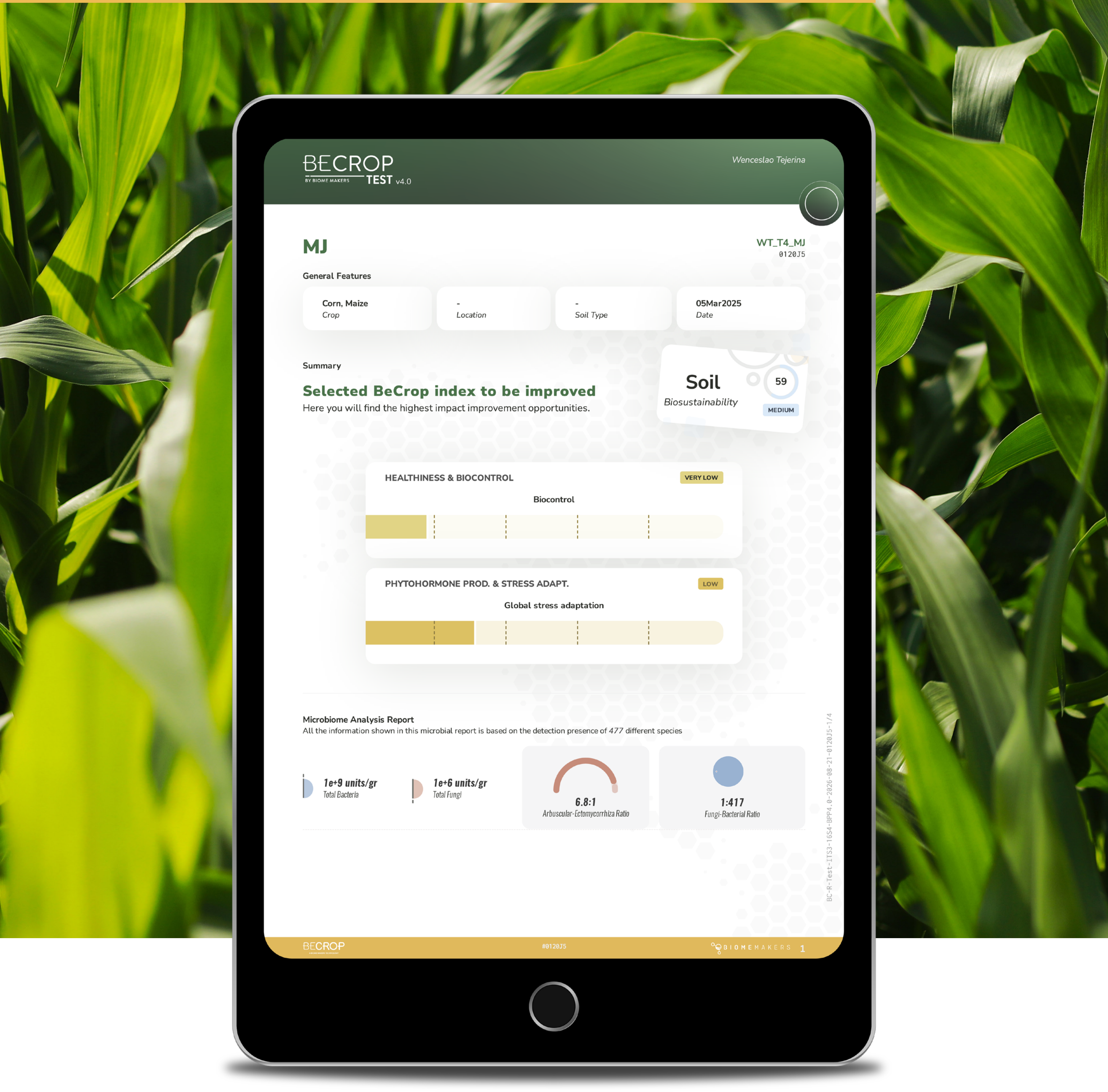
BeCrop Test 4.0
Guide



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Introduction

Welcome to the BeCrop Test 4.0 Report Guide! This is Biome Makers' most advanced soil microbiome assessment. Moving beyond conventional chemical and physical soil analyses, the BeCrop Test uses advanced DNA sequencing technology to profile the microbial communities (bacteria and fungi) within your soil. This approach identifies not only the specific microbial populations present but also their functional pathways and ecological roles.

