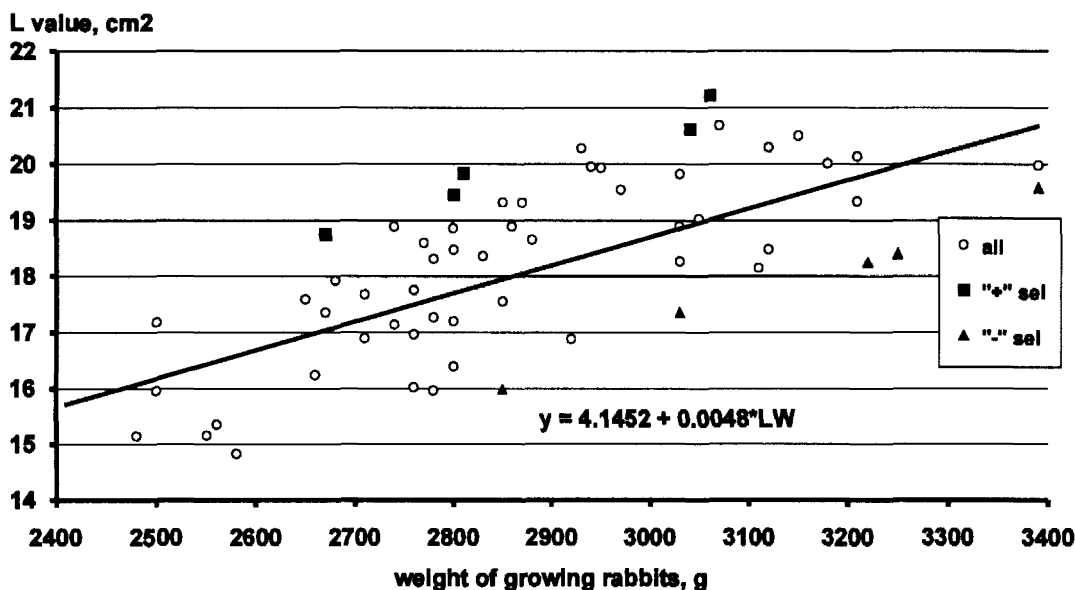


Figure 2 : The best 5 (« + sel », above) and the weakest 5 (« - sel », below) according to their L-value



Thereafter randomly chosen does (non selected for carcass trait by CT) were inseminated with the semen of these bucks. In the second selection's step the best 5 (« ++ sel ») were repeatedly chosen from among the progenies group of the « + sel » bucks (n=40). In this experiment the L-value and the carcass traits were compared of the progenies of the three buck groups (« - sel », « + sel », « ++ sel ») with approximately the same live weight (avg.= 2784 g, sd.= 40.5) and the same birth date. (The « - sel » and « + sel » bucks were the same as in the first selection step.)

Finally the effect of the field selection was measured. During it nearly 1000 Pannon White growing rabbit were scanned within the last two years. Every time 40 to 80 males were examined -always the best ones in daily weight gain-, then the top 10 % was chosen on the base of the L-value for breeding animals.

The approximately 11 week old progenies were scanned after 12 hours' fasting at night, without anaesthetics in the CT Biological Centre of our University.

The rabbits were slaughtered after 24 hours' fasting with the method of BLASCO et al., (1993). The weight of the carcass, fore part, intermediate part, hind part, skin, full gastrointestinal tract (stomach and intestines with empty bladder) and edible organs (lungs, trachea, heart, kidneys and perirenal fat) were measured. Further on the dressing percentage (warm carcass with head and edible organs compared to the live weight after 24 hours' fasting) was calculated too.

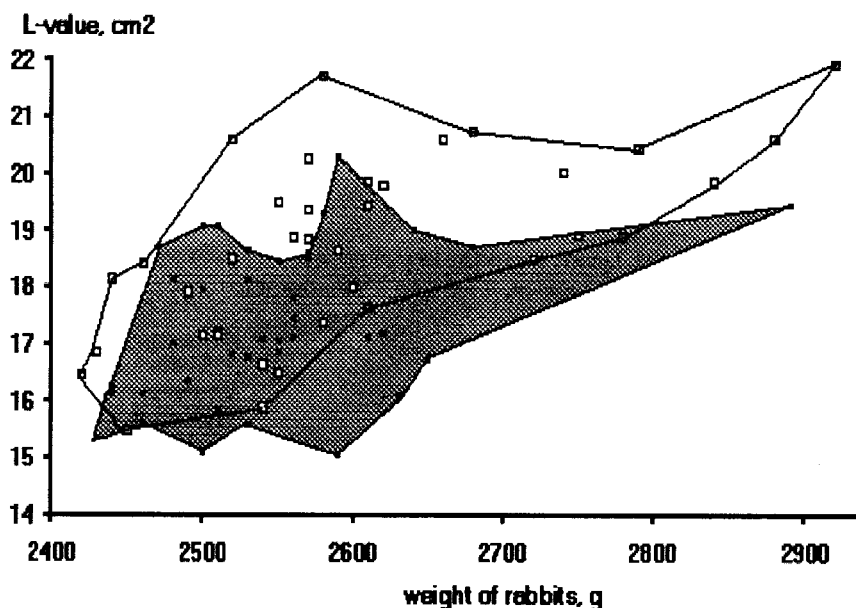
The statistical analysis was done by the One-Way ANOVA (exclude cases analysis-by-analysis) and the LSD post hoc multiple comparison (sample size estimate - harmonic average of pairs) procedures of the SPSS 5.0 software package.

