The cover crop mixture TerraLife®-MaisPro was analysed as a biodiverse mixture with twelve plant species (12-plant mixture) in the CATCHY project

WHAT ARE THE BENEFITS OF COVER CROPS IN THE CROP ROTATON

In this regard, in the CATCHY research project were determined results that are extremely valuable for practical use. Since 2015, individual components have been compared as pure seeds and cover crop mixtures with a black fallow in crop rotation trials.

The research project examined several focal points that reflect the added value of cover crops for agriculture:

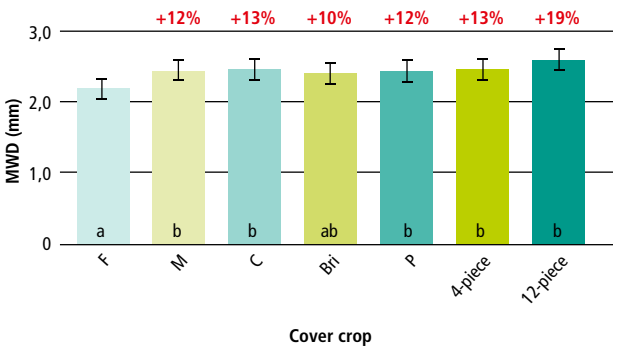
Soil structure & humus build-up

Cover crops improve the formation of water-stable soil aggregates compared to fallow (see Fig. 1). The highest potential of +19 % was determined for the TerraLife®- MaizePro mixture with 12 components. The resulting improved soil structure is the basis for healthy soil and the agriculture that takes place on it. Cover crop cultivation can also increase the humus content in the long term if it is continuously integrated into the crop rotation. An important parameter for describing efficiency here is the C/N ratio of the cover crop/sprout mass. A close C/N ratio of approx. 15 favours microbial processes and thus increases humus formation.

The CATCHY cover crop project was launched by the Federal Ministry of Education and Research (BMBF) in 2015. The universities and institutions that have conducted joint research here include Leibniz Universität Hannover, Weihenstephan-Triesdorf University of Applied Sciences and Arts, the Leibniz Institute of Plant Genetics and Crop Plant Research in Gatersleben and the University of Bremen. The main objective was to examine cover crops as a measure for developing innovative cultivation systems that maintain and improve soil fertility. The following focal points were investigated: The effect on soil structure and quality, the microbiome, the nutrient and water balance as well as the yield effect and profitability.This article summarises all the sub-projects. A closer look at the subprojects will follow in the next editions of Innovation.

CATCHY

FIG. 1: EFFECTS ON THE SOIL STRUCTURE



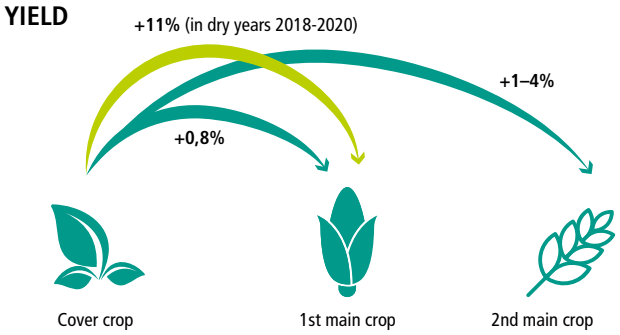
Influence of cover crops on the mean diameter of water-stable aggregates (MWD) in the soil. Different lower case letters indicate significant differences. The red values indicate the increase in MWD in percent compared to fallow.
Source: according to Gentsch et all. (2024)

Stabilisation of stock health

All soil functions are microbially influenced. The more diverse the microbiome (totality of microorganisms) is, the more stable the agroecosystem can be against disturbances such as extreme weather conditions. The CATCHY project was able to show that each plant species activates an individual microbiome. A combination of different species in mixtures can lead to a greater diversity of the microbiome, depending on the location and year. It therefore plays a role whether the soil is fallow, cover crops are grown in pure seed or in mixtures.

