Nitrogen efficiency of mineral concentrates under controlled conditions

INTERREG IVB

The Biorefine project aims to provide innovative strategies for the recycling of inorganic chemicals from agro- and bio-industry waste streams. The project is financed via Interreg IVB
http://www.biorefine.eu/

Introduction Manure processing can be used to increase nutrient use efficiency of manure. Reverse osmosis of the liquid fraction from separated slurry produces an end-product called mineral concentrate, which has similar properties as a liquid fertilizer. Field experiments showed that from mineral concentrates nitrogen (N) was taken up by plants less effectively than from calcium ammonium nitrate (CAN). In pot experiments the efficiency of mineral concentrates was compared with mineral fertilizers.

Methods In pot experiments of Ehlert et al. (2012) the Nitrogen Fertilizer Replacement Value (NFRV; N uptake from a fertilizer as percentage from the uptake from CAN) was determined of several injected mineral fertilisers, pig slurry, and mineral concentrates. The concentrates differed in contents of organic nitrogen. The pot experiment was carried out with perennial ryegrass and Swiss chard on a clay and a sandy soil. All fertilisers were applied in liquid form, but the reference fertiliser CAN was applied as granules. Klop et al. (2012) carried out a pot experiment with grass in which mineral concentrate was both surface-applied and injected.

Fertilizer	Swiss chard		Ryegrass	
	clay	*sand*	*clay*	*sand*
CAN	100	100	100	100
Liquid NH_4NO_3	108	101	97	101
Mineral conc. MC1	78	96	93	97
Mineral conc. MC2	82	89	80	76
Pig slurry	67	76	73	71

Nitrogen Fertilizer Replacement Value *of liquid NH_4NO_3, mineral concentrates (MC1 and MC2) and untreated pig slurry; all N-sources were injected and CAN was broadcast as granules.*

Results of a pot experiment of Ehlert et al. (2012). Total N in MC1 consisted of 99% NH_4-N and 1% organic N, and in MC2 of 92% NH_4-N and 8% organic N.

Results Concentrate MC1 had a NFRV of 78-97%, and that of MC2 was 78-89%. The NFRV lower than 100% is likely due to a combination of N losses by NH_3 emission and denitrification, and the presence of some unavailable organic N in the concentrates. The NFRV of pig slurry was consistently lower than NFRV of mineral concentrate. In the second pot experiment of Klop et al. (2012), the NFRV of surface-applied mineral concentrate was 36–62%, and much lower than when injected (92%). The low NFRV of surface-applied mineral concentrates was likely due to a combination of scorching of the grass because of high salt, NH_3 and/or volatile fatty acids concentrations near the grass roots, and to N losses as NH_3. The NFRV of injected mineral concentrates obtained in the pot experiments was similar to the theoretical NFRV of mineral concentrate, assuming that part of organic N is not available for plants and that some NH_3 emission will occur.

Further reading P.A.I. Ehlert et al. (2012) Alterra Report 2314. [*link*]; G. Klop et al. (2012) Soil Use Manage. 28:468-477; G.L. Velthof et al. (2012) Proc. 716, Int. Fert. Soc., Leek, UK.

ALTERRA WAGENINGEN UR

for more info contact :

gerard.velthof@wur.nl
Alterra, Wageningen, The Netherlands