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THE CARCASS COMPOSITION OF ANGUS, HEREFORD × ANGUS, FRIESIAN × ANGUS, CHAROLAIS × ANGUS AND SOUTH DEVON × ANGUS STEERS

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SUMMARY

The carcass composition of purebred and crossbred Angus steers was compared. The Charolais × Angus produced the heaviest hot carcass and more lean boneless meat than the other breeds. The Friesian × Angus ranked as second highest producer of boneless meat and was just superior to the South Devon × Angus and the Hereford × Angus.

INTRODUCTION

A large number of crossbred beef animals have resulted from the introduction of some of the Western European beef breeds into the New Zealand beef herd. Although the economic characteristics of the newly imported breeds have been reviewed by Carter (1970) and Mason (1971) and examined in the United States by Adams *et al.* (1973), there is little evidence on the performance of these breeds in the New Zealand beef herd as distinct from crosses with the dairy herd (Barton, 1968; Everitt, 1972).

The purpose of this investigation was to collect information on the carcass characteristics of some of the new and existing beef breeds produced from the breed evaluation programme of Carter (1972).

MATERIALS AND METHODS

ANIMALS AND MANAGEMENT

The male progeny from Angus cows crossed with Angus, Hereford, Friesian, South Devon and Charolais sires were weighed, identified and castrated at birth in spring (August-October) 1972. The steers were single suckled and weaned at an average age of 132 days at Tokanui Research Station. At about 8 months of age a balanced half of the progeny of each sire, in terms of birth date, age of dam and liveweight, was transferred for grazing to the Rukuhia Soil Research Station. Representative samples totalling 14 to 20 steers by each sire breed were slaughtered for detailed carcass evaluation at the Ruakura abattoir in 9 separate batches in May-June 1974 at about 20 months of age (Table 1). The remainder, not considered in this paper, were killed at commercial meat works.

Slaughter Procedures

Steers were weighed from pasture and again after 24 h without feed. At slaughter the hot carcass weights were recorded with the kidneys and all of the carcass fat still retained. The cold sides were graded for export and local markets by experienced graders before being quartered between the 10th and 11th rib. The hind quarters retained the kidneys, perinephric, channel and cod fat. The left sides were broken down into wholesale joints according to the New Zealand commercial system (Everitt and Jury, 1964) and some of the muscles were dissected from the right side of the carcass and then completely cleaned of fat (Walker, 1958; Butterfield and May, 1966). The perinephric fats of the left sides were weighed separately from the excess fat trimmed from the commercial joints.

Biometrical Methods

Least squares analysis of individual muscle weights and the weights of carcass components included the effects of sire breed, sires within breeds, age of dam, grazing location and its interaction with both age at slaughter and sire breed, with age adjustment of weights.

Percentage composition was not adjusted for age at slaughter. An analysis of actual component weights adjusted for hot carcass weight gave results similar to those derived from the analysis of the percentage data.

In all cases the significance of overall sire breed differences was tested relative to the variation between sires within breeds. The limited numbers of sires per breed and progeny per sire precluded reliable estimates of individual breed differences. Consequently the results are discussed in terms of the relative ranking of the different sire breeds.

RESULTS

For absolute weights of the carcasses and their principle tissue components, both age at slaughter and differences between sires were significant or approached significant ($P < 0.10$) (Table 1). Sire breeds differed significantly in fasted liveweight, hot carcass weight, meat weight and bone weight and ranked from the heaviest to the lightest in the following order: Charolais × Angus (C × A), Friesian × Angus (F × A), South Devon × Angus (SD × A), Hereford × Angus (H × A) and Angus × Angus (A × A).