It was also possible to prove that cover crops influence the microbiome of the following main crop: For example, different cover crop species and mixtures were cultivated and the roots of the subsequent maize were analysed. Most health-promoting fungi were found after phacelia in pure culture and after the TerraLife®-MaisPro mixture. Harmful Fusarium fungi occurred most frequently after fallow or mustard. However, there is a need for extensive further research, particularly in this area,

FIG. 2: COVER CROPS HAVE A YIELD EFFECT ON THE FOLLOWING CROPS



in order to utilise cover crops as an appropriate biocontrol agent in the future.

Save fertiliser with cover crops

Cover crops make a significant contribution to closing the nutrient cycles in agriculture. It should be noted that individual plant species can mobilise different nutrients very specifically. Key factors here are biomass formation, root architecture and specific mobilisation mechanisms (e.g. the excretion of specific organic acids or enzymes via root exudates). These properties can be specifically combined in mixtures to optimise nutrient management according to the crop rotation. This leads to more stable biomass formation and nutrient utilisation in different environments. Long-term crop rotation trials have shown that nutrients are released from the cover crop not only in the following crop, but also via organic nutrient depots in the soil to the entire crop rotation. This results in potential fertiliser savings throughout the entire cultivation system. In addition, a reduction in nitrate leaching of 80 to 90 % was measured over the vegetation-free period. Cover crop cultivation is therefore active groundwater protection.

Controlling the water balance with cover crops

Many farmers ask themselves „Do cover crops only steal water from my main crop?“. No, this assumption is not correct in all cases. The project results prove that the site-specific water balance can be actively controlled with cover crops.

Freezing cover crops can provide the following main crop with more water than a fallow (on average +11.5 % soil water supply for maize sowing) and are therefore particularly advantageous with increasing early summer droughts. In the dry years during the project, this effect, among others, led to additional yields of +11 % on average for silage maize (see Fig. 2). It is important to have in mind that winter-hardy cover crops also extract water over the winter and especially when vegetation returns in the spring. On dry sites, this can lead to a lack of water for the following main crop. On moist sites, on the other hand, this can e utilised in a targeted manner to ensure successful spring planting of the main crop.

Long-term earnings stability

The diverse influencing factors described above also result in a complex effect of cover crops on the yields of the main crops. If managed correctly, this is positive. The short-term yield effects on the direct subsequent crop are rather low (0.8 % additional yield in the following silage maize). However, it is proven that there are effects beyond the following crop on the entire crop rotation: In winter wheat following silage maize, long-term trials showed yield increases of 1 to 4 % (see Fig. 2).

Conclusion

The CATCHY project has significantly improved our understanding of the many benefits of cover crops in agriculture. The properties and effects of different plant species and their societies are very complex. When considering all the parameters as a whole, it becomes clear that the targeted combination of species in mixtures leads to greater resilience in the crop production system. Continuous integration of the right cover crops into the crop rotation is essential to realise the many benefits.

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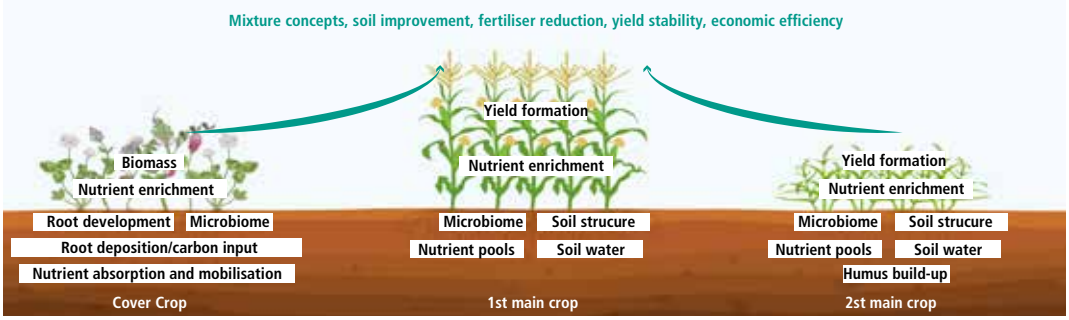
FIG. 3: ILLUSTRATION OF THE STRUCTURE AND RESEARCH FOCUS OF THE CATCHY PROJECT



Plant images according to Kutschera et al. (2009)

More about the CATCHY results can be found here: