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R-EF-10: Influence of Bedding Material on Ammonia Emissions from Cattle Excreta

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Abstract

Dairy cattle barns are a major source of NH_3 emissions to the atmosphere. Previous studies have shown that the bedding material used in the barn can influence the magnitude of NH_3 emissions, but little is known about which bedding characteristics are important in this respect. The aims of this study were to assess, at a laboratory scale, the relative importance of the chemical [pH, cation exchange capacity (CEC), C:N] and physical (urine absorbance capacity, bulk density) characteristics of 5 bedding materials (chopped wheat straw, sand, pine shavings, chopped newspaper, chopped corn stalks, and recycled manure solids) on NH_3 emissions from dairy cattle urine. Recycled manure solids were the most absorbent of the bedding types (4.2 g of urine/g of bedding), and sand was the least (0.3 g of urine/g of bedding). When beddings were soaked in urine to their absorbance capacities, NH_3 emissions over 48 h (expressed as a proportion of the urine N absorbed) were not significantly different among bedding types, despite differences in initial bedding pH, CEC, and C:N. When equal volumes of urine were applied to equal depths of dry bedding, NH_3 emissions over 48 h were significantly less from sand and pine shavings (23 and 42% of applied urine N, respectively) than from chopped newspaper, chopped corn stalks, and recycled manure solids (62, 68, and 65% of applied urine N, respectively), whereas emissions from chopped wheat straw (55% applied urine N) only differed significantly from that from sand. Differences in the chemical characteristics of the beddings did not explain differences in emission; NH_3 emissions increased linearly with CEC contrary to expectations, and there was no significant relationship with initial bedding pH. The physical characteristics of bedding materials were of more importance, as NH_3 emissions increased linearly with absorbance capacity and decreased as the bulk density of the packed beddings increased.

Key words: ammonia emission, bedding material, cattle, urine

Abbreviation key: CEC, cation exchange capacity, TAN, total ammoniacal N