TABLE 1: CARCASS COMPONENTS (kg) ADJUSTED FOR AGE AT SLAUGHTER
(N.Z. Commercial cut of left side of carcass)

	C×A	*F×A*	*SD×A*	*H×A*	*A×A*	*Sig. Sire Breed*
No. of sires	5	3	5	4	6	
No. of progeny	17	14	20	20	20	
Age at slaughter (days)	608	605	605	609	611	
Fasted liveweight	403	391	370	370	340	*
Hot carcass weight	118.9	114.2	107.6	105.5	96.1	**
Boneless meat	79.4	72.0	69.1	68.5	61.8	**
Excess fat[1]	9.5	12.9	10.4	10.4	10.6	†
Kidney fat	1.41	2.22	1.89	1.58	1.57	*
Bone	26.5	25.8	23.9	23.4	21.0	**

[1] Excess fat includes the weight of all the internal and subcutaneous fat removed during preparation of boneless meat but excludes perinephric fat.
† $P < 0.10$.

The F × A produced the greatest, the C × A the least amount of fat, but overall sire breed variation was not significant for this component.

The percentage carcass composition was significantly different ($P < 0.10$) between sires for boneless meat and excess fat (Fig. 1). A significant difference was also found between sire breeds

TABLE 2: MUSCLE WEIGHTS (kg) ADJUSTED FOR AGE AT SLAUGHTER.
(Muscles removed from right side of carcass and cleaned of all surface fat)

Muscles	*C×A*	*F×A*	*SD×A*	*H×A*	*A×A*	*Sig. Sire Breed*
Gluteus medius	2.94	2.45	2.28	2.20	2.06	**
Biceps femoris	5.40	4.68	4.51	4.37	3.99	**
Longissimi thoracis et lumborum	4.71	4.06	3.97	3.91	3.66	**
Quadriceps femoris	4.67	4.07	3.94	3.80	3.51	**
Semitendinosus	1.87	1.64	1.56	1.46	1.41	**
Psoas major and minor	1.86	1.59	1.49	1.51	1.35	**
Semimembranosus	3.97	3.42	3.29	3.09	2.84	**

(*M. quadriceps femoris* includes: *M. rectus femoris, M. vastus lateralis, M. vastus medialis, M. vastus intermedius* and *M. articularis genu.*)

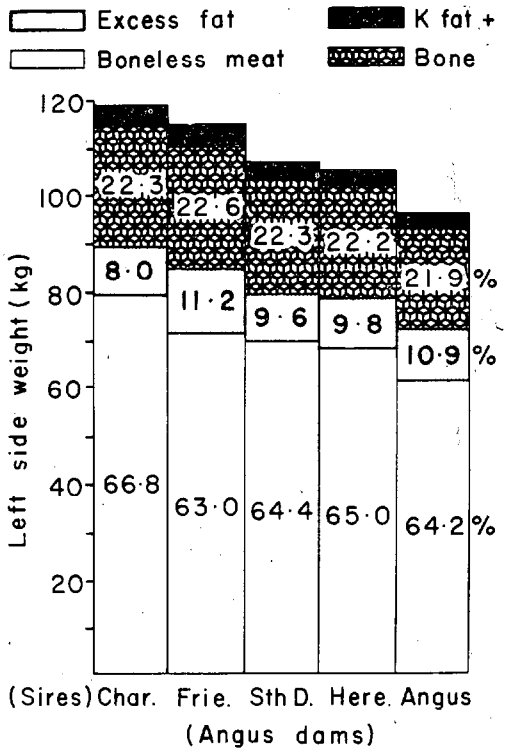

FIG. 1: *Percentage carcass composition (N.Z. commercial cut of left side of carcass).*

for percentage boneless meat. The C × A had the highest percentage of boneless meat and the lowest percentage of excess fat of all the breeds. The F × A was the reverse of the C × A with the highest fat percentage and lowest boneless meat percentage.

Weights of dissected muscles, adjusted for age at slaughter, differed between sires ($P < 0.10$) and between sire breeds, except for the psoas major and psoas minor muscles (Table 2). Muscle weights ranged from the heaviest to lightest for sire breeds as follows: C×A, F×A, SD×A, H×A and A×A. This ranking was the same as that for carcass weight and the weights of the carcass components. The only difference in sire breed ranking was for the psoas major and psoas minor muscles in which the H×A ranked marginally ahead of SD × A.

