Review: Nitrogen sustainability and beef-cattle feedyards: I. Introduction and influence of pen surface conditions and diet

H. M. Waldrip, N. A. Cole, PAS and R. W. Todd

USDA-ARS, Renewable Energy and Manure Management Research Unit, Conservation and Production Research Laboratory, Bushland, TX 79012

Abstract

Greater public awareness of the potential effects of agriculture on the environment calls for beef production systems that are sustainable with regard to the environment, society, and the economy. Reactive nitrogen (N) from feedyards could negatively influence air and water quality in the event of volatilization of ammonia (NH₃) and nitrous oxide (N₂O), and leaching and runoff of nitrate (NO₃⁻) or other forms of organic and inorganic N. Sustainable N management challenges producers to better understand the dynamics of feedyard N and consider the long-term implications of management practices. The concept of N balance is key when considering the role of N in feedyards. Efforts to improve the sustainability of feedyard operations revolve around managing the components of the N balance so that N is used efficiently and losses are minimized. The objectives of this review were to examine the critical components of the feedyard N balance, provide a comprehensive analysis of the state of the science of each component, and identify ways to minimize the negative effects of N that detract from sustainability. In this work, we reviewed the current literature to assess the effect of beef-cattle feedyards on the environment, evaluated methods to mitigate losses of N from feedyards, and identified knowledge gaps and areas requiring further research. Two key factors addressed were feedyard manure management and cattle diet. Nitrogen-balance studies showed that only about 15% of the N flow through a feedyard remains in animal tissue (average of 25 g per animal per day). Most N (44%) was lost to the atmosphere or as runoff, whereas only 41% was removed with harvested manure. Dietary concentration and ruminal degradability of dietary protein were the primary factors affecting the quantity and route of excretion (urine vs. feces) of N by beef cattle, where excretion of urinary N increased with N intake and with increased dietary ruminally degradable protein. Further research is warranted to improve understanding regarding the effects of diet composition on N transformations and fate on feedyards.

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