Associations between Weather Conditions and Bovine Respiratory Disease in Feedlot Cattle

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Introduction

Bovine respiratory disease complex (BRD) is the most common cause of disease in weaned cattle. Ambient environmental conditions affect nutritional requirements, metabolism, and BRD risk; however, data on associations between specific weather conditions and BRD morbidity in cattle are sparse. The goal of our study was to quantify associations between daily BRD incidence rates and preceding weather conditions in different lag periods (considering up to seven days from the current day of interest) in feedlot cattle.

Materials and Methods

Our study population included 1,904 cohorts (representing 288,388 head) of cattle in nine US feedlots. Study inclusion criteria included: feedlot arrival between September and November during 2005 to 2007, only steer or heifer cohorts (no mixed cohorts), mean arrival weights between 500 and 800 lb (227 and 363 kg), and initial cohort size of 40 to 340 cattle. Our outcome, daily within-cohort BRD incidence, involved cases of initial respiratory disease (diagnosed with BRD for the first time by feedlot personnel and subsequently treated with an antimicrobial) and the number of cattle at risk within the cohort on that day. Cohort-level demographic factors included mean arrival weight, gender, respiratory risk classification (high or low), month and year of feedlot arrival, cohort size and days on feed (0 to 45 days). Weather data were downloaded from the National Oceanic and Atmospheric Administration website and were collected from weather stations near (< 50 miles) each feedlot. Effects of weather variables were assessed using three lag periods from the day of interest (when an animal was first considered a BRD case); lags were: short (1 and 2 days previously), intermediate (3 and 4 days previously), and long (5 to 7 days previously). Weather variables evaluated included: mean temperature, mean wind chill, wind speed, temperature change, total daily precipitation, and weather-related events (rain, freezing drizzle, and snowfall). Associations between cattle demographics, weather variables, and daily BRD incidence were analyzed with a multivariable mixed-effects binomial regression model.

Results

There were 24,947 total cases of BRD with an overall mean daily incidence of 0.25%. Cumulative BRD incidence risks for the first 45 days on feed ranged from 0 to 36% within cattle cohorts. Month and year of study, days on feed, cohort's average weight at entry, risk classification, and cohort size were significantly associated with daily BRD incidence. Weather variables pertaining temperature change, wind chill, and wind speed also were associated with daily BRD incidence. Two-way interactions significantly associated with daily BRD incidence ($P \leq 0.05$) included: medium-lag maximum wind speed and medium-lag mean wind chill, long-lag temperature change and medium-lag maximum wind speed, long-lag mean wind chill and long-lag temperature change, and risk code and year of arrival.

Significance

We have provided the first report of how specific weather effects in different time periods and different cattle populations appear to be associated with daily BRD incidence. Defining the weather conditions associated with BRD in specific populations of feedlot cattle may enable cattle health managers to predict and potentially manage more effectively these effects; further, estimates of these effects may contribute to the development of quantitative predictive models for this important syndrome.