TABLE 3: CARCASS GRADE (%) AND BACK FAT MEASUREMENTS (mm)

	Charolais	*Friesian*	*South Devon*	*Hereford*	*Angus*
Export Grade:					
Chiller	17.7	35.7	40.0	55.0	65.0
FAQ	70.5	64.3	55.0	40.0	30.0
Boner	11.8	—	5.0	5.0	5.0
Local Grade:					
Prime	88.2	100.0	85.0	90.0	95.0
Choice	—	—	10.0	10.0	—
Standard	11.8	—	5.0	—	5.0
Back fat depth:					
C	2.24	5.28	4.61	5.62	5.78
D	1.85	4.81	4.37	5.27	4.94
E	2.40	4.52	4.06	5.45	4.48

(Back fat depth taken over *Mm. longissimi thoracis et lumborum;* Anon, 1965.)

The export grades of the various breeds demonstrates that the A×A graded the highest and the C×A the lowest of all the breeds (Table 3). The local gradings gave different breed rankings from of the export grades. This was probably due to the decreased importance of the subcutaneous fat cover in the local grade. The H×A and SD×A in the local gradings were superior to the other breeds but the C×A still graded the lowest. The breed differences in both the export and local grades could not be explained by the back fat measurements taken (Table 3), although the C×A had the lowest gradings and back fat measurements for all the breeds.

DISCUSSION

The breed comparison for the weights of boneless meat, excess fat and bone as well as percentage boneless meat indicate the superiority of the C×A in a grazing situation when killed at 20 months of age. The high yield of boneless meat and the low yield of fat in the C×A found in this trial are in agreement with other workers (Anon., 1966; Mason, 1971) who have compared both purebred and crossbred steers. When the percentages of boneless meat from various dairy-beef breeds and crosses were compared by Barton (1968) and Everitt (1972) it was found that the Charolais × Jersey and purebred Angus had a higher percentage

of trimmed cuts or boneless meat than the crossbred Friesian, Hereford × Jersey steers and purebred Hereford and Friesian steers. The Charolais × Jersey, however, had a lighter carcass weight than that of the purebred Friesian.

The South Devon has been considered to have a similar growth rate and final size to the Charolais (Currie and Wilkinson, 1966; Anon., 1969), but in this trial the SD × A failed to rank higher than the F×A and was similar to that of the H×A in terms of boneless meat. The F×A ranked second to the C×A in boneless meat production but produced more fat than all the other breeds. This result does not agree with those reported by Bass *et al.* (1975) where the H×A produced more excess fat than both the F×A and A×A. However, the breed ranking for boneless meat and bone in these three breeds is consistent with those previously reported.

The breed comparison of the dissected muscle weights, when adjusted for age at slaughter, shows that the C×A has heavier muscles than the other breeds at the same age. The muscles dissected in this study form the major part of the *Pan Traite* as described by Everitt and Jury (1964) and from this is derived the first-quality meat of most countries other than the U.S.A. (Preston and Willis, 1970). The C×A, therefore, can yield significantly larger quantities of first quality lean boneless meat than the other breeds.

Although the C×A produced more lean boneless meat than the other breeds, it is penalized by the export grading system which requires a definite layer of subcutaneous fat (Everitt and Evans, 1970). To partly compensate for this, the removal of the perinephric, channel and part of the cod fat in the freezing works before the carcass is weighed has a greater effect on the weights of the fatter animals. However, this does not compensate for the monetary loss incurred when a beast receives a low grade. If the greater muscling of the Charolais or any other large beef breed is to be introduced into the New Zealand Angus and Hereford beef herds, it may be necessary to change the present grading system so that the farmer is rewarded for the extra lean meat produced and not penalized as happens under the present export grading system.

In this trial the C×A appeared superior to the other breeds in boneless meat production, but the evaluation of a larger number of sires per breed and other beef breeds is needed before a complete evaluation of the various breeds and their crosses can be achieved.

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