

Anaerobically digested green manure is a valuable fertilizer

Anaerobic digestion of green manure increases nitrogen (N) availability. However, the N fertilizer replacement value is affected by the initial quality of the green manure, which is related to plant species composition and cutting frequency.

14.09.2018 | CHIARA DE NOTARIS, PETER SØRENSEN, HENRIK MØLLER, RADZIAH WAHID, JØRGEN ERIKSEN



Inclusion of forage legumes in the rotation can increase N availability in arable systems, but the management of the green manure can make the difference. The common practice of mulching green manure does not allow distributing nutrients according to crop requirement and increases the risk of losses to the environment. If removed from the field, the green manure can be used as a substrate for anaerobic digestion, which produces biogas and a nutrient-rich digestate. In particular, N availability is increased by the higher proportion of mineral-N in the digestate compared to the undigested material. Also, the lower dry matter content allows a better infiltration in case of surface application. In addition, the digestate can be applied to crops according to their needs, increasing the efficiency of the system.

The economics of removing green manure cuts and redistributing the digestate can be optimized by increased biomass production, e.g. through the inclusion of forbs, and reduced cutting frequency. The latter would also benefit pollinators. However, this affects the quality of the green manures, which may in turn affect the fertilizer value of the digestate.

As part of the MultiPlant project, a field experiment was set up to investigate the effect of plant species composition and cutting frequency on the N fertilizer replacement value of anaerobically digested green manure cuts. Pure lucerne, cut four times a year, was compared to a mixture including lucerne, grass and forbs, cut two or four times. The plant materials were ensiled after harvest and later digested without addition of animal manure. The digestate obtained was used as spring fertilizer for winter wheat (surface band application) and spring barley (injection prior to sowing).

Green manure quality counts

Anaerobic digestion increased the N fertilizer replacement value of the green manure by 25-63%, mostly due to the higher proportion of mineral N.

The yield of winter wheat and spring barley showed differences based on the applied fertilizers. Digestate obtained from pure lucerne, cut four times, gave the highest yields of both winter wheat and spring barley, with an N fertilizer value comparable to digested cattle slurry (46-65%). The lowest yields were obtained with the multispecies mixture, cut two times. The different initial quality of the green manure, and in particular the total N concentration, could explain most of the variation in the N fertilizer replacement value of the corresponding digestates. When the initial total N concentration exceeded 3.5 %, the digestate had an N fertilizer replacement value comparable to digested cattle slurry (Table 1).

Table 1: Initial total N concentration of three green manures and the N fertilizer replacement value (NFRV)* of the corresponding digestates.

Species composition	Cutting	Initial total N (%)	NFRV (%)	
			Winter wheat	Spring Barley
100% lucerne	4 cut/yr	4.9	55	86
Ryegrass, lucerne, chicory, plantain, caraway	4 cut/yr	3.6	41	65
Ryegrass, lucerne, chicory, plantain, caraway	2 cut/yr	2.6	24	39

*NFRV (%) indicates the amount of mineral N fertilizer that can be replaced by 100 units of the applied material.

Plant species composition and cutting frequency were the two factors determining the different initial quality. Four cuts per year were necessary to obtain a digestate, which could replace cattle slurry, even though the positive effect of anaerobic digestion on N availability was particularly relevant for the most fibrous material (two cuts). Also in terms of biogas production, the best results were obtained with four cuts per year due to less fibrous materials, which can impair the functioning of the plant.

Overall, the management of forage legumes should take into account the effect on the N fertilizer value of the green manure, which can be increased by anaerobic digestion. Despite the lower economic cost, a reduced cutting frequency decreases the initial quality of the green manure (e.g. total N concentration), corresponding to lower grain DM yields.

MultiPlant is part of the Organic programme, which is coordinated by ICROFS (International Centre for Research in Organic Food Systems). The project has received grants from 'Grønt Udviklings- og Demonstrationsprogram (GUDP)' under the Ministry of Environment and Food of Denmark.

Read more about MultiPlant here

Jordbrug og fødevarer

DEL PÅ FACEBOOK



DEL PÅ TWITTER



DEL PÅ LINKEDIN



SEND TIL EN VEN



Nyhedsarkiv

› 2019

- › marts 2019: 4 artikler
- › februar 2019: 5 artikler
- › januar 2019: 8 artikler

› 2018

- › december 2018: 6 artikler
- › november 2018: 8 artikler
- › oktober 2018: 4 artikler
- › september 2018: 4 artikler
- › august 2018: 6 artikler
- › juli 2018: 4 artikler
- › juni 2018: 5 artikler
- › maj 2018: 8 artikler
- › april 2018: 5 artikler
- › marts 2018: 3 artikler
- › februar 2018: 5 artikler
- › januar 2018: 10 artikler

› 2017

- › december 2017: 8 artikler
- › november 2017: 16 artikler
- › oktober 2017: 8 artikler
- › september 2017: 9 artikler
- › august 2017: 6 artikler
- › juli 2017: 3 artikler
- › juni 2017: 6 artikler
- › maj 2017: 9 artikler
- › april 2017: 3 artikler
- › marts 2017: 5 artikler
- › februar 2017: 12 artikler
- › januar 2017: 9 artikler

› 2016

- › december 2016: 5 artikler
- › november 2016: 5 artikler
- › oktober 2016: 7 artikler

- › september 2016: 7 artikler
- › august 2016: 4 artikler
- › juli 2016: 2 artikler
- › juni 2016: 7 artikler
- › maj 2016: 5 artikler
- › april 2016: 3 artikler
- › marts 2016: 3 artikler
- › februar 2016: 8 artikler
- › januar 2016: 6 artikler
- › **2015**
- › december 2015: 5 artikler
- › november 2015: 8 artikler
- › oktober 2015: 7 artikler
- › september 2015: 7 artikler
- › august 2015: 8 artikler
- › juli 2015: 7 artikler
- › juni 2015: 7 artikler
- › maj 2015: 15 artikler
- › april 2015: 8 artikler
- › marts 2015: 12 artikler
- › februar 2015: 15 artikler
- › januar 2015: 15 artikler
- › **2014**
- › december 2014: 14 artikler
- › november 2014: 8 artikler
- › oktober 2014: 6 artikler
- › september 2014: 2 artikler
- › august 2014: 1 emne
- › april 2014: 1 emne
- › januar 2014: 1 emne

HENVENDELSE OM DENNE SIDES INDHOLD: CHIARA DE NOTARIS, PETER SØRENSEN, HENRIK MØLLER, RADZIAH WAHID, JØRGEN ERIKSEN
REVIDERET 29.03.2019