Cradle-To-Farm Gate Environmental Footprints of Beef Cattle Production in Kansas, Oklahoma, and Texas

Rotz CA*, Asem-Hiablie S*, Dillon J†, Bonifacio H*

*Pasture Systems and Watershed Management Research Unit, USDA-Agricultural Research Service, University Park, PA, 16802
†Department of Animal Science, The Pennsylvania State University, University Park, PA, 16802

Abstract
A comprehensive national assessment of the sustainability of beef is being conducted by the U.S. beef industry. The first of 7 regions to be analyzed is Kansas, Oklahoma, and Texas. A survey and visits conducted throughout the region provided data on common production practices. From these data, representative ranch and feedyard operations were defined and simulated for the varying climate and soil conditions throughout the region using the Integrated Farm System Model. These simulations predicted environmental impacts of each operation including cradle-to-farm gate footprints for greenhouse gas emissions, fossil-based energy use, nonprecipitation water use, and reactive N loss. Individual ranch and feedyard operations were linked to form 28 representative production systems. A weighted average of the production systems was used to determine the environmental footprints for the region where weighting factors were developed based on animal numbers reported in the survey and agricultural statistics data. Along with the traditional beef production systems, Holstein steer and cull cow production from the dairy industry in the region were also modeled and included. The carbon footprint of all beef produced was 18.3 ± 1.7 kg CO₂ equivalents (CO₂e)/kg carcass weight (CW) with the range in individual production systems being 13 to 25 kg CO₂e/kg CW. Energy use, water use, and reactive N loss were 51 ± 4.8 MJ/kg CW, 2,470 ± 455 L/kg CW, and 138 ± 12 g N/kg CW, respectively. The major portion of each footprint except water use was associated with the cow-calf phase; most of the non-precipitation water use was attributed to producing feed for the finishing phase. These data provide a baseline for comparison as new technologies and strategies are developed and implemented to improve the sustainability of cattle production. Production information also will be combined with processing, marketing, and consumer data to complete a comprehensive life cycle assessment of beef.


“This study was funded by The Beef Checkoff Program”