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# COST-EFFECTIVENESS OF OPTIMIZING CONCENTRATED FEED BLENDS TO DECREASE GREENHOUSE GAS EMISSIONS

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## Abstract

Livestock production is under growing public and scientific scrutiny for its greenhouse gas (GHG) emissions. This article contains a preliminary assessment of the inclusion of upstream life-cycle GHG emissions in concentrated feeds design, using the most common nonlinear programming optimization algorithms to determine feed composition. First, GHG emissions are included as costs in a single criteria optimization problem. The unit price of GHG emissions was obtained using a genetic algorithm. Second, GHG emissions are included as a target function to minimize in a multi criteria optimization problem using goal attainment programming. Results obtained after both optimization methods were applied to two case studies, namely fattening pigs and rabbit feeds. Changing ingredients in concentrated feed blends has a marginal effect on GHG emissions due to mandatory nutritional constraints. If the optimization is unconstrained, the maximum possible decrease in GHG emissions is 27.5% for the pigs feed, accompanied by increasing costs and a decrease in feed nutritional quality. To maintain nutritional integrity, the maximum possible reduction in GHG emissions is 7.5%. Considering cost as an optimization variable in the problem, the maximum decreases are even lower. It is possible to decrease emissions by 71% for the rabbits feed, but the cost of the reduction is higher than the opportunity cost for farmers to reduce GHG emissions using other strategies. These results are qualitatively robust but critically depend on feed ingredients GHG emissions and cost data.

*Key words:* genetic algorithm, goal programming, greenhouse gases, linear optimization, livestock feed

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