FINAL REPORT
Valorisation of effluents of manure processing

ABSTRACT

RESEARCH PERIOD : 01/12/2002 – 30/11/2004

Colofon

Project title:	Valorisatie van resteffluenten afkomstig van de mestverwerking, Verkorte samenvatting
Project number:	P/OO/012
Client:	Vlaamse Landmaatschappij, afdeling Mestbank
Publication:	April 2005
Production:	Bodemkundige Dienst van België (promotor), West-Vlaamse Proeftuin voor Industriële Groenten vzw (partner), Interprovinciaal Proefcentrum voor de Aardappelteelt vzw (partner)

Bodemkundige Dienst van België vzw
Afdeling Onderzoek en Ontwikkeling
W. de Croylaan 48
3001 Leuven-Heverlee

Provincie West-Vlaanderen
Door mensen gedreven

Contact adresses

Promotor:

Bodemkundige Dienst van België vzw

W. De Croylaan 48

3001 Heverlee

Projectverantwoordelijke: Greet Verlinden

Tel: 016 31 09 22

e-mail: gverlinden@bdb.be

Projectpartners:

West-Vlaamse Proeftuin voor Industriële Groenten vzw

Ieperseweg 87

8800 Rumbeke-Beitem

Projectverantwoordelijke: Danny Callens

Tel: 051/26 14 14

e-mail: danny.callens@west-vlaanderen.be

Interprovinciaal Proefcentrum voor de Aardappelteelt vzw

Ieperseweg 87

8800 Rumbeke-Beitem

Projectverantwoordelijke: Kürt Demeulemeester

Tel: 051/26 14 27

e-mail: kurt.demeulemeester@west-vlaanderen.be

Project group:

VLM (S. Ducheyne, J. Casaer, A. Goossens, F. Stuyckens, D. Struyf, E. Gouthals, M. Peeters, J. Deprez, B. Paeshuyse, R. Van Mol, O. Goedertier, T. Van Craenem, S. Verplaetse)

VMM (S. Overloop)

AMINAL-Land (H. Neven)

AMINAL-Water (G. Janssen, L. Van Craen)

AMINAL-Milieuvergunningen (J. Opdebeek)

ALT (P. Gabriëls, D. Van Gijseghem)

VCM (I. Vermander, M. Devrome, K. Van Rompu)

VALORISATION OF EFFLUENTS OF MANURE PROCESSING FOR AGRICULTURAL USE

The aim of the project was to gain more insight in the value of effluents of manure processing for agricultural use. Apart from agricultural aspects like yield and product quality also soil and environmental aspects were considered. The first step in the project was the study of all existing literature about the topic. The second step was the chemical screening of a wide range of effluents from manure processing. The most important part of the study was the establishment of field trials and as a last and final step a Code of Good Agricultural Practices for the use of manure processing effluent was created.

In this study, we mainly focused on two types of effluents: the liquid fraction after separation of pig manure and the effluent from biological treatment of the liquid fraction. The liquid fraction results from the separation of pig manure into a liquid fraction and a solid fraction. Subsequently the liquid fraction can undergo further processing in a biological treatment facility, where micro-organisms reduce the nitrogen content in the effluent. The resulting effluent is called 'effluent from biological treatment'. In the liquid fraction as well as in the effluent from biological treatment, the concentration of potassium, chloride and sodium is still very high. Therefore applications on a regular base of large amounts of these effluents can cause growth problems in crops due to too high salinity levels in the soil or toxicity of the specific ions. Beside the accumulation of salt and nutrients, irrational use of effluents also leads to insufficient import of organic material into the soil system. From an environmental point of view, one must consider the leaching of nitrate, chloride, potassium and sodium. The emission of ammonia caused by application of the liquid fraction does not differ significantly from emissions caused by application of pig manure. In contrast, application of effluent from biological treatment leads to lower emissions of ammonia.