The report translates complex biological data into actionable agronomic insights across three major areas of soil biological performance:

Biosustainability: Provides comprehensive indices for global biosustainability, nutritional balance, and carbon cycling, offering a holistic view of the field's ecological health.

Health: Evaluates crop health through the balance between disease risks, beneficial biocontrol organisms, microbial phytohormone production potential, and stress adaptation potential.

Nutrition: Quantifies the microbial mobilization and cycling of macronutrients (carbon, nitrogen, phosphorus, and potassium) and essential micronutrients. This section indicates whether the soil biology is facilitating or limiting plant nutrient availability.

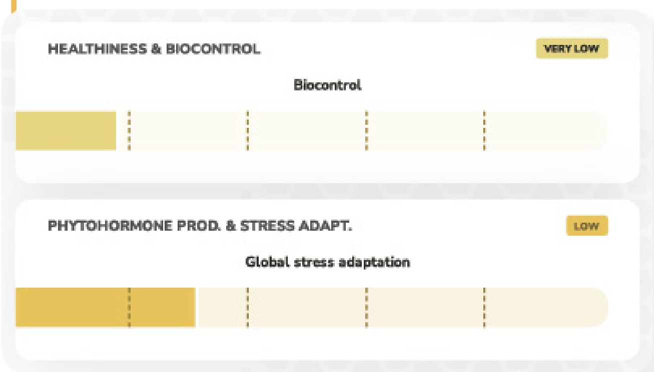
BeCrop Test Report Highlights

1 Soil Biosustainability:

An indicator of overall soil biological status based on microbial biodiversity, functionality, and ecological network properties.

2 Selected Indexes to be Improved:

Highlights the biological indices with the greatest opportunity for improvement based on the soil microbiome analysis. These indices may be supported through targeted management practices or biological solutions.



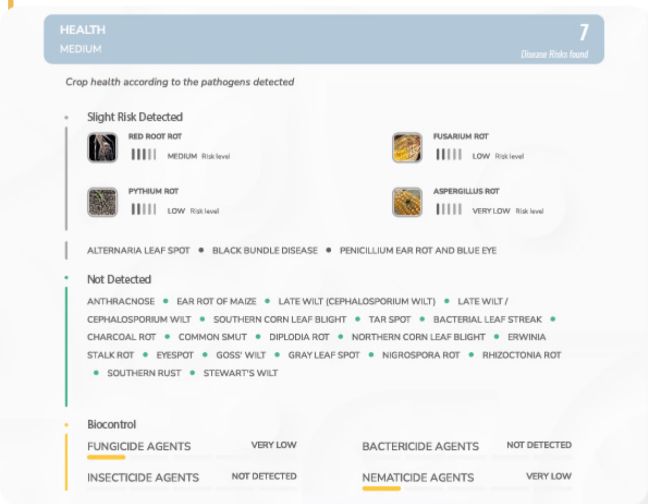
3 Quantification of species:

This section provides descriptive information about the abundance of bacterial and fungal DNA detected in the sample. These values help characterize the biological composition of the soil but are not agronomic indicators and should not be interpreted as positive or negative on their own.

BeCrop Test Report Highlights

4 Healthiness & Biocontrol:

Evaluates crop health according to detected pathogens and the presence of beneficial biocontrol organisms that can help suppress pests and pathogens.

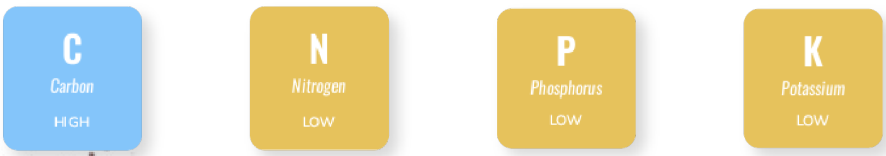


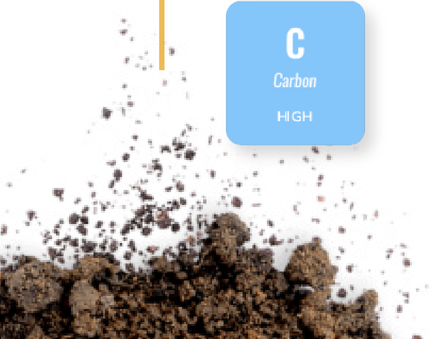
5 Phytohormone Production & Stress Adaptation:

Evaluates microbial functions associated with phytohormone production and mechanisms that help plants withstand stress conditions.

