

Use of urea as nitrogen source (nitrogen emissions)



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- **Type of challenge:** Environment.
- **Challenges:** Soil contamination (nitrates emission); air pollution (ammonia emission), resource management (nutrient losses).
- **Action:** Reduction of nitrates and ammonia emission in the environment.
- **Animal category:** Ruminants with fully functional rumen.
- **Technique:** Decreasing dietary crude protein levels in compound feed by adding up to 1% urea per kg of total Dry Matter Intake, as substitute of nitrogen from vegetable protein.
- **Mode of action:** Urea is hydrolysed in the rumen to ammonia and CO₂ by the bacterial enzyme urease; ammonia from urea is used by the ruminal microbiota for synthesis of microbial proteins which are subsequently digested in the intestine.
- **Potential efficacy:** The slow release form may increase feed efficiency up to 3% and nitrogen use efficiency up to +4% for dairy cows; may lower emissions of ammonia and N₂O from the faeces and urine between 2.7% and 3.1% (i.e. -12 to -13 g/cow/d) and N excretion intensity by 3.6% to 4.0% (i.e. -0.50 to -0.53 g N/kg milk).
- **Nature of evidence of efficacy:** Peer-reviewed scientific publications (meta-analysis); EFSA assessment.
- **Factors impacting on efficacy:** Variation in rumen function, including duration and extent of rumen digestion.
- **Mode of use:** Incorporated into compound feed (complete or complementary).
- **Requirements/limitations:** Urea should be coated to prevent rapid hydrolysis of urea to NH₃ that is toxic; the utilization of urea in ruminant nutrition is limited due to its rapid hydrolysis to NH₃ in the rumen, exceeding the rate of carbohydrate fermentation in the rumen; doses up to 1 % of complete feed DM (corresponding to 0.3 g/kg bw/day) is considered safe; the substance must be added in a mixture by a registered feed business operator applying HACCP (R183/2005); not permitted in organic farming.
- **Economic consequences:** Reformulation of protein sources may reduce feed cost.
- **Other considerations:** The asynchrony between rumen NH₃ production and available fermentable energy could exert a negative effect on the efficiency of microbial protein synthesis; reformulation of diets with slow release urea can result in significant changes in the composition of raw materials in dairy diets.
- **References:**
 - Salami SA et al. (2021). *Meta-analysis and sustainability of feeding slow-release urea in dairy production*. PLoS ONE 16(2): e0246922. <https://doi.org/10.1371/journal.pone.0246922>
 - EFSA (2012). *Scientific Opinion on the safety and efficacy of Urea for ruminants*. EFSA Journal Volume 10, Issue 3 2624. <https://doi.org/10.2903/j.efsa.2012.2624>
- **Other techniques:** Adding rumen protected amino acids to feed.