

Cover crops for energy production

Low-impact agriculture

About cover crops

Cultivation of cover crops used to be a common practice in the former times, when extensive agriculture and smaller farms were dominating in the agricultural landscape. Due to the development of intensive agriculture cover crops are not so commonly cultivated anymore, since in the standardized agricultural system the fitting of two cultures after each other creates certain difficulties.

For most of the agricultural crops, e.g. potatoes, sugar beet, wheat, the harvest of cover crop in the spring would be too late to ensure the usual yields of the main culture. Maize as a main crop is potentially well predestined but only if not harvested too late (End of September or October).

Main challenge:

To balance cultivation of main crop and cover crop to keep the maximum possible yields for both cultures



Source: Inagro



Why winter rye?

- Later sowing in autumn possible with still good yields
- Earlier start of the growth in spring and therefore high biomass yields already at the end of April
- Low protein content i.e. low nitrogen demand
- Good frost resistance
- Benefits of winter rye co-digestion

Potential risks

Unfavourable weather conditions in spring may retard the harvest of the cover crop and the sowing of the main crop

Dry weather conditions in spring might reduce amount of water left in the soil profile for the main crop

Reduced yield of the main crop resulting in lower incomes of the farmer

General environmental advantages

Cover crops contribute to groundwater protection through capturing nitrate left in the soil profile after the main crop, but also ensure soil protection from erosion through the soil coverage in winter and add organic matter to the soil through roots and stubbles left on the field.

In general, cover crops next to generation of multiple benefits for the soil can be considered as additional biomass source securing local supplies without producing additional negative environmental impacts

Benefits of winter rye co-digestion^a

- Decrease by more than 50% in marine eutrophication effect due to the reduction of nitrate leaching
- Acidification and terrestrial eutrophication effects reduced by 5% due to lower ammonia emissions to air
- Reductions for terrestrial and freshwater ecotoxicity by 5-15% due to lower heavy metal emissions to soil
- Reduced agricultural land occupation (by 15%) mainly due to double use of the same land for the main and cover crop cultivation
- Reduced nutrient load (for nitrogen and phosphorous) during cultivation of rye (80 kg N/ha and no P) as compared to maize (190 kg N/ha and P application via digestate use) resulting in lower emissions of nutrients and heavy metals

^awith maize and manure as compared to maize co-digestion with manure only

1 ha based energy and CO₂ balance

Cultivation of maize and winter rye on the same parcel generates additional CO₂ emissions and energy demand per ha as compared to cultivation of maize only, but much higher CO₂ and energy amounts can be sequestered/captured in the crops.

1 ha maize + winter rye

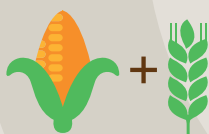
CULTIVATION

Additional emissions CO₂eq:

2 tonnes/ha

Additional energy demand:

16 GJ/ha



CAPTURED IN CROPS

Additionally sequestered CO₂eq:

40 tonnes/ha

Additionally captured energy:

85 GJ/ha

Investment costs & revenues

Seeds, fertilizers, material	171 €/ha
Fuel and machine costs	509 €/ha
Manpower	131 €/ha
Total costs without manpower	680 €/ha
Total costs	810 €/ha
Market value of the silage	912 €/ha
Revenues for farmer	102 €/ha
Max. possible revenues^b	232 €/ha

^bIf works done by farmer, no manpower costs considered

Recommendations

- Cover crops should become a common practice again
- Deadlines for the cover crops planting in the national subsidy policies should be kept flexible so that farmers can adopt to the weather conditions and main crop growth
- Incentives for use of cover crops in anaerobic digestion could be considered
- Introduction of obligation for cultivation of cover crops, wherever the main culture allows that, should be considered

Literature for more details:

ARBOR case study report (2015): Development of Low-Impact Energy Crops

Golkowska et al. (2015): Environmental and economic assessment of planting cover crops for energy production, Proceedings of the 23rd European Biomass Conference and Exhibition in Vienna

Igos et al. (2016): Biomass sourcing from cover crops for energy production – environmental and economic assessment, in preparation



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