(Bio)-enzymatic additives to boost anaerobic digestion

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Anaerobic digestion : process flow and innovation

Will the additive facilitate the hydrolysis and thus increase the biogas production?

Process flow

Harvested biomass
↓ Ensilage
Ensiled biomass
↓ Hydrolysis → Slow
Simple molecules
↓ Fermentation → Fast
Precursors
↓ Methanogenesis → Sensitive
Biogas

Innovation

Harvested biomass ← (Bio)-enzymatic additive
↓ Ensilage
Ensiled biomass
↓ Hydrolysis → Fast
↓
↓
More biogas ???

Benefits

- ✓ Simple
- ✓ Low cost
- ✓ Readily upscalable
- ✓ More energy production ?

Material and Methods

Four treatments tested. Biogas production followed up in batch and semi-continuous tests.

Fig. Harvested, chopped maize

Fig. Ensiled maize

Fig. Semi-continuous test

- 1 x input • day^{-1}
- 50 L reactor
- 37 °C
- Continuous monitoring

Energy content of biogas (Nm^3 CH_4 / ton ODM)

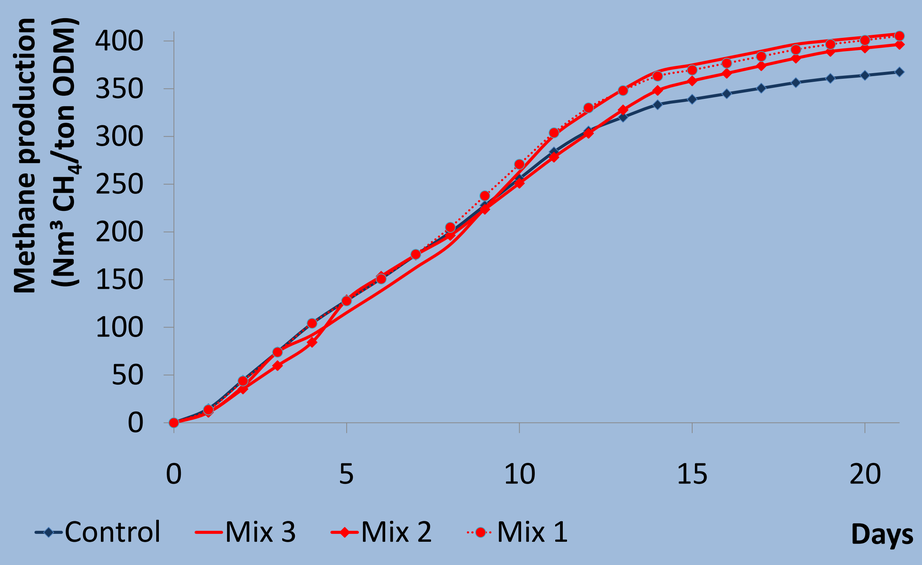
Fig. Batch tests

- 1 x input
- 2,2 L reactor
- 37 °C
- Batch monitoring

Treatments :
- Control (no addition)
- Mix 1 : homo- and heterofermentative bacteria
- Mix 2 : homo- and heterofermentative bacteria + enzymes
- Mix 3 : complex (bacteria + yeasts)

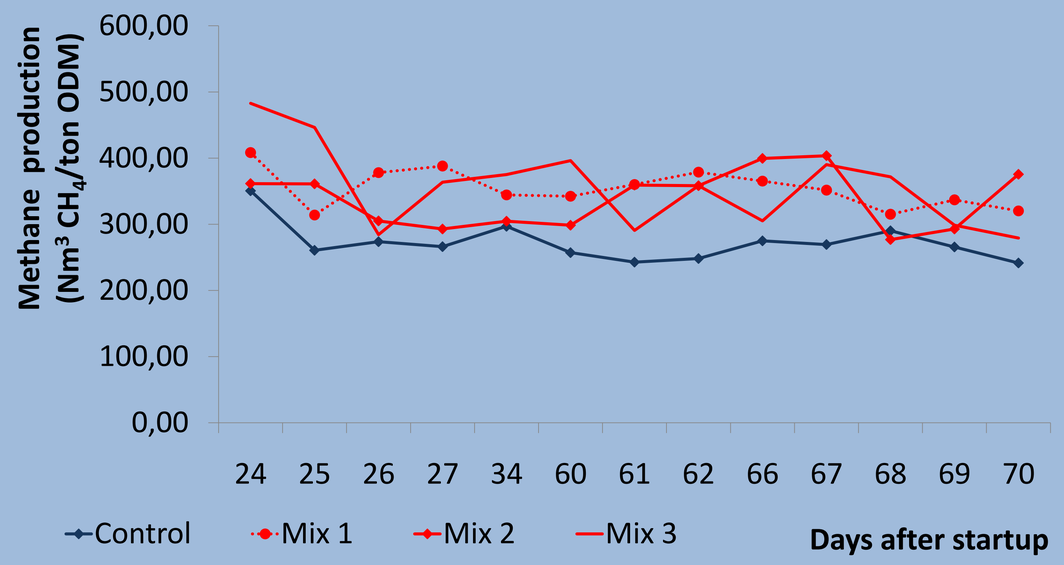
Results

Batch tests



Up to 14,5 % surplus methane (duplicate experiments)

Semi-continous tests



Up to 22,5 % surplus methane

All treatments statistically significant higher than control !

Conclusions

- **Both in batch tests and semi-continuous test : more methane production. Up to > 20 % surplus compared to control**
- **Comparable surplus between treatments**
- **Good ensilage (low DM losses, pH ~ 4, high lactic acid and acetic acid concentrations, low NH3 losses) (results not shown)**
- **Simple and straight forward upscaling possible**

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