

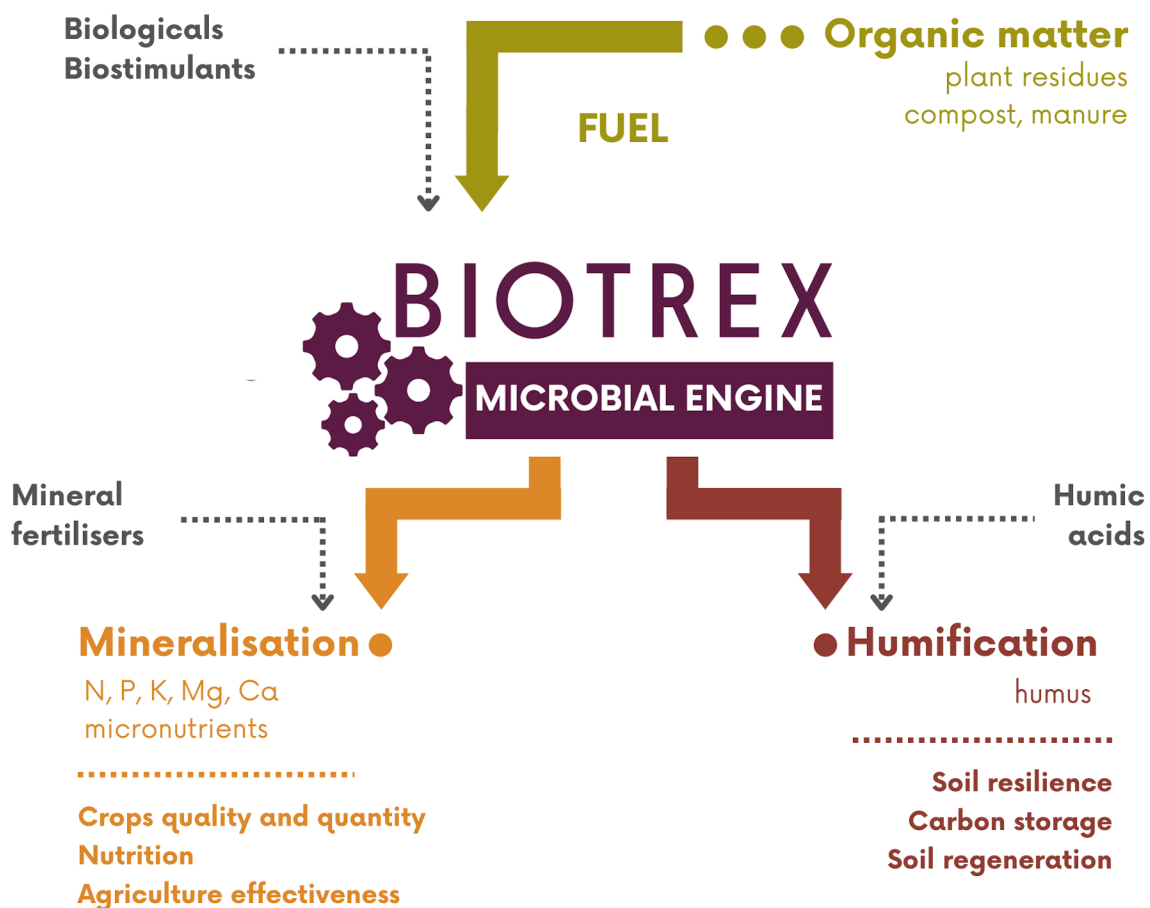
BIOTREX report manual

BIOTREX is a universal microbiological soil health indicator. With it, we measure soil microbiome biodiversity and activity. This includes all microbes – bacteria, fungi and archaea – which work together as a community to sustain the ecosystem in the soil.

To properly read BIOTREX results, you need to know your field well. We provide you with one number – the BIOTREX index. It contains information about current microbial activity and biodiversity in a simplified form. In our laboratory, exactly 18,432 individual, automated measurements were done on each sample to produce these results. This manual will contain some helpful information on how to interpret the BIOTREX index. Read it carefully to get the most from your analysis!

What is the soil microbiome?

