



# CROP ROTATION BENEFITS FROM COVER CROPS

## Regulate successful main crops through cover crop mixtures

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Extreme years like 2018 show that main crops suffer greatly in adverse weather conditions. The effects on the plants cannot be prevented, but cover crops are a helpful instrument for obtaining resistant plant populations. This is demonstrated by studies from the German Federal Ministry of Education and Research (BMBF) CATCHY project.

One of the initial results from the CATCHY project are the positive effects of cover crop mixtures on the soil biology and the nutrient balance. The more diverse the cover crop mixtures, the better photosynthesis performs on the farmland. The TerraLife® MaizePro DT Greening mixture even absorbed three times as much CO<sub>2</sub> from the atmosphere than mustard. The increased photosynthesis performance of the mixtures is due inter alia to an increased leaf area index for the different species. For this reason a species-rich cover crop provides a high value, in order to prepare the soil biology and nutrient balance for the main crop.

### Species-rich cover crops for optimum nutrient supply

When the soil is cultivated in the spring a portion of the frozen cover crop biomass has already decayed. In particular with mustard the quickly available nitrogen content is converted early. The straw, rich in structural materials, with a wide C/N ratio remains and is worked into the soil in the spring. The micro-organisms use the entire growing season from the mineral fertiliser application of the subsequent crop to decay the

mustard straw.

The nitrogen is then immobilised in the microbial biomass. In comparison with this the C/N ratio in cover crop mixtures can be considerably improved by a skilful choice of plants. Within the CATCHY project the species-rich TerraLife® MaizePro DT Greening mixture demonstrated the most effective nutrient release. Sustained nitrogen delivery for the subsequent crop was measured and an increase of 62% N, 40% P and even 91% K in comparison to mustard was established.

### The vital importance of wa- ter balance management

The increase in spring and summer drought as a consequence of climate change makes it vitally important to manage the water balance on agricultural land. This is where frost-tolerant cover crops offer a distinct advantage over over-wintering crops or leaving the land fallow. Standing biomass and increased evaporation on fallow land can result in consumption of water reserves during the winter in conditions of insufficient precipitation.



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## Extract from the German magazine „Innovation“

### \*Soil biology and more

The CATCHY cover crop project is part of the BonaRes Soil as a Sustainable Resource for the Bio-economy project initiated in 2010 by the German Federal Ministry of Education and Research (BMBF). During a total of nine years investigations have been conducted in two consecutive crop rotations into the effects of cover crops on the soil and its biology and therefore on the yields of the main crops.



As well as DSV, microbiologists from Bremen, soil scientists from Hanover, plant nutritionists from Gatersleben, crop farmers from Triesdorf and socio-economists from Gießen are involved in the project. DSV brings to the project its many years of experience with cover crops and the composition of intelligent mixtures for growing cover crops.

Conversely, once frozen, the cover crop provides a layer of mulch. In comparison to leaving the land fallow all the varieties of cover crop in the CATCHY project, with the exception of mustard in spring 2019, added a definite plus to the soil humidity during the sowing of maize. Just as in mixed woodland, by exploiting the variety in plant height in the species-rich mixture, different levels with very dense growth are formed. This creates a micro-climate, which retains humidity close to the soil surface. This special micro-climate means that the land loses less water overall through evapotranspiration and the water balance is optimised.



### Optimal compositions for mixtures

The initial results from the drought year of 2018 showed that in particular, phacelia, bristle oat, mustard and niger were the plants most probably suited to countering water and heat stress. Together with wild flax and oil flax, these plants also demonstrated the highest efficiency in absorbing nitrogen during the trials. These species are also particularly suitable for absorbing residual nutrients from the soil. The principle of redundancy, a kind of reinsurance, proved its worth in mixtures; this principle makes it possible to have ready one or more plants for every climatic condition. If possible, cruciferous plants, such as mustard or rapeseed, should not be sown as sole crops and the total amount in mixtures should be less than 5-10%. Certain sulphur compounds in crucifers have a negative impact on soil micro-organisms. Since clover only forms low biomass and recycles little residual nitrogen from the soil, clover varieties should be used only in a mixture. In among other plants it is ideal for closing off the lower levels. Positive synergy effects have also been discovered in the case of vetch and pea; they stimulate the growth of the companion plants. In addition, the high N content in the shoot and rhizome make legumes an important species for optimising the C/N ratios in the cover crop biomass. A percentage of legumes of approximately 25% in the biomass of the mixtures proved its worth in the trials.

### Summary

Even in drought years frost-resistant cover crops do not compete with the subsequent main crop for water and even improve the water balance in the soil. The higher the diversity in cover crop mixtures, the more diverse is the microbial community in the rhizosphere. The complete crop rotation benefits from this. In the right combination mixtures can be used as an effective instrument for efficient nutrient exploitation and release to produce a more productive and more robust main crop.

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### Seed production as a worth-while extension to crop rotation

Deutsche Saatveredelung AG breeds, produces and markets rapeseed, cereals, grasses, clover and cover crops.

More than 35,000 tons of grasses are produced annually, principally in Germany, Denmark, the Netherlands and Poland on some 28,000 hectares of propagation land. The DSV has its own field production department, with 24 crop consultants, who work intensively on planning and implementation in the respective countries.



Seed producers use the production of grass and clover seeds not only for economic reasons, but also to bring variety into narrow cereal crop rotations by introducing seed production.

Cultivation of grass seed over one year and in particular over several years has especially positive effects on physical soil properties. Many species can be used biennially and for longer periods for seed production.

In addition to these positive effects on crop rotation and the soil, with all grasses there is the possibility of subsequent use in autumn (seed litter + one forage cut) and with several grasses early use for forage is also possible in spring.

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