Title: The effect of feeding a calcium peroxide feed additive to mitigate enteric methane emissions in lambs

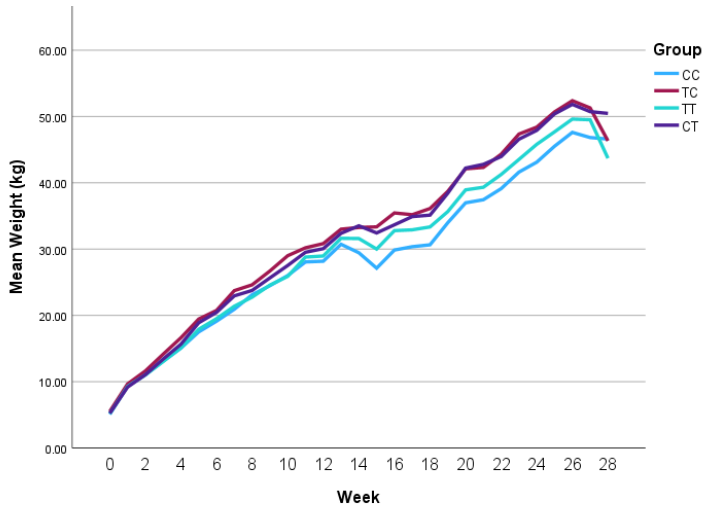
Application: Calcium peroxide can be added to the diet of ewes to reduce methane production

Introduction:
Methane is a natural product resulting from enteric fermentation in the rumen forestomach of ruminants. Specifically, 70-80% of methane is produced by rumen methanogens through conversion of carbon dioxide and hydrogen. The latter is a consequence of microbial digestion of plant material resulting in formation of Volatile Fatty Acids (VFAs), which are a source of energy for the animal. Increasing concerns over greenhouse gases produced by livestock and their subsequent heating potential has led to an increase in research into mitigating enteric methane from ruminants. Feed additives, such as 3-NOP, have been shown to reduce methane emissions, but apart from 3-NOP, other potential additives have not been studied to a great extent. Various peroxide-based additives have been screened *in vitro* and shown potential for application as methane mitigating feed additives. This study investigated the methane reducing potential of a calcium-peroxide (CP) based formulation in an early-life lamb study. This study follows on from a previous ewe trial that determined the optimal inclusion rate.

Materials and Methods: Initially, *In-vitro* studies using a rumen-simulating batch culture system were used to incubate varying inclusion levels of the additive with artificial saliva, rumen fluid and grass silage. Following this, seventy pregnant Lowland crossed ewes (35 ewes/group) expecting twin lambs were selected and fed concentrate pellets (dry matter (DM) basis) as follows: control (0.0%) and CP (7.5%) two weeks prior to lambing. Limestone was used to balance mineral concentrations in the 3 concentrate pellets. At weaning, each of the twin lambs was assigned either the control or treatment pellet, resulting in four treatment groups: Control x Control (CC), Control x Treatment (CT), Treatment x Treatment (TT) and Treatment Control (TC). Grass silage was fed ad libitum to both ewes and lambs, whilst the amount of concentrate was periodically adjusted (25% DM basis). DM intake (DMI) was recorded daily, with body weight recorded weekly. Enteric methane emissions were measured using a GreenFeed unit.

Results: *In-vitro* batch culture experiments found the calcium peroxide-based formulation significantly reduced methane emissions compared with the 0% control when added at 0.375%, 0.75%, 1.5%, 2.25% an 3% ($p = 0.014$). At animal level, a one-way ANOVA (SPSS, 26.0) revealed significant differences among the treatment groups ($F = 6.18$, $p < 0.01$). Post-hoc tests using Tukey's HSD indicated that lambs in group TT showed the greatest methane reduction compared to the CC group, although this was not significant ($p=0.94$). Lambs born to ewes fed the CP weighed consistently heavier than those born to ewes fed the control diet until weaning (11 weeks).

Figure 1: Mean lamb weight (kg) on a weekly basis



Conclusions: The supplementation of calcium peroxide (has shown great potential in reducing methane emissions and increasing productivity in lambs.

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