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## Dietary Manipulations to Lower Ammonia Emission from Laying-hen Manure

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**Species:** Poultry (Layers)  
**Use Area:** Animal housing  
**Technology Category:** Diet Modification  
**Air Mitigated Pollutants:** Ammonia

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### System Summary:

Dietary manipulation has been shown to lower ammonia emission from laying-hen manure. Dietary amendments include lowering the protein content of the diet, including high-fiber ingredients such as corn distiller's dried grains with solubles (DDGS), or including EcoCal™—a proprietary mixture of calcium sulfate and zeolite. Liang et al. (2005) showed that a 1% lower crude protein diet caused a 10% decrease in ammonia emission from laying hens housed in high-rise houses. Roberts et al. (2007) found 40% lower ammonia emission from manure of hens fed 10% DDGS, 38% lower emission when hens were fed 7.3% wheat middlings, and 26% lower emission when hens were fed 4.8% soybean hulls compared to a standard diet. Field research from our group indicates that 3.5% dietary EcoCal lowers ammonia emission by 23%. Research has also evaluated the egg production from hens fed each of the adjusted diets and demonstrated that, when diets are properly formulated, egg production will be similar to that from hens fed a standard control diet.

### Applicability and Mitigating Mechanism:

- Ammonia volatilization from laying-hen manure is affected by manure pH, content and chemical form of nitrogen, moisture content, and physical handling of manure
- Low protein diets lower nitrogen content of the manure
- High-fiber diets lower manure pH
- In EcoCal, calcium sulfate lowers manure pH and zeolite binds ammonia, preventing or reducing volatilization

### Limitations:

- High-fiber ingredients may not be suitable for nutrient-dense diets
- Amino acid requirements of hens must be precisely known in order to formulate low-protein diets and maintain egg production
- EcoCal adds cost to the diet with little nutrient addition
- Diet cost and ammonia reduction must be evaluated for each individual egg production situation

### Cost:

The cost of diet modifications must be determined for each individual egg production situation. Feed ingredients are often priced according to private contracts and proximity to the supplier. Feed ingredients can only be added to the diet in exchange for other ingredients (mainly corn and soybean meal), making the evaluation of price amongst ingredients difficult. This exchange of one ingredient for another should be analyzed as the total diet cost of a nutritionally balanced diet, considering all ingredients together. Least-cost diet formulations consider the cost of an ingredient with regards to nutrient content. High-fiber ingredients are typically going to have a relatively low energy content and varying contents of digestible amino acids and minerals, which can be valued in the diet formulation. Low-crude protein diets are formulated by adding crystalline amino acids to the diet, replacing soybean meal and increasing corn. These diets may be cost-effective if the price of amino acids is favorable. EcoCal contributes some calcium to the diet, partially replacing limestone, a relatively inexpensive diet component.