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Monitoring nutrient turnover during composting has to be based on a constant reference parameter. Is total ash content really a good choice?

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Introduction

Because of organic matter turnover during composting, the fresh and dry matter contents of the heap change continuously. In contrast, total ash content is usually considered to be fairly constant, apart from addition of minerals by precipitation and losses by seepage. Therefore, nutrient contents and losses over time normally are related to ash content, not dry matter content. Our field trials with farmyard manure, however, revealed that ash composition varies during the composting period. This raises the question of whether ash is really a constant parameter.

Materials and methods

At the beginning of May cattle manure was put on heaps (45 m long, 2 m wide, 1 m high). The biodynamic manure preparations were applied twice to each heap. Four heaps, looking as uniform as possible, were selected for a trial. Half of each heap, i.e. 8 sections, was used for different treatments: 2 coverings (fleece and plastic film) and 2 turning frequencies (4 and 7 times) in 2 replicates (Raupp & Baur, 2000). At the middle of June and end of October, samples were taken from the 8 sections to analyse dry matter, ash and nutrient contents. The ash was broken up with hot hydrochloric acid; the insoluble portion was filtered and weighed, the soluble fraction was calculated as the difference between total ash and insoluble portion.

Results and discussion

The total ash content of the manures increased from approx. 30% dry matter in May to 70% in October. If nutrient turnover is based on these total ash values, unlikely high carbon and nitrogen losses of 80% and 70%, resp., are calculated. This caused us to analyse the ash composition as regards HCl soluble and insoluble fraction. Whereas the soluble ash increased from May to October by 1.23 times (from 13% to 16% dry matter), the insoluble portion multiplied by 2.88 (from 18.5% to 53.3%) over the same period. If changes are merely caused by composting intensity (organic matter degradation), both fractions should have accumulated in the same degree. It is hypothesized that the higher rise of the HCl-insoluble fraction gives a hint that soil material was mixed into the heaps during composting, as the insoluble fraction originates mainly in soil-borne silicates while the soluble fraction is derived from (plant and animal) organic matter. Contamination with soil material could occur when turning the heaps by machine as was done several times in this trial. This explanation is supported by our results of another composting study carried out for several years without turning the heaps. No such disproportionate changes of the soluble and insoluble ash fractions were observed under these conditions.

Based on the HCl soluble ash contents the carbon and nitrogen losses are calculated at 65% and 51%, resp. This order of magnitude has also been reported in other investigations (Thomsen, 2000).

Conclusion

It is suggested to use the HCl soluble ash contents as a reference parameter, at least in field trials without absolutely controlled conditions.

References

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