Growth promoting technologies reduce the carbon footprint, ammonia emissions, and cost of California beef production systems

Stackhouse KR¹, Rotz CA, Oltjen JW, Mitloehner FM.

¹Department of Animal Science, University of California, Davis 95616

Abstract

Increased animal performance is suggested as one of the most effective mitigation strategies to decrease greenhouse gas (GHG) and ammonia (NH₃) emissions from livestock production per unit of product produced. Little information exists, however, on the effects of increased animal productivity on the net decrease in emission from beef production systems. A partial life cycle assessment (LCA) was conducted using the Integrated Farm System Model (IFSM) to estimate GHG and NH₃ emissions from representative beef production systems in California that use various management technologies to enhance animal performance. The IFSM is a farm process model that simulates crop growth, feed production, animal performance, and manure production and handling through time to predict the performance, economics, and environmental impacts of production systems. The simulated beef production systems compared were 1) Angus-natural, with no use of growth-enhancing technologies, 2) Angus-implant, with ionophore and growth-promoting implant (e.g., estrogen/trenbolone acetate-based) application, 3) Angus-β2-adrenergic agonists (BAA; e.g., zilpaterol), with ionophore, growth-promoting implant, and BAA application, 4) Holstein-implant, with growth implant and ionophore application, and 5) Holstein-BAA, with ionophore, growth implant, and BAA use. During the feedlot phase, use of BAA decreased NH₃ emission by 4 to 9 g/kg HCW, resulting in a 7% decrease in NH₃ loss from the full production system. Combined use of ionophore, growth implant, and BAA treatments decreased NH₃ emission from the full production system by 14 g/kg HCW, or 13%. The C footprint of beef was decreased by 2.2 kg carbon dioxide equivalent (CO₂e)/kg HCW using all the growth-promoting technologies, and the Holstein beef footprint was decreased by 0.5 kg CO₂e/kg HCW using BAA. Over the full production systems, these decreases were relatively small at 9% and 5% for Angus and Holstein beef, respectively. The growth-promoting technologies we evaluated are a cost-effective way to mitigate GHG and NH₃ emissions, but naturally managed cattle can bring a similar net return to Angus cattle treated with growth-promoting technologies when sold at an 8% greater premium price.


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