RESULTS AND DISCUSSION

First selection experiment

Figure 3. indicates that progeny of the +sel and -sel bucks are located separately in part according to their L-values. Average L-value of the 80 growing rabbits was 18 cm². Average of the two groups differed from this value by 0.6-0.7 cm².

Figure 3 : L-values of progenies of « + sel » (light) and « - sel » (dark) bucks (n= 40 - 40)



The difference between average L-values of the progeny of « + sel » and « - sel » bucks (18.7 cm², n=40 and 17.42 cm², n=40) was significant at P<0.05 level. This proves that selection of the male growing rabbits for L-value was efficient.

This statement is supported by results of the comparative slaughter too. Average dressing percentage of the progenies of +sel and -sel bucks (n=25 and 30) amounted to 59.86 % and 58.43 % resp. (the difference of 1.43 % was significant at P<0.05 level). The most frequent values were 59-60 % in the « + sel » group and 58 % in the « - sel » group.

Second selection experiment

Table 1 shows the L-value and carcass traits of the average live weight progenies of the three buck groups. As a result of the One-Way ANOVA with the exception of the fore part and the edible organs all parameters differ at P=0.05 level between the three progenies groups. The second and third column shows the F ratio and F prob.

values of the analysis. The differences between the experimental groups were checked with the LSD test at P=0.05 level.

It can be seen that the CT based selection increases the intermediate and hind part weight (the most valuable parts of the carcass) and it decreases the rate of the skin and the gastrointestinal tract (probably there is a connection between the skin weight and the fat building in).

Table 1 : The L-value and the carcass traits in the progeny groups

Groups	« - sel » n=25		« + sel » n=26		« ++ sel » n=24			
Live weight, g	2785	33.1	2785	48.9	2781	38.9		
Carcass traits	F	P	Mean	SD	Mean	SD	Mean	SD
L-value, cm ²	3.421	0.038	19.61 ^a	1.56	20.5 ^{ab}	1.61	20.75 ^b	1.64
Carcass, g	4.803	0.011	1347 ^a	44.4	1356 ^a	37.7	1382 ^b	44.1
Fore part, g	0.068	0.934	397	15.8	397	22.3	395	18.4
Int. part, g	5.908	0.004	430 ^a	25.9	433 ^a	23.4	452 ^b	25.7
Hind part, g	3.337	0.041	513 ^a	23.7	514 ^a	20.0	527 ^b	21.7
Skin, g	3.326	0.042	386 ^a	23.5	374 ^{ab}	22.7	370 ^b	22.7
Edible org., g	3.231	0.045	124	14.8	117	9.7	124	10.3
Gastroint., g	2.817	0.064	379 ^a	35.5	364 ^{ab}	35.2	356 ^b	34.6
Dressing p., %	12.694	0.000	62.25 ^a	1.49	63.04 ^b	1.35	64.06 ^c	0.89

This is why the dressing percentage is improved continuously. There is no difference in the weight of the fore part and edible organs.

On Figure 4, the considerable difference is well visible between the « - » and « ++ » selected groups in the case of the L-value -over 5 %- and dressing percentage -nearly 2 %.

Figure 4. Changes of the L-value and the dressing percentage in the progeny groups of the « - », « + » and « ++ » bucks

