E INFLUENCE OF THE GENOTYPE OF SIRE AND PHYSIOLOGICAL TYPE ON CARCASS COMPOSITION

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MMARY: The carcass composition charactersitics of certain sire (Afrikaner-A, Brahman-B, Charolais-C, Hereford-H & mentaler-S) genotypes and physiological groups (early, medium-early, medium, medium-late & late) were evaluated an equal subcutaneous fat (SC fat) (%). Weaner steers of these genotypes were slaughtered immediately post weaning 210 kg) and, after intensive feeding, at 340, 380 and 440 kg live masses respectively. Carcass composition were ermined in terms of bone, meat and SC fat (dissection) and muscle and total fat (proximate analysis). Significant $<0,05$ & $P<0,01$) sire and physiological effects were evident for all carcass composition characteristics, except muscle). These significant differences favoured the late maturing C- and S-sired genotypes and medium-late and late groups, h higher values for meat (%) and muscle:bone ratio and a lower bone (%). Further, an important observation was significantly ($P<0,05$) higher total fat (%) in these later maturing animals at an equal SC fat (%), compared to the y maturing animals (A-, B- & H-sire and early, medium-early & medium).

RODUCTION: In countries such as the United Kingdom (MLC), France and also South Africa beef carcasses are sified in fatness classes by means of the visual appraisal of SC fat (%). The general assumption is that by using criterion of classification, carcasses from diverging genetic backgrounds and physiological origins would be uniform carcass composition, when classified in common fat codes or grades. Recent research, however, indicates that this umption is not always true, especially when relatively large within-population variations in physiologigal status are nmonly found.

In this regard KÜNZI *et al* (1978), for intance, found a significantly ($P<0,05$) higher meat (%) and consequently wer bone (%) in the carcass of the C, as compared to three earlier maturing genotypes at a constant SC fat (%). MPSTER *et al* (1982a, 1982b) also found in both studies significant ($P<0,05$) genotypic differences in the saleable at yield (%), when evaluated at a common SC fat (%). Although there was a tendency in the latter studies for r maturing genotypes (C- & S-sire) to show the higher values, an early maturing sire such as the Sussex was also racterized by a favourable meat yield (%).

In the light of these possible genotypic and/or physiological differences in carcass composition and the important of SC fat (%) as a common basis of classification, it was therefore inevitable that attention should be given to:

a) the reliability of SC fat (%) as a uniform criterion for beef carcass classification and

b) the identification of certain genotypes with more favourable carcass composition characteristics within such a mmon basis of classification..

TERIALS AND METHODS: Six purebreds, eight two-way crosses and 20 three-way crosses were evaluated with the kaner (A) as the predominant dam genotype and the A, Brahman (B), Charolais (C), Hereford (H) and Simmentaler as the respective sire genotypes. The Bonsmara (Bo) was also included, both as a purebred and a dam genotype, combination with the above-mentioned sire genotypes (except with A). From each sire genotype, between 11 - 12 es were used. Weaner steers of these genotypes (34) were intensively fed (average: ME = 10,50 MJ/kg & CP = ,86 %) in individual feeding pens and slaughtered immediately post weaning (±210 kg) and at 340, 380 and 440 kg e masses respectively for further analysis. The 34 genotypes were also combined in 5 physiological groups, by using rcass mass at an equal SC fat (%) as the basis for grouping.

The wholesale cuts of each carcass were dissected into SC fat, meat and bone, in order to determine the physical mposition of the respective cuts and the entire carcass. The meat + SC fat of each prime rib (8, 9 10th ribcut) es subjected to a proximate analysis (protein, fat, moisture & ash)(A.O.A.C., 1985). These chemical results were combined th the physical composition of the specific carcass for the calculation of the total fat and muscle (%). The composition this cut has been found to correlate closely with the composition of the entire carcass (NAUDÉ, 1972).

Carcass composition results were analysed by an analysis of covariance (SNEDECOR AND COCHRAN, 1967). This ethod of analysis has the advantage, due to the mutual comparison of more than one regression line within a single alysis, that varying numbers of genotypes or physiological groups can be compared against each other, regarding e different carcass composition characteristics (y = muscle %, bone %, meat %, etc.), at an equal carcass fatness = SC fat %). For this presentation the five (5) sire genotypes (A, B, C, H & S) and five (5) physiological groups arly, medium-early, medium, medium-late & late) were compared respectively at SC fat = 6,8 % (upper range of the ptimum grade in South Africa).

