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Media release

Soil microbes replace fertiliser

Beneficial soil microbes can significantly increase crop yields while reducing the amount of fertiliser. This is shown in a global meta-study by the Research Institute of Organic Agriculture FiBL and the University of Basel, which was recently published in the renowned magazine "Frontiers in Plant Science".

(Frick, 02 February 2018) Crop yields can be increased by up to 40 percent if beneficial soil microorganisms – so-called bio-fertilisers – are added to the soil during sowing. This is the result of a worldwide meta-study conducted by FiBL and the University of Basel. The optimum efficacy of the inoculated microbes depends on the content of plant available phosphorus in the soil. Thus, it is crucial to adjust phosphorus fertilisation according to the needs of the specific added microbes. The highest level of predicted efficacy is achieved with added nitrogen-fixing nodule forming bacteria, living in a symbiosis with legumes, such as beans or peas, and which have been selected specifically for certain crops.

Addition of microbes promising for dry areas

In general, the use of microbes to increase yields is most promising in dry areas, such as the Mediterranean region or dry tropical regions (e.g. parts of India and Africa). In these climatic areas, the highest yield increase was achieved.

This is the conclusion of the researchers in their meta study, in which they took into account 171 systematically selected publications worldwide (1672 pairwise comparisons). The study was published in the internationally renowned journal "Frontiers in Plant Science".

Further results of the study:

- The use of beneficial soil microorganisms can improve the crop plant's use efficiency of both phosphorus and nitrogen. This saves input costs of mineral fertiliser for farmers and reduces the environmental impact of over-fertilisation.
- Especially in dry areas where planting occurs during the rainy season, yields can be increased. This result of the study is important, as some regions of the world are predicted to become drier in the future, and the use of these microorganisms could provide an adaption measure to climate change. Great potential lays thus especially in dry areas such as the Mediterranean region or parts of India or Africa.
- Yield increases depend on the category of microbes. These include, for example, nitrogen-fixing bacteria living in a symbiosis with roots of leguminous plants (nodule forming bacteria) and free-living nitrogen-fixing bacteria. These bacteria

Research Institute of Organic Agriculture FiBL | Ackerstrasse 113 | Postfach 219
5070 Frick | Switzerland | Phone +41 62 865 72 72 | info.suisse@fibl.org | www.fibl.org

reach their optimum in soils with a relatively high phosphorus (P) content. Phosphorus solubilizing bacteria and fungi work best with a medium soil P content. Efficacy of so-called arbuscular mycorrhizal fungi reach their optimum with a relatively low P content.

- The efficiency decreases with an enhanced content of humus in the soil, which is linked to a larger population of soil microorganisms. This makes it more difficult for newly introduced microorganisms to establish themselves.

FiBL contacts

- Paul Mäder, Department of Soil Sciences, FiBL Switzerland
  Phone +41 62 865 72 32, e-mail paul.maeder@fibl.org
- Helga Willer, Communication, FiBL Switzerland
  Phone +41 62 865 72 07, e-mail helga.willer@fibl.org

University of Basel contacts

- Lukas Schütz, Department of Environmental Sciences-Botany, University of Basel, Switzerland
  Phone +41 78 963 64 39, e-mail lukas.schuetz@unibas.ch
- Mathimaran Natarajan, Department of Environmental Sciences-Botany, University of Basel, Switzerland
  Phone +41 61 267 23 37, e-mail mathimaran.natarajan@unibas.ch

Supporters

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Partners

- Department of Environmental Sciences, University of Basel, Switzerland
- Institute for Environmental Decisions IED, Swiss Federal Institute of Technology, ETH, Zurich, Switzerland

Link to the study

- "Improving Crop Yield and Nutrient Use Efficiency via Biofertilization" in "Frontiers in Plant Science": https://www.frontiersin.org/articles/10.3389/fpls.2017.02204/full

Citation

Schütz, L., Gattinger, A., Meier, M., Muller, A., Boller, T., Mäder, P., Mathimaran, N., 2017: Improving crop yield and nutrient use efficiency via biofertilization – a global meta-analysis. ***Frontiers in Plant Science*** 8. doi: 10.3389/fpls.2017.02204

Further information on the topic

- Link to the FiBL project data base: http://www.fibl.org/en/projectdatabase/projectitem/project/886.html
- ISCB management unit at the École polytechnique fédérale de Lausanne, Switzerland: https://iscb.epfl.ch/page-113659-en.html

Further FiBL studies on the topic

Mäder, P., Kaiser, F., Adholeya, A., Singh, R., Uppal, H S., Sharma, A.K., Srivastava, R., Sahai, V., Aragno, M., Wiemken, A., Johri, B.N., Fried, P.M., 2011: Inoculation of root microorganisms for sustainable wheat-rice and wheat-black gram rotations in India. ***Soil Biology & Biochemistry***, 43: 609-619. doi.org/10.1016/j.soilbio.2010.11.031

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Thonar, C., Lekfeldt, J.D.S., Cozzolino, V., Kundel, D., Kulhánek, M., Mosimann, C., Neumann, G., Piccolo, A., Rex, M., Symanczik, S., Walder, F., Weinmann, M., de Neergaard, A., Mäder, P., 2017: Potential of three microbial bio-effectors to promote maize growth and nutrient acquisition from alternative phosphorous fertilizers in contrasting soils. ***Chemical and Biological Technologies in Agriculture*** 4: 7. doi.org/10.1186/s40538-017-0088-6

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This media release online

This media release and pictures can be accessed online at www.fibl.org/en/media.html.

About FiBL

Since 1973, the Research Institute of Organic Agriculture FiBL has been finding intelligent solutions for a regenerative agriculture and sustainable nutrition. About 280 employees carry out research, advisory services and training at various sites to support organic agriculture.

- Homepage: www.fibl.org
- Video: www.youtube.com/watch?v=U84NrJlORFc