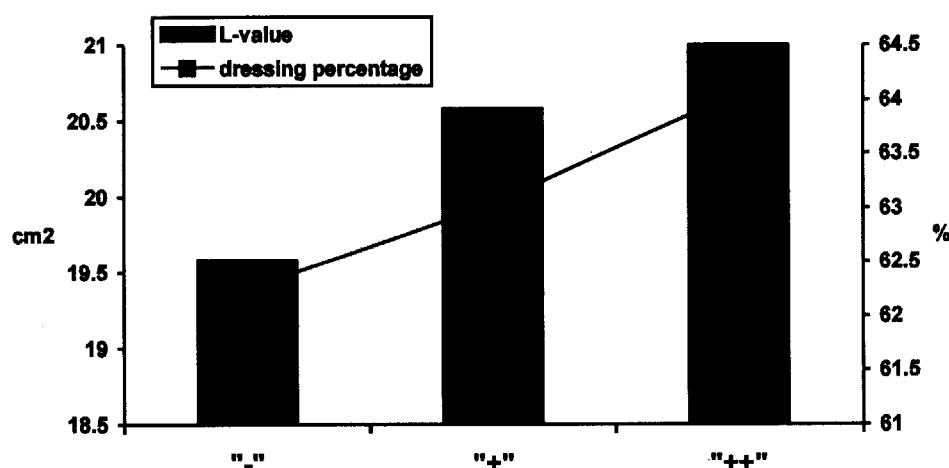
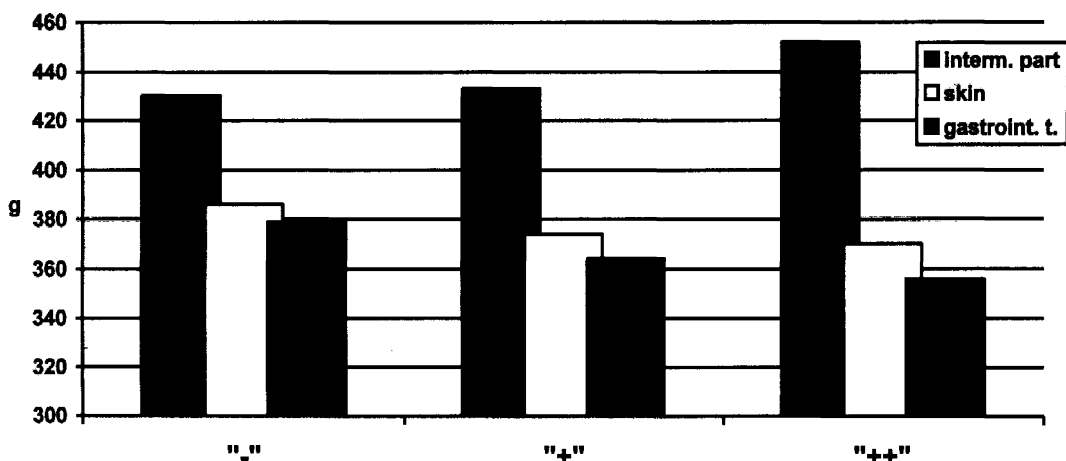


Figure 5, demonstrates the differences in the weight of the intermediate part, skin and gastrointestinal tract between the progenies groups.

Figure 5 : Changes of the intermediate part, skin and the gastrointestinal tract weight in the progeny groups of the « - », « + » and « ++ » bucks



Field selection

Two groups were picked out to measure the efficiency of the selection. The first one contained 285 animals the parents of which weren't selected by CT. The second one contained the results of the last four scanning steps' 231 rabbits which were originated from CT selected bucks. The average live weight was 2800g and 2937g resp. The two rabbit groups are well separable. The average surface of the m. longissimus dorsi increases from 18.35 to 20.71 cm². The difference between the two groups is more than 11 %, which is significant at P=0.05 level.

In the case of the progress measuring of the dressing percentage -similarly to the above mentioned- two rabbit groups were created. While the first one contained the 150 progenies of non selected bucks, the second one contained 209 progenies of CT selected bucks. The average live weight was 2601 g and 2645 g resp. While the starting group's average dressing percentage was 61.79 %, the second one had a value of 63.77 %. It means an about 2 % increase which is significant at P=0.05 level.

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Die zweiselektion auf schlachtwert mit hilfe des computertomographen - Aufgrund der mit dem Computertomographie erhaltenen L-Werte (durchschnittliche Querschnittsfläche des m. longissimus dorsi zwischen dem 2./3. und dem 4./5. Wirbel) wurden 3 Gruppen mit je 5 Rammlernachkommen gebildet: die schwächsten (-minus), die besten der 1. Generation (+plus) und die besten der 2. Generation (++plus). Der Unterschied zwischen den beiden Extremgruppen (-und++) betrug beim L-Wert 5 %, bei der Schlachtausbeute 2 % (P<0.05). Das Gewicht von Schlachtkörper, mittlerem Rumpf und Keulen nahm in dieser Reihenfolge um 34, 22 und 14 g zu, während das Gewicht von Haut und Magen-Darm-Traktes um 17 bzw. 23 g zurückging (P<0.05). Das Gewicht des Vorderendes und der verwertbaren Innereien veränderte sich nicht. Nach 2jähriger Selektion aufgrund der L-Werte des CT erreichte der L-Wert einen 11 % höheren Wert (von 18.3 auf 20.7 cm²), und die Schlachtausbeute stieg um 2 % (von 61.8 auf 63.8 %).