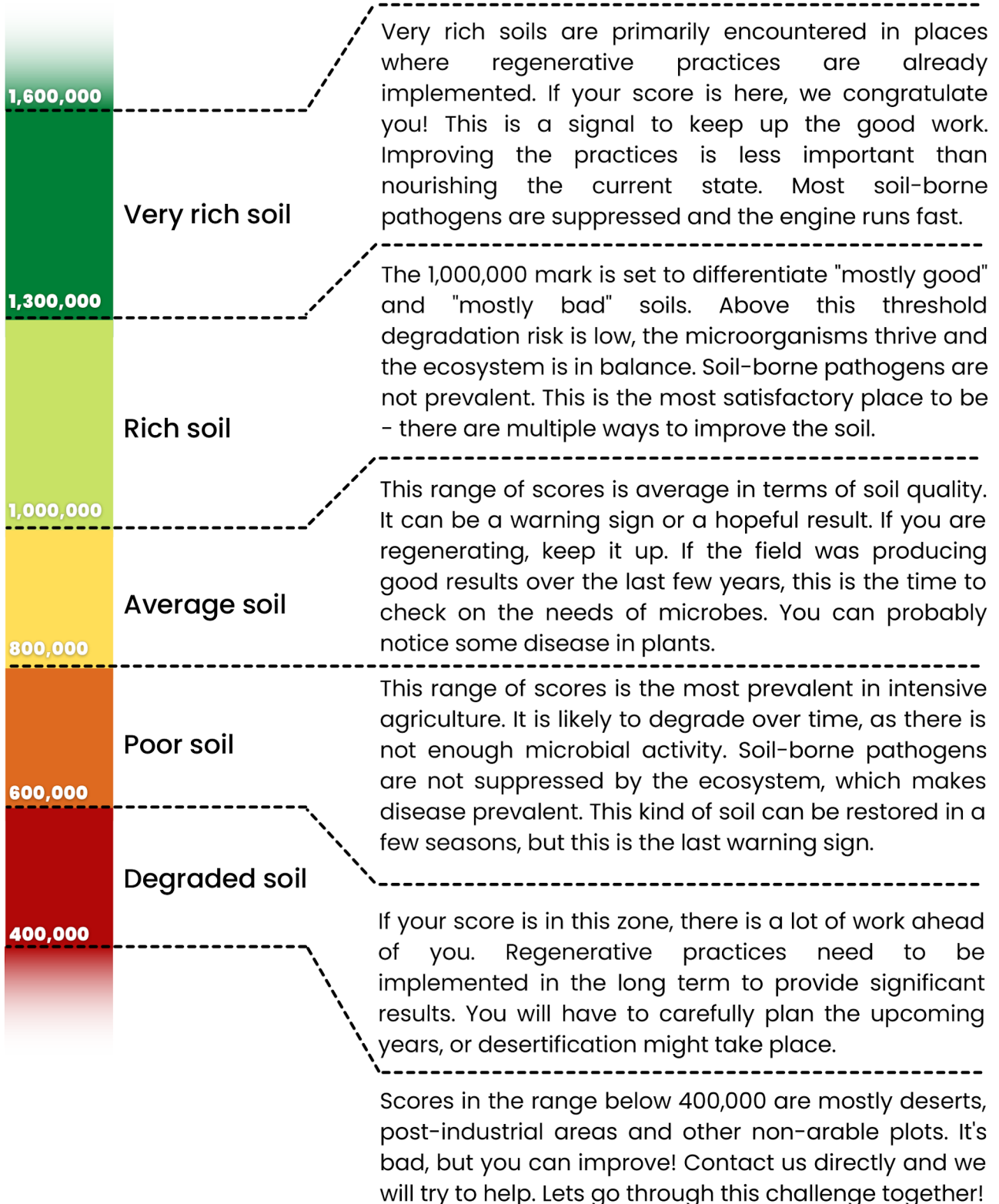
Soil microbiome is one of the most important factors in agricultural efficiency. No crops would ever grow if not for the diverse microorganisms working underground. To show how it works, we like to use the analogy of an engine. The more diverse and active the microbiome, the faster the engine runs and the quicker the results. This also means that it burns through the fuel (organic matter) faster! The BIOTREX index is like a rev counter for this microbial engine. The higher the score, the faster the engine runs. Biodiversity and activity of the microbes are the factors we test because this is what lets the microbiome as a community work through the fuel to provide you with results.





BIOTREX index scale

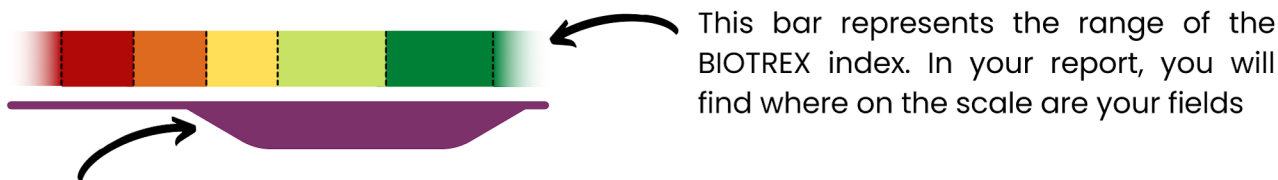
Easy interpretation guide



Regenerative agriculture practices and products

According to your BIOTREX index

How to read our suggestions?