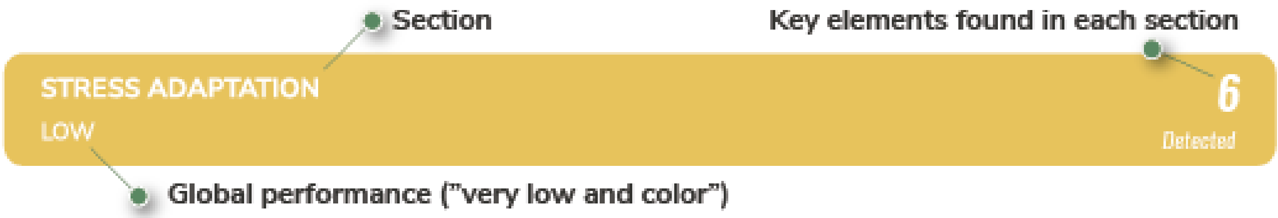
6 Nutrition:

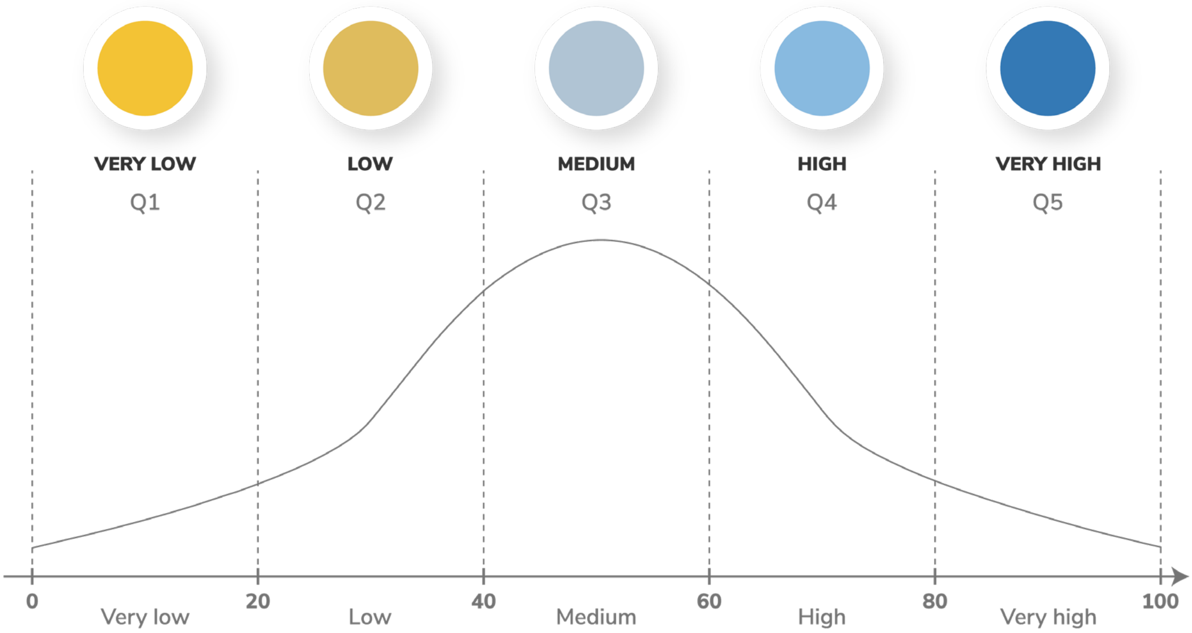
Evaluates the microbial genetic potential to mobilize nutrients, improve nutrient availability for plants, and contribute to carbon cycling within the soil.





BeCrop Test Report Highlights





Each score is benchmarked against Biome Makers' crop-specific soil microbiome database. Based on where your sample falls within the distribution of results for similar crops, it is assigned a ranking from Very Low to Very High. These rankings help identify biological strengths and areas with potential for improvement relative to comparable agricultural systems.

Agricultural systems managed using more conventional practices are typically associated with lower score ranges, while systems incorporating biological, organic, or regenerative management practices tend to achieve intermediate to higher scores. The highest scores are generally associated with management approaches that promote greater soil biological functionality and ecological balance.

In general, higher scores indicate a healthier and more biologically functional soil ecosystem.

Insights

Soil Biosustainability

This metric provides a single score representing overall soil biological status. It is based on microbial biodiversity, functionality, and network properties (microbial ecology). This index is benchmarked to assess changes in agricultural management practices on overall soil biological status, with lower scores indicative of intensive management, and higher scores indicative of regenerative management.

What is it?

Biosustainability provides a metric based on soil microbiome properties like the microbial community network, taxonomic biodiversity, and predicted functional diversity. Low values in the Biosustainability index are indicators of intensive practices that can degrade soil health, while high indexes are linked to regenerative practices, such as cover crops, conservation tillage, organic amendments, and biological/biostimulant products. Soils with a high Biosustainability rating tend to be less specialized and more versatile and cooperative, similar to a natural forest system, while lower Biosustainability values represent a highly specialized microbiome with more niche partitioning and negative interactions between microbes driven by the selective influence of human and environmental selection.

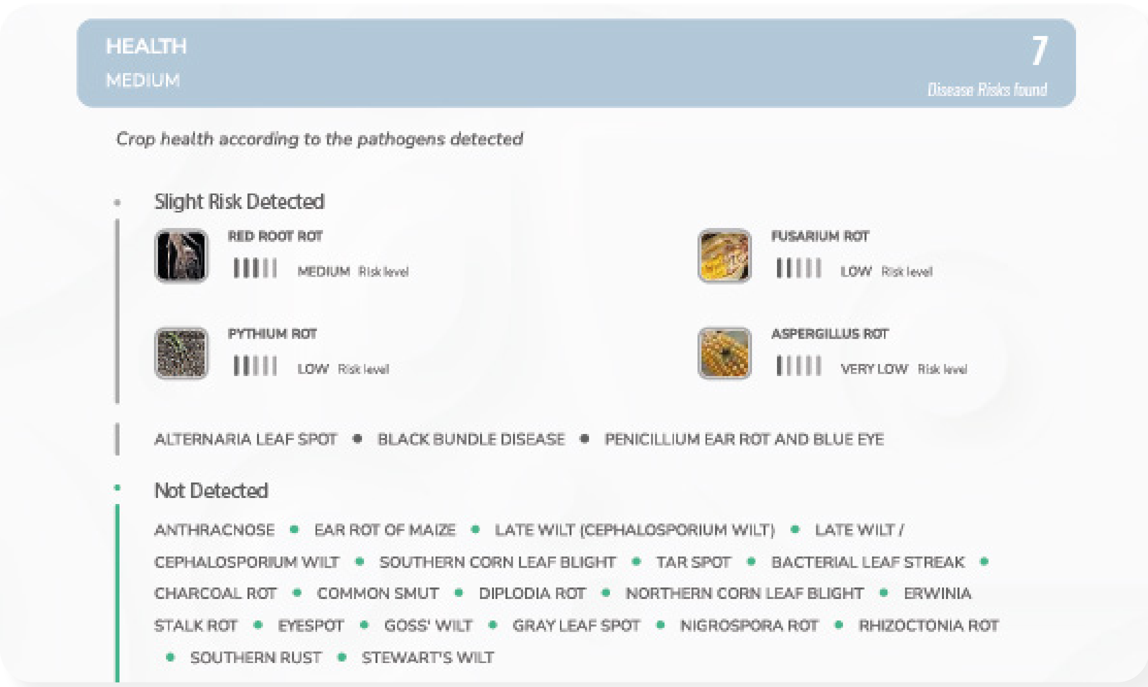
Insights

Healthiness & Biocontrol

Healthiness

Healthiness evaluates crop health according to the detected pathogens. It is calculated using epidemiological information based on a compilation of data gathered from other samples, and the vulnerability of the microbial ecosystem is analyzed. It is established depending on the risks of the progression of detected diseases. The Healthiness score reads like every other BeCrop index: higher is better. A Very High score (Q5) means no major disease was detected at a relevant risk level. A Very Low score (Q1) means one or more major diseases were detected with a strong presence. The score is driven by major diseases; minor diseases are listed for awareness.

The risk level is calculated based on the pathogen load, as well as the ecology (biocontrol levels) of the sample. High or very high risk levels indicate a high probability that the disease **could develop in the future or may already be developing**. Low or very low risks do not need immediate action, though they require attention. **Therefore, the analysis can support both disease prevention and the diagnosis of complex disease sources and their associated pathogens.** Unlike other metrics in our report that represent an average value, the risk level represents the highest level detected in the sample.



Three primary factors drive plant disease development and are commonly referred to as the “disease triangle”: Plant phenology, weather conditions, and presence/dominance of the pathogen, which is the factor measured here. A high risk does not mean that you are going to develop the disease, but does indicate that you should be aware that one of the three disease triangle factors favors disease development.

Insights

Major Diseases

Major diseases are those that can cause a high impact on the yield, either causing high damage to the fruits or significantly decreasing the quality or quantity, or affecting plant health to the point that the plant may need to be removed or sacrificed. The farmer should take these risks into consideration immediately.

Major diseases are always presented at the top as they are more important than minor diseases. They include a photo of the impact or damage they trigger. The higher the level of risk detected, the larger they are displayed.

Minor Diseases

Minor diseases are those that may slightly downgrade productivity or the appearance of the fruit or plant, without representing a real impact on the farmer. However, they could be the cause of something worse in the long term or, combined with other major diseases, can accelerate undesired effects, so they should not be ignored.

Minor diseases are listed below the major diseases and do not present a level of risk, only detection.

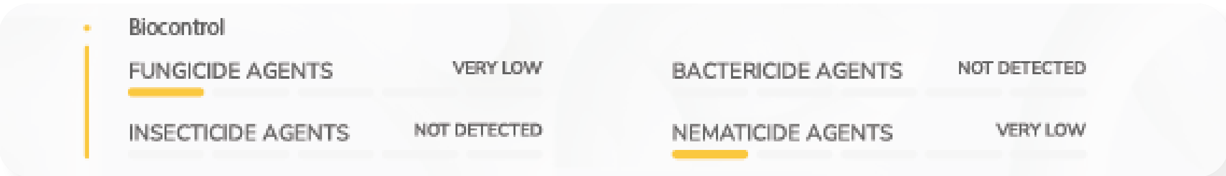
Insights

Healthiness & Biocontrol

Biocontrol

Microbial species are grouped here according to the type of pest or pathogen they can suppress. The four considered groups are fungicides, bactericides, insecticides, and nematicides. These values do not indicate presence of residues in the soil, but of naturally-occurring organisms that help suppress pests or pathogens.

Biocontrol agents could be predatory, parasitoids of pathogens species, or competing for the same ecological niche with them. Based on their level detected, the presence of biocontrol agents indicates potential for natural control of pests and pathogens by beneficial soil microbes. So soils with high-very high values in these biocontrol indexes may not need to rely on heavy applications of plant protection products to control pest or pathogen impacts.



Insights

Phytohormone Production & Stress Adaptation

Phytohormone Production

Hormone producers: microbial species grouped according to their potential to produce phytohormones. Phytohormones are organic compounds synthesized not only by plants, but also by soil microorganisms as part of their interaction with the plant and surrounding ecosystem.

The Phytohormone Production metric evaluates the microbiome's potential to synthesize plant growth-promoting phytohormones. These compounds, even at low concentrations, can influence plant development, root growth, nutrient uptake, and overall crop performance.

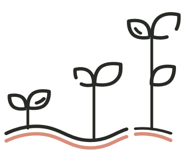
We evaluate three main groups of phytohormone-related microbial functions in the report: **Auxins (IAA), Cytokinins (CK), and Gibberellins (GA)**. When interpreting these results, it is important to consider the crop's phenological stage, as the relevance of each hormone varies throughout plant development. A low value is not necessarily detrimental and should always be interpreted within the agronomic context of the crop.

