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Meat Shrinkage

Jerry Leising and Harold Tuma

Introduction

Meat shrinkage is a major problem for the beef industry. Shrinkage (loss in weight) results from many factors: improper chilling, low humidity, not packaging, poor sanitation, or excessive ageing time. Most beef is chilled overnight (16-20 hrs.) at cooler temperatures of 25 to 40°F. Internal temperatures after 20 hours chill vary from 55° to 70°F depending on cooler conditions and carcass weight. During a normal chill cycle, beef carcasses shrink 6 to 12 pounds or 1-2% for 600-pound carcass with the shrink depending on many cooler and carcass factors. Various methods have been used to reduce moisture evaporation (shrink) by protecting the meat with a bag or wrapper and by controlling temperature and relative humidity. Information is limited concerning optimum chilling conditions for maximum cooling efficiency with minimum shrinkage.

Materials and Methods

We studied variables that affect shrinkage and effects of carcass weight and fat thickness on cooling rates.

Seventy-two beef carcasses from three different Kansas packing companies (A, B, and C) were used. Carcasses were selected at random for weight and fat thickness before washing and shrouding. Weight groups of 550, 650, and 750 and fat thickness of 0.2", 0.5", and 0.75" between the 12th and 13th ribs were used.

Carcass temperatures were recorded continuously during the chill period by a Honeywell Electronik-16 Potentiometer. Temperatures were recorded from both the deep of the round (8" deep) and the deep of the chuck (under the scapula), as was cooler temperature. Relative humidity recordings were taken during the chill cycle by a Hygro-thermograph. Air velocity was measured with a Hastings RB-1 air meter in cooler locations. At each location readings were taken above, below, and between carcasses. Shrinkage for each carcass was determined by collecting hot carcass weight before washing and shrouding minus chilled weight without shroud. Shrinkage data were collected at 24 and 48 hours.

Results and Discussion

Significant differences were found in carcass shrinkage in all coolers A, B, and C. Shrinkage values after 24 hours were: A = 1.49%, B = 1.29%, and C = 2.13%. Differences between weight groups were significant (table 57).

Shrinkage of light (550 lbs.) and medium (650 lbs.) carcasses was significantly ($P < .05$) less in coolers A and B than in cooler C. Shrinkage of heavy carcasses (750 lbs.) also differed significantly among coolers A, B, and C. Cooler C was the least efficient; cooler B was most efficient.

Cooler B maintained both the lowest cooler temperature (34.7°F) and relative humidity of (61.0) percent. Cooler C varied the most in air temperature during the chill cycle. Its average air temperature was (38.0°F); relative humidity, (82.0) percent. Cooler C shrinkage was comparatively high for a 24-hour chill. The higher shrinkage in cooler C might be explained by warmer temperatures and slower chill rate. Shrinkage in cooler A was slightly higher and its temperature (35.6°F) slightly higher than they were in cooler B. Air velocity averaged 169 ft. per min., in cooler A, 97 ft. in cooler B, and 95 ft. per min. in cooler C. Differences in air velocities between coolers A and B may explain the slightly greater shrinkage in cooler A. Cooler B's lower relative humidity otherwise would indicate more shrinkage in B than in A. Most published data indicate lower relative humidities increase shrinkage. Relative humidity's importance may vary with cooler temperatures and air velocities. However, low relative humidity is advantageous for meat color, bloom, general appearance, and absence of surface slime.

Summary

Cooler temperatures should be held constant at approximately 32° with average relative humidity 80-90%, and cooler air evenly distributed at a velocity of 120-147 ft. per min. Fat thickness had no significant effect on carcass shrinkage. Carcass weight significantly affected total shrinkage with 550 lb. carcasses shrinking 1.77% and 750 lb. carcasses 1.54%. After 20 hours internal chuck temperatures were 45 to 55°F , internal round, from 55 to 65°F . Significant differences were found among coolers A, B, and C.

Table 57. Meat shrinkage in coolers by indicated weight groups.

Cooler	Carcass weight groups			Pooled for coolers
	550	650	750	
	<u>(%) shrinkage 24 hours</u>			
A	1.50	1.39	1.57	1.49 ^a
B	1.26	1.30	1.29	1.29 ^b
C	2.54	2.09	1.76	2.13 ^c
Pooled by weight groups	1.77 ^a	1.59 ^b	1.54 ^b	

abc Mean with different superscripts differ significantly. ($P < .05$).