KIRCHBERG, LUXEMBOURG

BECH BUILDING

B. Livestock feeding strategies

Introduction

11. Ensuring that farm livestock are not fed more protein than required for the target level of production can reduce the N excretion per livestock unit and per unit production. Decreasing the amount of N in manure will not only abate ammonia emissions but also other potential N losses (leaching, denitrification). N excretion by different livestock categories is strongly dependent on the production system (Table 3.1). Standard excretion values should therefore be calculated on a national or regional level.

12. Protein surplus in livestock rations is primarily excreted in the form of urea (uric acid in poultry manure). These compounds are rapidly degraded to ammonia and ammonium that have a high emission potential. Reducing N excretion by reducing the protein content of the ration, therefore, results in a disproportional decrease in ammonia losses. Furthermore, emission abatement is effective at all stages of manure management (houses, storage, application).

13. Even under optimal conditions, animals excrete more than half the protein intake in feed in the form of different N compounds. There are usually excesses in the protein supply for almost all livestock classes and production systems, the reduction of which could reduce N excretion.

Methods for decreasing N excretion

14. The following general methods can be used to decrease the amount of N excreted by livestock:

(a) Better adjusting the composition of the diet to the requirements of the individual animal e.g. according to lactation stage, age and weight of animals, etc.;

(b) Reducing excesses in the protein supply by ensuring that it does not exceed current feeding recommendations;

(c) Reducing the crude protein content of the ration by optimization of the amino acid supply. For monogastric animals, the required amino acid supply can be controlled by addition of pure amino acids to the diet or by using a combination of different protein feeds in the diet;

(d) Increasing the efficiency of N use by improving animal performance so that a diminishing proportion of the total protein requirement is used for maintenance.

Pigs and poultry

15. For pigs, N excretion can be reduced by matching more accurately the diet to the specific requirements of different growth and production stages. This can be achieved by:

(a) Ensuring that the protein content of the feed or ration is not higher than the recommended level.

;

(b) Using different diets for lactating and gestating sows;

(c) Using different diets for different growth stages of fattening pigs (phase feeding).

16. In addition to the above options, the protein level of pig diets can be lowered by optimizing the essential amino acid content rather than the crude protein content on the basis of the precaecal digestibility of individual amino acids. This can be achieved by adding pure amino acids, especially lysine, methionine and threonine, to the diet. Even though such strategies will result in somewhat higher feed prices, they are some of the cheapest measures to reduce ammonia emissions.

17. For poultry, the strategies to reduce N excretion are basically the same as for pigs.

<u>Ruminants</u>

18. For ruminants protein surplus and N excretion strongly depend on the proportion of grass, grass silage and hay in the ration and the crude protein content of these feeds. The crude protein surplus and the resulting N excretion and ammonia losses will be highest for grass-only summer rations with young, intensively fertilized grass or grass legume mixtures. In such cases, a ration matched to the energy demand of the animals will always result in a high protein surplus. The following strategies can improve this situation:

(a) Ensuring that N-fertiliser application rate on the grassland is not excessive;

(b) Improving the energy/protein equilibrium by:

  (i) substituting some of the fresh grass with roughage of lesser protein content (maize silage, hay harvested at advanced stages of maturity, straw etc.);

  (ii) using older grass or rationed amounts of grass and more high energy concentrates. Nevertheless, for livestock production systems predominantly based on grassland, the feasibility of this strategy is often limited because a full use of the grass production would no longer be guaranteed (under conditions of limited production, e.g. milk quotas) and the nutrient balance of the farms would not be in equilibrium.

19. A reduction of ammonia emissions from ruminants can also be achieved by increasing the proportion of grazing because much of the urine infiltrates into the soil before urea is degraded and lost as ammonia. Nevertheless, the total N efficiency of grazing systems tends to be lower than that of mown grassland due the uneven distribution of the excreta. Furthermore, grazing is often limited by climatic and soil conditions as well as farm structure. A minimum period of grazing per year may be required for animal welfare reasons.

20. A special form of reducing N excretion and losses per unit product is the improvement of the feed conversion efficiency through higher yields. Increasing the number of lactations per cow could also decrease ammonia emission per unit of milk production over the life of the animal.

21. Feed NUE (fraction of feed N recovered as milk N) can be used as a tool for evaluating the environmental performance of livestock (dairy) farming. To enhance the feed NUE by improving the crude protein quality of feed, especially grass products, the following aspects should be considered:

(i) Preserving grass for winter feeding influences the proportion of rumen-undegradable feed crude protein and overall NUE;

(ii) To keep true protein degradation in grass silage at a low level:

- (a) grass should be ensiled as fast as possible after cutting;
- (b) oxygen should be excluded quickly from the silo after filling;
- (c) heat damage should be avoided.

Table 3.1. Nitrogen excretion by different classes of farm livestock

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Animal type	**Production level**	**N excretion**		
		kg N $place^{-1}$ $year^{-1}$	per unit production	
			kg N	per ...
Dairy cows	less than 5000 kg milk cow^{-1} $year^{-1}$	60-110	15-25	1000 kg milk
	5000-6000 kg milk cow^{-1} $year^{-1}$, low amount of concentrate	100-140	20-28	1000 kg milk
	5000-6000 kg milk cow^{-1} $year^{-1}$, >500 kg concentrate $year^{-1}$	80-100	16-20	1000 kg milk
	9000-10000 kg milk cow^{-1} $year^{-1}$	110-140	11-14	1000 kg milk
Beef cattle	Extensive: mainly grazing	40-50	10-20	100 kg growth
	Intensive: corn silage etc.	35-45	7-10	100 kg growth
Breeding sows	including piglets to 25 kg	30-40	1.4-2	per piglet
Fattening pigs	25-100 kg; no phase feeding	15-18	6-8	100 kg growth
	with phase feeding	12-15	5-7	100 kg growth
	phase feeding and pure amino acids	10-14	4-6	100 kg growth
Laying hens	1 bird	0.60-0.80	2.0-3.5	1000 eggs
Broilers	1 bird-place	0.35-0.50	2.0-4.0	100 kg growth