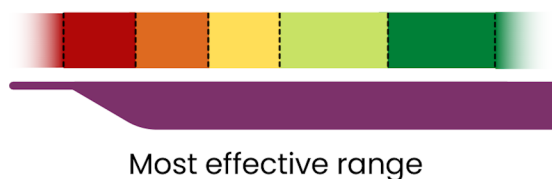
This bar represents the range in which we expect each practice and product to perform best. This is a suggestion, not a requirement - you have to consider your technical possibilities and the specifics of your field. **The product or practice will still work outside of the range, but the effectiveness might be lowered.**

#1 Organic and organo-mineral fertilisers

These are the products that may contain various beneficial ingredients - organic matter, humus, minerals, nutrients, and active microbes. They benefit the soil on many levels - improve the structure, water retention and aeration, nourish soil with nutrients, organic matter, and microbes which will work hard to benefit your crops. However, each of them has slightly different composition, and will benefit the most regarding of soil current score.

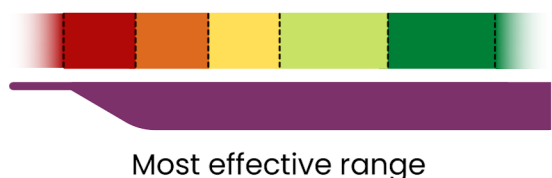
Composts

Compost is a mixture of decomposed organic wastes. It serves as a source of organic material, nutrients and helpful microorganisms. It can differ a lot in composition. There is no single compost recipe, with various waste, microbial compositions and substances content. Most of the time it is beneficial. We tested multiple commercially available composts and found out they can differ quite a lot. You can test the microbial activity or simply look for a quality product, both in retail and in your production. We only advise caution when applying it to degraded soils, as adverse effects on the plants are known to occur in this case.



Manure

Manure has been used as a fertiliser for about as long as we have kept farm animals. Just as compost, it is a source of organic matter, nutrients and microorganisms. The composition might be a bit different in manure, but it is still beneficial, especially after composting it for a while. We advise you to be careful when applying it to degraded soils, as it might have some adverse effects.



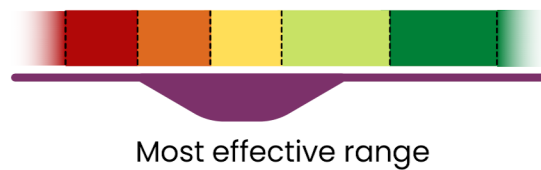
Humic and fulvic acids

Humic and fulvic acids are very large and complex chemical compounds that are a major component of soil humus. They can directly increase humus content in the soil, which improves soil structure, and water-holding capacity and stimulate soil microbes' activity. Using them is a shortcut - that's why we recommend using them in low and average score soils.



#2 Microbial products

Products that contain live microbes are one of the popular methods of introducing new species or functionalities of microorganisms. They typically contain one or more strains of microorganisms with the potential to be beneficial in agricultural practice. When applied directly to the soil, effectiveness may be lessened on very rich soils - there is no need to introduce additional microorganisms to the microbiological community that already is in a good shape and works well. Results may be not as splendid as we would hope, not because the microbial product is bad, but simply because the competition in the existing community is high and new strains might be struggling to fit in there. Extreme caution is advised on very poor soils, as the new strains might dominate and destabilise the ecosystem.

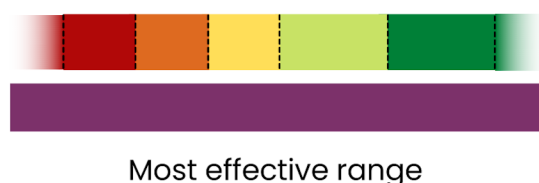


#3 Regenerative practices

Microbes are selfish creatures. They won't do what doesn't benefit them, and they won't live where conditions are inhospitable (however, what 'hospitable' is for microbes may sometimes amaze you). If the soil environment is not good for microbes, you can be sure it is not beneficial for your crops either. Regenerative practices mainly help to create the best conditions for both, microbes and plants. Although using those practices is nearly always beneficial, not all of them can be applied to every type of soil and cropping. Therefore, please choose what is best suited to your case.

Tillage reduction - no tillage, shallow tillage, strip tillage

Tillage has its benefits, but for microbes, it is a disadvantageous practice. The deep layers of anaerobic bacteria end up on the top and the aerobic bacteria on the bottom. This means that microbial activity is vastly reduced. Reducing the tillage will provide much-needed stability to the ecosystem. If you can implement the no-till practice, we recommend it. If you can't reduce tillage, you can implement strip tillage, which is lighter on the microbial ecosystem.



