The Effects of Terminal Sire Breed on Carcass Quality and Sensory Traits of Lamb

L.L. Gibson, G. Croken, C.M. Burbidge-Boyd

Procedures

Animals

Rams of five terminal sire breeds Suffolk (SUF), Charollais (CHR), Texel (TXL), Canadian Arcott (CAR) and Ile de France (IDF) were mated to the Lakeland College ewes to produce crossbred lambs. In total 142 lambs were utilized in this project, with approximately 30 lambs per ram breed (15 wethers and 15 ewe lambs) from five different terminal breeds. Using five rams per breed, each ram was bred to a minimum of six ewes, for the total of 30 or more lambs per sire breed. Several rams sired less than six progeny; therefore additional lambs were selected from the other sires within the respective breeds to obtain 30 lambs per breed.

The Canadian Arcott and Ile de France rams sired a total of only 26 lambs each (Table 1). In breeds where there were more than 30 lambs, naturally raised lambs and lambs with a market weight less than 130 pounds were utilized.

Slaughter and Sample Collection

The premium weight range for carcasses at Sunterra Meats is 20–25 kg, (45-56 lb.), corresponding to live weights of approximately 45–55 kg (95-120 lb.). Over a period of seven weeks, lambs were weighed, selected for this weight range and transported to Sunterra Meats in Innisfail for slaughter. Data was collected on the carcass, including carcass weight, GR measurement, carcass conformation scores and cutability (weight of wholesale cuts from a carcass after trimming to a constant degree of fatness).

Following 24 hours of chilling, the carcasses were split and the short loin roasts (longissimus muscle) were deboned from the left side, 15 cm posterior from the 12th thoracic. All loins were vacuum-packaged, placed on ice and transported in a cooler to the Lacombe Research Centre where they were aged 7 days in a 4° C refrigerator, then frozen.

In order to balance the taste panel model of 30 loin samples per breed, 8 loins were substituted from extra loins by gender from Suffolk and Charollais animals due to the fact there were missing animals in both the Canadian Arcott (4) and Ile de France (4) breed groups. All 150 frozen loin roast samples were sorted for the project and stored in a walk-in freezer at -25° C for approximately 120 days. The assigned vacuum packaged loin samples were removed from the freezer and placed on trays to thaw at 4° C in a refrigerator for 24 hours prior to panels.

Sensory Evaluation

On the day of evaluation, roast samples were removed from the refrigerator and the fat covering thickness was measured using an electronic digital caliper. Each loin roast was trimmed of fat and any external excess muscle down to the silver skin, then measured for length, width, depth, and weighed. Each loin was subjectively scored for muscle colour using photos from the American Lamb Council, Guide to Lamb Colour, (1=pink, 2=pale red, 3=cherry red, 4=slightly dark red, 5=moderately dark red, 6=extremely dark red). Marbling was subjectively evaluated using the beef marbling standard photos from the AMSA on a six point scale, (1=devoid, 2=trace, 3=slight, 4=small, 5=moderate, 6=abundant).

The loins were placed silver skin down on a wire rack in an oval roasting pan (28 cm x 18 cm x 7 cm deep) and type T thermocouple probes were inserted diagonally into the thickest portion close to 2/3 of the length of each roast. The five assigned loin roasts, one roast per terminal sire, were placed into a preheated electric convection oven (Baker's Pride X-800) at 177° C in an assigned position for cooking.

Cooking time and temperature rise was monitored every 5 seconds using a Hewlett Packard Data Acquisition Unit connected to a laptop computer. All roasts were cooked to an internal temperature of 71° C then removed from the oven and cooking time recorded. The probe was removed from the roast and the roast was allowed to cool for 3 to 4 minutes prior to weighing to calculate percent cooking loss. In the order that the roasts were removed from the oven, they were then sub-sampled by being cut into five 1.9 cm

slices from the posterior end. The remaining anterior loin section (approximately 5.5-6.0 cm long) was placed into a plastic bag and immersed in ice to cool for 20 minutes, subsequently refrigerated overnight for shear measurements. Each taste panel slice was cut into 1.9 x 1.9 cm cubes removing the bottom silver skin and outside edges with the top browning remaining. The eight most uniform cubes were then placed in pre-warmed glass jars in a six jar rack and covered with an assigned random three-digit coded aluminium lid and held in a 7° C circulating water bath prior to serving.

The samples were served to an experienced eight member sensory panel, screened and trained according to AMSA guidelines (AMSA, 1995). Each panellist placed their rack of sample jars into a Pyrex dish hot water bath provided in each booth, which maintained the samples at a constant temperature of 4° C ± 3° C. The five samples for each panellist were presented in a design assigned in Compusense 5 release 4.6

software. Panellists rated their samples in well ventilated, partitioned booths, under red lighting. Panellists cleansed their palate between each sample with apple juice diluted 50% with filtered water, unsalted crackers and filtered room temperature water.

Attribute ratings were electronically collected using eight-point descriptive scales for initial and overall tenderness (8=extremely tender; 1=extremely tough), juiciness (8=extremely juicy; 1=extremely dry), lamb flavour intensity (8=extremely intense lamb flavour; 1=extremely bland lamb flavour), off flavour intensity (8=extremely bland or none, 1=extremely intense off flavour).

Flavour desirability and overall palatability were rated on an eight point hedonic scale, (8=extremely desirable; 1=extremely undesirable). Initial tenderness was rated on the first bite through the cut surface with the incisors, juiciness was rated after eight chews with the molars, flavour

desirability was evaluated after 10 to 15 chews, lamb flavour and off flavour intensity between 10 to 20 chews and overall tenderness after 25 chews. At the end of each ballot, all panellists had the opportunity to comment on any off flavours or texture characteristics that were found in the samples. At each panel session, panellists rated five samples, one from each breed, for the total of four sessions a day over a three week period.

Shear Measurement
Following twenty four hours refrigeration, the shear section of the loin was cut in half and the sides and silver skin were removed to facilitate muscle fibre orientation. Using a 1.27 cm diameter borer, four cores were removed parallel to the muscle fibres.

The three most uniform cores were selected and sheared with the Instron 4301 Material Testing System equipped with a Warner-Bratzler cell and Series 9 Software (Instron Canada, Burlington ON). Each core was sheared once perpendicular to the fibre grain and the mean of the three cores was used to determine peak shear force in kg/cm^2.

Statistical Analysis
Shear measurements, loin dimensions, cooking and sensory data on 142 lambs were analyzed by Mixed-model analysis (SAS Institute, Inc., 2001) to examine the fixed effects of breed of sire and sex of the lamb, with hot carcass weight as a covariate.

Table 1. Means (S.D.) live and hot carcass weights in pounds

Sire Breed	No. Lambs	Live Weight (S.D.)	Hot Carcass Weight (S.D.)
CAR	26	112.8 (8.9)	55.3 (6.4)
CHR	30	112.2 (5.3)	58.2 (4.0)
IDF	26	113.1 (4.8)	58.6 (5.0)
SUF	30	114.8 (6.6)	57.3 (5.3)
TXL	30	112.8 (5.5)	58.2 (5.2)