BIODIGESTED CROP RESIDUES FOR IMPROVED NUTRIENT EFFICIENCY IN BEETROOT

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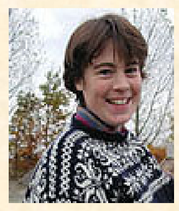

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Introduction

General practice in organic farming without ruminants is to leave the beet leaves and biomass from green manure ley in the field for their residual fertility effect.

The hypothesis of this project was that use of N in an organic crop rotation with beetroot can be improved by processing biomass from ley and beet leaves in a biogas reactor and using the effluent as a fertilizer compared to the general practice.

Method

Effluent production:
Effluent was produced by processing beet leaves and biomass from mixed ley in a bio reactor for biogas production.

Field trial:
A two-year field trial was carried out where the first year of the experiment included: 1) mixed ley, cut for green manure; 2) mixed ley, harvested; 3) barley. In the second year the beetroot after barley was grown with different amounts of effluent. There were also controls with barley, green manure ley and harvested ley without supply of effluent but with supply of Na and K.

Experimental stirred reactor tank for one-step biogasification. Estimated methane yield was 0.21 m^3 kg VS^{-1}.

Effluent was supplied to the beetroot before drilling, at 6-8-leaves and 4 weeks later. Nutrient content in kg per tonne was 1.1 NH4-N, 3.0 total N, 0.3 P, 4.5 K and 1.0 Na

Results

Amount of N that the system can support (N-$total_{supp}$) was calculated as the yield in harvested ley and beet leaves. N-$total_{supp}$ was found to be 299 kg for a crop rotation with 1 ha of green manure ley and 1 ha of beets. With the quality of our effluent that ment 107 kg of NH_4-N.

Using results from the field study the decrease in pre crop effect from harvesting the mixed ley instead of leaving the plant material in field was calculated to 56 kg NH4-N ha^{-1}.

Taking this into account, and also a reduced residual fertility effect from harvesting the beetroot leaves (20 kg N ha^{-1}), the net effect of processing the crop material in the biogas reactor was calculated as 31 kg ha^{-1}.

We also found that the variation in beet root yield was lower in treatments with barley as pre crop and effluent supply than with green manure ley as pre crop and no effluent supply.

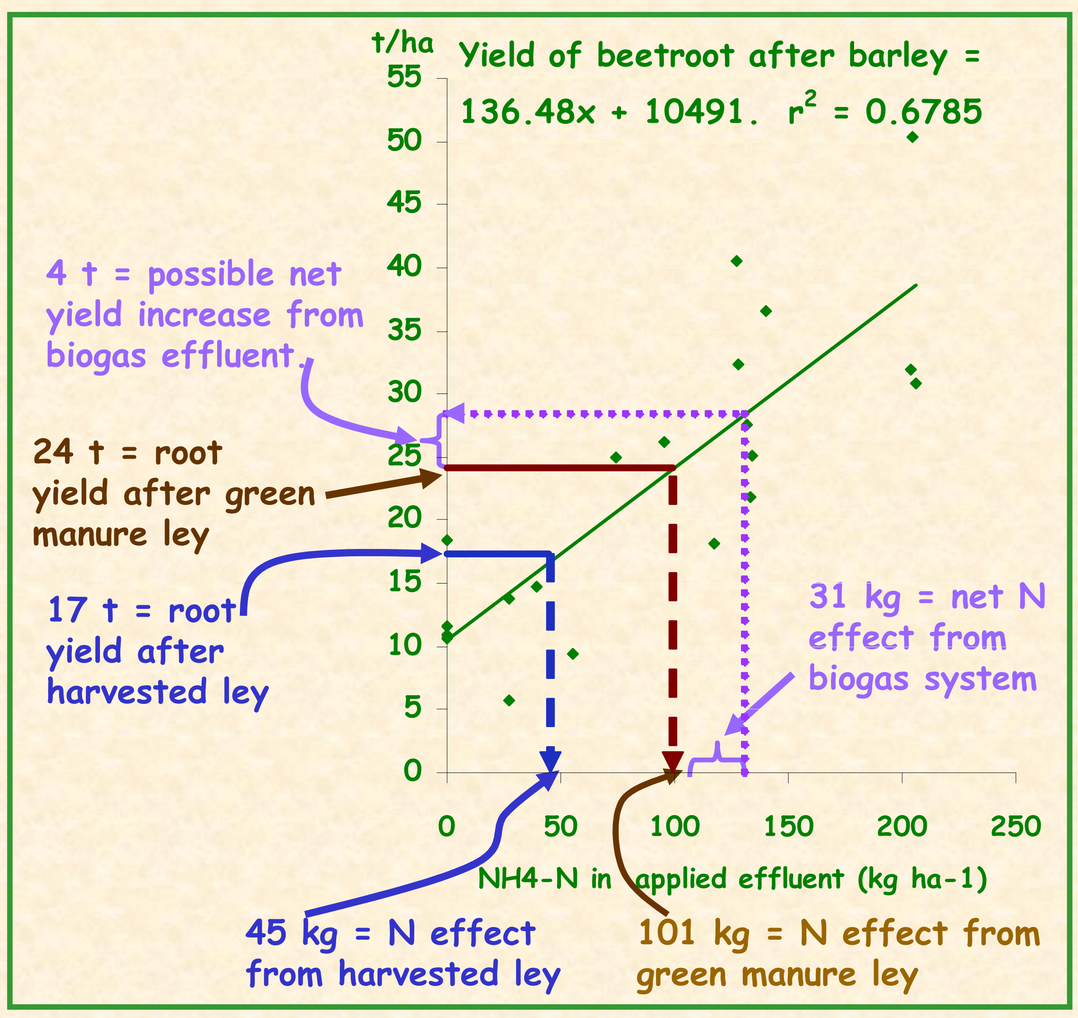

Figure explanation: The green dots corresponds to yield of marketable red beet roots (i.e. size 30 – 75 mm in diameter) with different application rate of NH4-N in effluent. Pre crop is barley. Yield after green manure and harvested ley are marked with brown and blue lines and the calulated N-effect from them is marked with broken lines. Net N effect from biogas system is caclulated as:

N-$total_{supp}$ x NH4-N/total N in effluent – (N effect from green manure – N effect from harvested ley) – 20. The factor 20 is the expected N effect from beet leaves left in the field compared to if they are harvested.

Conclusion

Our preliminary results indicate that the biogas producing system showed a small but inconsistent advantage in N efficiency compared to a green manure system. However, a crust in the biogas reactor decreased the accessibility of the biomass to the degrading microorganism and therefore the ratio NH4-N/tot-N became low. Solving this is a determining factor for the value of the biogas system in plant husbandry.