

Diversification of silage maize cultivation by using winter cover crops enabled by ultra-early maize varieties

Problem

Continuous monocropping of silage maize is associated with non-intended impacts on production levels and the environment, such as decreasing soil quality, pressure on biodiversity and ground water quality and increasing GHG-emissions (Riemens et al., 2017; Schils et al., 2019).

Solution

To counteract these impacts, cover crops are grown in the winter, as a break crop between two maize crops. Using ultra-early maize varieties ensures that these winter crops have more time to grow and increases their positive effects for example to soil quality.

Outcome

Cover crops have the potential to fix remaining nitrogen from the soil, which can then be released to the soil in the next growing season (Riemens et al., 2017). Past research showed that the cultivation of a winter-hardy cover crop after silage maize reduced nitrate leaching up to 60% (Schröder et al., 1992).

Practical recommendation

- After the harvest of silage maize, cover crops can be sown without main additional tillage, if the field is free of deep harvest traces. Cover crops can also be undersown.
- Winter-hardy cover crops can include winter rye and ryegrass. Red clover, winter pea and other legumes can be added in a mixture to fix extra nitrogen.
- After winter, cover crops can either be mown for livestock feed or used as green manure.
- Before sowing maize the following season, (strip) tillage can be useful to prepare a good seedbed for the maize. A proper seedbed preparation for the following winter crop is also crucial.
- Ultra-early (short season) maize varieties ensure that cover crops have a longer growing time, which will help to maximise benefits of the cover crops on soil quality and weed control. Sowing time can be delayed with these varieties, which might also be beneficial for weed control.

Applicability box

Theme

Multiple cropping, field, cropping system, rotation, N management

Geographical focus

The method was tested in the Netherlands in an area with a clay loam soil and a mean annual temperature of 9.1 °C.

Application time

Cover crops undersown during the growing season of maize or after the harvest of the silage maize.

Required time

After maize harvest: sowing of the cover crops; in next spring: optional harvesting and tillage before sowing maize.

Period of impact

In winter, between two maize cultivations and on next maize crop.

Equipment

Suitable seed drill.

Best in

Early maturing maize varieties.



Picture 1: Grass-clover
(Photo: M. Gorter, WUR).



Picture 2: Rye-winter pea (Photo: M. Gorter, WUR).

More detailed recommendations

In the following tables, two examples of suitable cover crops for winter cultivation are presented, including information on sowing densities and an estimation of seed costs.

Grass - clover: The grass-clover mixture can be undersown during the growth of the silage maize. After the harvest, the grass-clover mixture can develop further to a full cover crop during fall and winter.

Mixture crop	Quantity	Price/kg (Van der Voort, 2018)	Total seed costs/ha
Italian rye-grass	25 kg/ha	€ 2.50	€ 62.50
Red clover	5 kg/ha	€ 10.-	€ 50.-
			€ 112.50

Rye - winter pea: The rye-winter pea mixture can be sown directly after the harvest of the silage maize.

Mixture crop	Quantity	Price/kg (Van der Voort, 2018)	Total seed costs/ha
Winter rye	100 kg/ha	€ 0.55	€ 55.-
Winter pea	40 kg/ha	€ 2.50	€ 100.-
			€ 155.-

Advantages

An investment in winter cover crops, is not only an investment to sustain soil fertility. Cover crops also provide beneficial impacts on biodiversity. By keeping fields green during the winter, there is constant food and (early) shelter in spring for beneficial insects. The cover crops can also be used as an additional fodder crop, which can be harvested in spring. The most important environmental advantages to these cover crops are the fixation of nitrogen (leguminous crops), which may help to reduce N applications in following crops, and reduced nitrogen leaching (by nitrogen uptake of grasses) over winter.

Challenges

There is a risk that the maize crop will perform less, in terms of production levels, after cultivation of winter cover crops. It requires more attention from the grower to take this into account and to respond to it in a good way. If one provides time and attention to growing the two crops it is possible to overcome the potential negative yield effects by competition. The combination of spring harvest of the cover crop and maize yields, can provide more feed. To prevent hydric stress for the maize crop, cover crops should be mowed and worked under a month before sowing maize. Further research is needed to understand the full potential of winter cover crops used as fodder, and for enhancing ecosystem services such as pollination and soil and ground water quality.

Further information

- For more information - <https://www.wur.nl/en/newsarticle/Sustainable-silage-maize-farming-requires-earlier-varieties-.htm>

Used sources

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About this practice abstract and DiverIMPACTS

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DiverIMPACTS: The project is running from June 2017 to May 2022. The overall goal of DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability - is to achieve the full potential of diversification of cropping systems for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains.

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