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Gaseous N and C Losses During Sun-Drying of Goat Manure – Effects of Drying Conditions and Feed Additives

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Abstract

Animal manure is a key resource in farming systems of arid and semi-arid regions. Its quality is often low due to inappropriate storage. Thus, it is important to assess the effects of drying and storage conditions on nutrient losses during typical sun-drying of manure, and how these losses can possibly be mitigated by changes in manure properties. Charcoal and tannins are known to stabilise organic matter and increase nitrogen (N) retention in soils and compost. Therefore, they were used as feed additives in order to stabilise carbon (C) and N in manure.

During sun-drying at three times during the cropping season, differing in temperatures and resulting drying rates, NH₃-N, N₂O-N, and CO₂-C losses from goat manure were measured. Manure was obtained from goats fed a diet of 50 % hay, 47 % maize and 3 % soybean with or without the addition of either 2.6 % activated charcoal (AC) or 3.4 % Quebracho tannin extract (QT).

The cumulative N and C losses reached up to 1.7 % and 0.3 % of the initial N and C contents, respectively. During the drying process, control manure lost 2.5 to 6.1 mg N g⁻¹ of the initial N content, AC lost 3.3 to 4.8, and QT 2.3 to 3.9 mg g⁻¹ of the initial N content via NH₃ volatilisation and N₂O emissions. Carbon losses during drying ranged from 0 to 2.3, 0 to 1.9, and 0.1 to 1.3 mg g⁻¹ of the initial C concentration for Co, AC, and QT manure, respectively. Slow drying (up to 84 h) favoured CO₂ emissions and reduced NH₃ volatilisation due to higher microbial activity and an immobilisation of mineral N in manure. In comparison, two times more NH₃-N was lost during quick drying of manure (4 h) than during slow drying, even after manure reached constant weight. In contrast to dietary charcoal, tannins reduced N and C losses by up to 60 % during manure drying and storage, increasing its quality as organic fertiliser and improving nutrient recycling.

Keywords: Activated charcoal, ammonia, carbon dioxide, goat manure, nitrous oxide, tannin