The results of the **chemical screening** of the effluents confirmed that the liquid fraction has substantially lower dry matter contents and organic matter content and lower concentrations of phosphate, calcium and magnesium compared to pig manure. Liquid fractions still contain a considerable amount of nitrogen and high amounts of potassium and sodium. Effluents from biological treatment have very low dry matter contents and organic matter contents as well as very low concentrations of nitrogen, phosphate, calcium and magnesium. The

concentrations of soluble nutrients (potassium and sodium) remain high in the effluent too. The salt content of liquid fraction and pig manure is similar, whereas the salt content of effluents from biological treatment is much lower (between 7 and 24 mS/cm).

The field experiments consisted of four field trials: 1) application of liquid fraction and effluent from biological treatment on grassland, 2) application of effluent from biological treatment on maize, 3) application of liquid fraction and effluent from biological treatment on vegetables and 4) application of liquid fraction and effluent from biological treatment on potatoes. On the **grassland** (sandy soil) doses of 50 to 74 ton/ha of liquid fraction were applied in 2003. These treatments were compared with application of mineral fertilizer according to fertilization recommendations based on soil nutrient status and mowing regime. In 2004 the grass was mowed two times and subsequently grazed during the rest of the growing season. Plots receiving doses of 60 to 140 ton/ha of effluent from biological treatment were compared with mineral fertilized plots. In general the yields on all plots were good. The grass on the plots with high levels of effluent from biological treatment however was grazed significantly less compared to the other plots. The results showed a good uptake of the surplus of nutrients applied by the liquid fraction and the effluent by the grass. Therefore, well-considered application of effluents is important to avoid luxurious consumption of nutrients and antagonism among nutrients. Due to the high uptake of nutrients by grass, salt accumulation and leaching of nutrients was low.

Both in 2003 and 2004, effluent from biological treatment was applied to a **maize field** (sandy soil). The doses varied from 45 to 100 ton/ha for both years. Good yields were obtained when the potassium fertilization recommendation was filled in by application of effluent (corresponding to 70 – 80 ton/ha) and when the effluent dose was increased with 40 % above the recommendation. The results indicated that the applied doses did not harm maize, a known salt-sensitive crop. However, the risk of salt accumulation and leaching is much higher on maize fields than on grassland.

During the **vegetable field trial** (sandy loamy soil), cauliflower was cultivated in 2003 and beans in 2004. In 2003, the doses of liquid fraction and effluent from biological treatment were swapped by mistake. As a result very high doses of liquid fraction (42 to 98 ton/ha) and low doses of effluent (24 to 56 ton/ha) were applied on the field. Obviously, all results were affected by nitrogen responses. Beside the nitrogen effect, there was no negative response of

cauliflower to the applied doses of liquid fraction and effluent from biological treatment with respect to yield and chemical composition of the cauliflower. Beans have a low demand of nutrients. Therefore, the doses of liquid fraction (15 to 45 ton/ha) and effluent from biological treatment (17 to 49 ton/ha) were rather low in 2004. The plots receiving the lowest dose of liquid fraction and effluent showed slightly higher yields than other plots. During certain periods accumulation of salt, nitrogen, chloride and sodium in the soil was recorded.

The **potato field trial** was located in the 'Polder' region. Because of risk of soil structure damage, application of manure in spring is not possible on these soils. Therefore the effluents were applied at the end of the summer of the year before. Doses of liquid fraction and of effluent from biological treatment ranged from 24 to 56 ton/ha and 42 to 100 ton/ha, respectively on this field. The applied doses did not affect the development or yield of the potatoes. Yields were generally low due to second growth. Although potassium originating from the effluents could not be detected in the soil at the end of the winter period, sufficient potassium was available to the crop during growth season. This resulted in a positive effect on bruising of the potatoes. In the soil, accumulation of sodium, chloride and potassium was found after application of high amounts of liquid fraction or effluent from biological treatment.

The field trials demonstrate that effluents resulting from manure processing can be used in crop fertilization if the rules of the **Code of Good Agricultural Practices** (which was also compiled in this project) are taken into account.