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Temperature, relative humidity, and dew point of 6 commercial trailer compartments during summer transportations of beef calves in the mid-South

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ABSTRACT

Improving animal welfare during transit may reduce morbidity and improve subsequent animal health. The objective of this study was to determine whether temperature, relative humidity, dew point, and temperature–relative humidity index differed among 4 compartments of a commercial trailer while transporting beef calves during the summer within the mid-South region. A temperature–relative humidity data logger was fastened to the ceiling of each trailer compartment during June and July for 12 loads of cattle (BW = 344.5 ± 96.60 kg, mean ± SD) transported 542.9 ± 408.38 km. Compartment temperatures averaged 31.6 ± 0.79°C and did not differ (P > 0.10). Relative humidity in the belly (64.1 ± 2.74%), tail (62.5 ± 2.74%), and bottom nose (62.1 ± 2.74%) were not different (P > 0.10), and all were greater than the top deck (58.5 ± 2.74%; P < 0.01). Dew points in the bottom nose, belly, and top deck were 24.2, 24.2, and 24.0 ± 0.59°C, respectively, and were not different (P > 0.10); however, they differed from the dew point in the tail compartment (23.4 ± 0.59°C; P < 0.02). Temperature–relative humidity index did not differ among compartments (P > 0.10) and averaged 82.1 ± 0.89. The percentage of time temperature–relative humidity index was in the danger and emergency categories was 93.9, 86.6, 84.2 and 68.3 ± 0.04% for the bottom nose, top deck, belly, and tail compartments, respectively (P < 0.01). Hour of day differences during transport were observed for temperature, relative humidity, and temperature–relative humidity index (P < 0.10) but not dew point (P = 0.35). These differences could affect dehydration risk or shrinkage during transport.

Key words: cattle, temperature, relative humidity, dew point, temperature–relative humidity index

INTRODUCTION

Cow-calf producers are located throughout the United States (Feuz and Umberger, 2003), with over 24 million (71.7%) calves born west and 9.7 million (28.3%) born east of the Mississippi River (USDA, 2015). Thus, the cattle industry relies on commercial truck carriers to transport cattle from cow-calf operations to backgrounding facilities or to feedlots, which are concentrated in the Great Plains (Mintert, 2003).

Transporting cattle can affect shrink or BW loss associated with loss of urine, feces, body fluid, and tissue (Coffey et al., 2001; Cernicchiaro et al., 2012). Phillips et al. (1985) reported feeding hay 72 h before transport increased the amount of weight lost and the amount of feces excreted as compared with feeding a 50% concentrate diet. Increased shrink is associated with reduced calf health and performance (Cernicchiaro et al., 2012). Temperature during and duration of transport have a multiplicative effect because shrink increases most rapidly in cattle transported for both longer duration and at higher ambient temperature (González et al., 2012b). Other factors affect shrink such as excessive handling, diet, supplementation with ionophores, and preconditioning before transportation (Pritchard and Mendez, 1990;

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Table 1. Height, width, length, floor space, and volume of the 6 individual trailer compartments used to transport beef calves

Trailer compartment	Height (m)	Width (m)	Length (m)	Floor space (m^2)	Volume (m^3)
Top nose	1.35	2.57	3.20	8.22	11.10
Bottom nose	1.40	2.57	3.20	8.22	11.51
Top deck	1.81	2.57	8.95	23.00	41.63
Belly	1.81	2.57	8.95	23.00	41.63
Jail	1.30	2.57	2.92	7.50	9.76
Tail	1.53	2.57	2.95	7.58	11.60

Grandin, 1997; Coffey et al., 2001). Goldhawk et al. (2014b) reported the welfare of calves before loading was a major determinant of their posttransport welfare based on both biochemical and systematic indicators of calf welfare.

White et al. (2009) reported transient difference in ADG and some differences in disease risk during the backgrounding phase based on where cattle were housed during transport. Cattle in compartments with 15 calves or less tended to have lower odds of being treated for diseases than cattle in compartments with 16 to 30 calves. White et al. (2009) suggested greater numbers of animals within a compartment would likely increase their exposure to infectious diseases. It was therefore concluded the environment in each compartment of the transport vehicle is not homogenous. The objective of this study was to determine whether temperature, relative humidity, dew point, and temperature–relative humidity index (**THI**) differed among 6 livestock trailer compartments while hauling beef calves during the summer within the mid-South of the United States.

MATERIALS AND METHODS

Experimental Design

Animal used in this study were cared for in accordance to the Arkansas Beef Quality Assurance Program (Troxel and Powell, 2012). The owners of the cattle directly contracted the independent tractor-trailer operator to transport cattle to the destination determined by the cattle owner. At no time did the faculty nor the University of Arkansas own or manage the cattle used in the study.

The trailer used was a 1998 Cattle Drive (Merritt Equipment Company, Henderson, CO) with 6 compartments (Figure 1). The top and bottom trailer compartments (front to back) were designated top nose, top deck, and jail and bottom nose, belly, and tail, respectively. The height, width, length, and floor space of each compartment are reported in Table 1. From June 26 to July 30, 2015, 12 loads of mixed breed cattle totaling 715 calves (BW = 344.5 ± 96.60 kg, mean ± SD) were transported 542.9 ± 408.38 km, ranging from 105 to 1,387 km (Table 2). There were 495 (69.2%) black calves, 216 (30.2%) mixed-color calves, and 4 yellow calves (0.6%). All cattle were transported from southwest Arkansas to other locations in Arkansas or to locations in Oklahoma, Kansas, or Nebraska. The trips lasted an average of 5.8 ± 3.56 h and ranged from 1.75 to 12.45 h. The same driver and trailer were used for all 12 loads.

WatchDog data loggers (Model B102; Spectrum Technologies Inc., Plainfield, IL) were used to collect temperature and relative humidity data at 15-min intervals within each trailer compartment. The temperature and relative humidity ranges and accuracy specifications of the B102 data logger were −15 to 65 ± 0.6°C and 0 to 100 ± 5%, respectively. The data loggers were fastened 1.0 ± 0.22 cm (mean ± SD) below the ceiling of each compartment (Figure 1) using zip ties to prevent contact with the aluminum surface of the trailer and were outside the reach of the animals. An additional data logger was fastened on the front exterior, using a zip tie, 3.8 cm from the aluminum surface near the spare tire. All data loggers were synchronized before placement and programmed to record the temperature and relative humidity at 15-min intervals. SpecWare 9 Professional software (Spectrum Technologies Inc.) was used to synchronize start time, program recording intervals, and download data. The SpecWare 9 Professional software calcu-

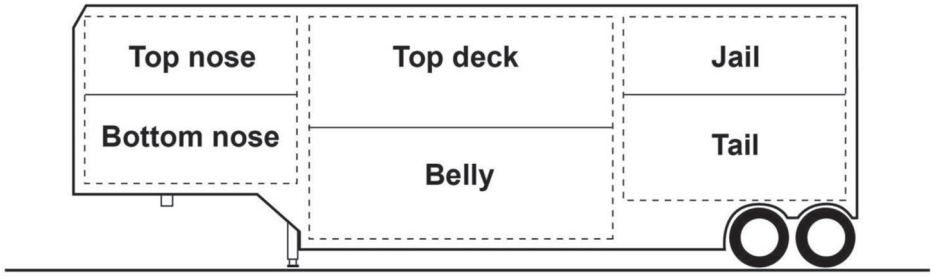

Figure 1. Commercial trailer design and reference names for the 6 trailer compartments used to transport beef calves.