SULTS AND DISCUSSION: The predicted values of the different carcass composition characteristics for the respective e and physiological groups, at SC fat = 6,8 %, are presented in Table 1.

Significant ($P < 0,05$) sire and physiological group differences were evident for all carcass composition charact except muscle (%) (Table 1). Thus, in the analysis of covariance non-significant slope and intercept differenc observed for muscle (%) in both the sire and physiological groups. Animals of different genetic backgrou physiological status are thus uniform in the carcass yield of the edible non-fat portion, when compared at an SC fat (%). It is thus evident that the South African beef carcass classification and grading system does group car correctly in terms of muscle (%). The predicted muscle percentages for the sire ànd physiological groups at S = 6,8 % are 66,4 and 66,2 respectively.

In contrast to the non-significant sire and physiological effects on muscle (%), significant differences were ob for total fat (%), hence intermuscular or muscle fat (%) (SC fat % constant), bone (%), meat (%) and musc ratio (Table 1). Bone (%) showed a direct relationship with the stage of maturity (physiological status) of the The later maturing, heavier C- and S-sired genotypes had lower values for bone (%), as compared to the A-, H-sired genotypes (significantly higher than C-sire). This distinct maturity effect on bone (%) was especially emp by the results for the respective physiological groups (Table 1). The bone (%) in the carcass decreased sign ($P < 0,05$) with each increase in physiological stage. Thus, at a constant carcass fatness (common SC fat % percentage bone in the carcass seemed to be primarily a function of the physiological status of the animal, hen carcass mass. JONES *et al* (1984) reported similar findings in small and large framed animals, evaluated at total fat in the carcass. The large framed animals with carcass masses 41,9 % (96,7 kg) heavier than those small framed animals, had significantly ($P < 0,05$) smaller bone percentages (16,5 vs 18,3 %) in the carcass. KO *al* (1976) and KOCH *et al* (1979), however, found no significant differences in bone (%) in the carcasses of a varying widely in maturity, when evaluated at a constant fat trim (%).

Above-mentioned sire and physiological group differences in bone (%) were directly responsible for almost sire and group differences in meat (%) and muscle:bone ratio (Table 1). Since muscle (%) was uniform, musc differences would follow almost a similar pattern to bone (%), while a similar tendency would be evident for me (meat % = carcass less bone (%) + SC fat % - constant). Bone and meat (%) as a result showed the between-sire and -physiological group differences (Table 1). The later maturing sires (C & S) and physiological with the smallest proportional bone yield showed the highest values for meat (%). Similar differences as for bo were also noticeable for muscle:bone ratio in the sire comparison. In the physiological groups the increase in musc

TABLE 1: PREDICTED VALUES OF THE DIFFERENT CARCASS COMPOSITION CHARACTERISTICS FOR THE RESPECTIVE SI PHYSIOLOGICAL GROUPS AT SC FAT = 6,8 %

SIRE/PHYS. GROUP	CARCASS * (kg)	BONE (%)	MEAT (%)	MUSCLE:BONE RATIO	MUSCLE FAT (%)	TOTAL F (%)
SIRE:						
A	186^{ac}	$14,1^{a}$	$79,1^{a}$	$4,70^{a}$	$12,4^{a}$	$19,2^{a}$
B	193^{a}	$14,5^{a}$	$78,8^{a}$	$4,61^{a}$	$11,9^{a}$	$18,6^{a}$
C	233^{b}	$13,3^{b}$	$79,9^{b}$	$4,95^{b}$	$14,1^{b}$	$20,9^{b}$
H	173^{c}	$14,5^{a}$	$78,8^{a}$	$4,61^{a}$	$11,9^{a}$	$18,6^{a}$
S	214^{d}	$13,8^{ab}$	$79,4^{ab}$	$4,76^{ab}$	$13,7^{b}$	$20,5^{b}$
PHYS. GROUP:						
EARLY	157^{a}	$14,9^{a}$	$78,3^{a}$	$4,65^{a}$	$11,6^{a}$	$18,4^{a}$
MEDIUM-EARLY	179^{b}	$14,6^{b}$	$78,7^{b}$	$4,69^{a}$	$12,1^{a}$	$18,7^{a}$
MEDIUM	206^{c}	$14,1^{c}$	$79,2^{c}$	$4,75^{ab}$	$12,7^{a}$	$19,5^{a}$
MEDIUM-LATE	230^{d}	$13,5^{d}$	$79,8^{d}$	$4,77^{ab}$	$14,4^{b}$	$21,1^{b}$
LATE	260^{e}	$12,8^{e}$	$80,4^{e}$	$4,89^{b}$	$14,8^{b}$	$21,6^{b}$