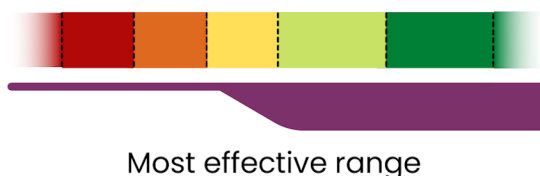
Optimising the crop rotation

Crop rotation is a basic practice you should incorporate if you want to keep healthy soil. Different types of plants have different nutritional needs. Some are very demanding and take a lot of nutrients from the soil (e.g. root crops), while others can enrich the soil with primary nutrients (e.g. legumes fixing the nitrogen). Plants can also feed the microbes – they produce and secrete sugars through their roots, which attract and stimulate beneficial microbes. A good crop rotation plan allows for keeping nutritional balance in the soil and nourishes soil microbes. Therefore, low and moderate BIOTREX scores may indicate not optimised crop rotation plan and poor soil regeneration.



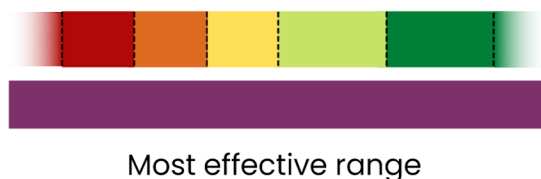
Post-harvest and other green residues

The plant organic matter left after harvesting the crops is a useful resource. Leaving it on the field is beneficial for the soil ecosystem. The requirement for this practice to work well is relatively high microbial activity. The fungi and bacteria in the soil will work to decompose the organic matter into humus and minerals. The process is effective only if microorganisms are abundant, diverse and active. If you have a high enough BIOTREX index, that means practice is effective, cheap and beneficial. If your soil microbial activity is low, you can speed up the decomposition process by using a microbial product containing strains specialised in plant residue decomposition. Last but not least, organic matter decomposition leads to an increase in soil organic carbon, and improves soil structure and BIOTREX score as well.



Cover crops

A "No bare soil" policy might bring you a long way in terms of results. Nearly every field benefits from a plant cover while it is not in use. Water loss and erosion prevention, and soil structure improvement are the obvious benefits, but there are more. The relationship between plants and microbes should be constant to provide stability to the ecosystem. A bare field is not only subject to physical erosion, but also to microbiological ecosystem degradation. Harsh weather conditions may be deleterious to soil biology and manifested by decreased BIOTREX score.

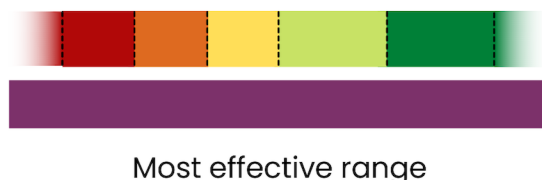


Tip: do you have a beekeeper close by? If you get in touch, you can both benefit by planting honey plants.



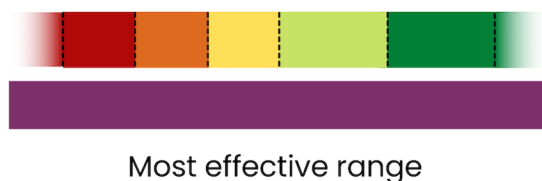
Fertilisation optimising

We always recommend creating a fertilisation plan based on chemical soil analysis. However, higher microbial diversity and activity increase the release of minerals and make them available for plants. Some of the soil microorganisms are capable to fix nitrogen from the air, unfortunately, the effectiveness of this process decrease with a higher amount of mineral nitrogen applied. To optimise fertilisation you need to take care of three factors: input of natural sources of minerals, a decrease of mineral fertilizers and activity of soil microbiome. Quickly you will find out that the microbiome is your ally in this endeavour.



Soil structure management - lighter machinery

Physical soil structure is at the centre of regenerative farming. Soil compaction affects water retention, aeration, and minerals availability, leading to erosion. All of those impact biological soil quality, historically measured by the enumeration of earthworms and nowadays by the BIOTREX score. Soil compaction by agricultural machinery might sound like a trivial issue, but we highly encourage you to consider it. If possible, choose the lighter options. Low-pressure tires are also available to lessen the force exerted on the ground. We know that is expensive stuff, we just encourage you to consider it while investing.



What to do when in doubt?

There are many other practices that you can use in your field. If you need to evaluate the potential benefits of a practice, you can go back to the microbial engine. To make it run faster, you have to do some maintenance and provide some fuel. Adding beneficial bacteria will boost it, but only if they actually move into their new home. Providing green residue will boost it, but only if there is somebody (specifically, some microbe) to consume it. If you consider your agricultural inputs in terms of your current microbiome state and where do you want to be in the future, you can expect improvements.

This manual for practices and products is constantly under development. We are researching new ideas every season. If you want to share your experience, get an update on the suggestions or run some more tests, contact us!



Harada Corporation
Dusseldorf office
biotrex@haradacorp.co.jp
biotrex.eu



Somigro
Warsaw office & lab
biotrex@somigro.com
somigro.com