^{a,b,c,d,e} - Values within columns of each sire/physiological group with different superscripts differ significantly (P<

PHYS. - Physiological

* - Cold carcass mass

o with an increase in stage of maturity was, however, not as significant as for bone (%). Significant ($P<0,05$) differences this regard were only evident in the higher muscle:bone ratio of the late maturing group, as compared to the early d medium-early groups (Table 1). KEMPSTER *et al* (1982a) also showed a higher saleable meat yield in the carcass kg) of the later maturing C-sired animals as opposed to the early maturing H-sired animals in their 16-month production tem. In this system, however, the early maturing Angus- and Sussex-sired genotypes were similar to the C-sired otypes in saleable meat yield (%). Results from the 24-month production system (KEMPSTER *et al,* 1982a) and a her study by these researchers (KEMPSTER *et al*, 1982b) were also very variable regarding saleable meat (%), and nce meat:bone ratio. Sires such as the later maturing C and Limousin and the early maturing Angus and Sussex re especially responsible for favourable meat yields (%) in the carcasses of their offspring, while animals, sired by er *alia* the H, Friesian and Lincoln Red, produced carcasses with less favourable meat yields (%) (KEMPSTER *et al*, 2a, 1982b). In contrast to the strong physiological stage effect on meat (%) and muscle:bone ratio in the present dy (Table 1), KEMPSTER *et al* (1982a, 1982b) indicated a tendency rather towards a specific genotypic effect. Carcasses the study of KEMPSTER *et al* (1982a, 1982b) were also evaluated on a constant SC fat (%) basis.

Besides the major effect of bone (%) on carcass composition, the other aspect of importance seemed to be ated to a genotypic and physiological group effect on the partitioning of fat between the major fat depots. By keeping SC fat (%) constant, a tendency towards a higher carcass yield of total fat (%) in the later maturing animals pointed ards a proportionally higher depositioning of fat in the intermuscular fat depot of these animals. The later maturing and S-sired genotypes had significantly ($P<0,05$) higher values for muscle fat (%), hence total fat (%), as compared the early maturing sires (A, B & H) (Table 1). The significantly ($P<0,05$) higher values for the medium-late and late ups for these characteristics, especially highlighted this phenomenon. CHARLES AND JOHNSON (1976) largely confirmed phenomenon also by using the analysis of co-variance as their basis of statistical analysis. These researchers for ance found that if total fat (%) in the carcass were to be kept constant (x = total fat %), the C would have had % more intermuscular fat and consequently 6,6 % less SC fat than the H in the carcass. KEMPSTER *et al* (1976) concluded that if SC fat were to be used to predict total fat in the carcass, biased results would be obtained ween genotypes, due to significant genotypic differences in the distribution of fat in the intermuscular fat depot. They nd a close relationship between kidney and channel fat and intermuscular fat and assumed that the combination of C and kidney and channel fat would improve the accuracy of predicting total fat more uniformly between genotypes. the present study no major differences were found between the sire and physiological groups respectively for kidney d channel fat (%) (DE BRUYN, 1991).

NCLUSION: When using SC fat (%) as a common basis for carcass composition comparison between animals of rging genetic backgrounds and physiological status, the following major conclusions could be drawn:

Biased results regarding total carcass fat (%) would be obtained. This observation seemed to be related directly to physiological status of the animal, with a higher relative carcass yield of total fat in later maturing animals. Thus, r a more uniform predition of total carcass fat (%), SC fat (%) should be combined with an alternative parameter(s) ch as final carcass mass or kidney and channel fat (%). New methods for the determination of total carcass fat) directly, would, however, be more preferable.

In spite of the above-mentioned higher total fat (%) in later maturing animals, these animals were characterized by e more favourable carcass composition results. Analogue to the heavier carcass masses of the later maturing C- and sired genotypes and medium-late and late groups, these animals showed the higher values for meat (%) and muscle:bone tio and lower values for bone (%). Thus, for a positive effect on quantitative and qualitative carcass quality characteristics, e utilization of a late maturing sire such as the S and C should be considered.

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