PHYTOHORMONE PRODUCTION
HIGH
3
Detected

AUXIN PRODUCTION (IAA)
Responsible for cell division and elongation.

GIBBERELLIN PRODUCTION (GA)
Responsible for elongation, germination, and flowering.

CYTOKININ PRODUCTION (CK)
Responsible for cell proliferation and cell differentiation.



Stress management mechanisms play important roles in plant growth as they improve the general health status and development of plants. The presence of microorganisms with the ability to produce these stress adaptive substances will improve plant development and crop yield.

Insights

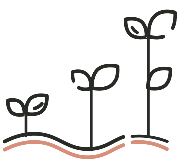
Phytohormone Production & Stress Adaptation

Stress Adaptation:

Adaptation to stress conditions: Microbial species grouped according to their ability to produce metabolites that help plants withstand stress conditions. The seven considered mechanisms are ACC (1-aminocyclopropane-1-carboxylate) deaminase production, exopolysaccharide production, heavy metal resistance, salt tolerance, siderophore production, salicylic acid, and abscisic acid.

STRESS ADAPTATION
MEDIUM

Metabolite	Functions		
Exopolysaccharide production	*Nutrient Trap*	*Salinity Protect*	*Drought Protect*
ACC deaminase (ACC-D)	*Pathogen Protect*	*Salinity Protect*	*Drought Protect*
Heavy Metal Resistance	*Bioremediation*	*Detoxification*	*Alleviate Heavy Metal Stress*
Salicylic Acid (SA)	*Drought Protect*	*Salinity Protect*	*Alleviate Heavy Metal Stress*
Salt Tolerance	*Salinity Protect*	*Root Growth Promotion*	
Abscisic Acid (ABA)	*Growth Regulation*	*Plant Resistance*	*Increase Yields*
Siderophore Production	*Iron Availability*	*Biofertilizer*	



Stress management mechanisms play important roles in plant growth as they improve the general health status and development of plants. The presence of microorganisms with the ability to produce these stress adaptive substances will improve plant development and crop yield.

Nutrition

The Nutrition section evaluates the soil microbiome's contribution to nutrient availability through the mobilization, transformation, cycling, and transport of essential compounds within the soil ecosystem.

Nutritional status is based on the microbial mobilization of certain compounds. Rather than measuring nutrient concentrations directly, these metrics assess the biological functions that influence nutrient availability and nutrient-use efficiency.

The report groups these functions into three categories:

- **Carbon Pathways:** Microbial functions involved in organic matter transformation, carbon turnover, carbon fixation, and other carbon-related processes within the soil ecosystem.
- **Major Nutrients:** Nitrogen, Phosphorus, and Potassium.
- **Minor Nutrients:** Functions associated with the cycling and transport of secondary nutrients and micronutrients required for crop development.

Carbon Pathways

Carbon is the basis of biological soil fertility. It is the main compound in organic matter and an essential source of food for beneficial soil microbes. The presence of organic carbon improves soil health and fertility, increasing crop yields and reducing soil degradation.
A low value indicates potential for carbon loss from the soil, while high values indicate potential for carbon sequestration.

Gain

CARBON FIXATION

The conversion process of inorganic carbon to organic compounds by living microorganisms.

ORGANIC COMPOUNDS DEGRADATION

The process in which soil microorganisms decompose vegetal debris, releasing diverse mineral nutrients. It is related to soil humification.

Loss

AEROBIC RESPIRATION

The process in which microbes use organic compounds in oxygenated conditions, releasing CO_2

FERMENTATION

The process in which cells gain energy from organic compounds in non-oxygenated conditions, releasing CO_2

METHANOGENESIS

The formation of methane (CH_4) by microbes, contributing to the degradation of organic matter. Typically in anoxic conditions.

Major Nutrients

The Major Nutrients section evaluates microbial functions associated with the cycling of nitrogen, phosphorus, and potassium within the soil ecosystem.

These metrics do not measure nutrient concentrations directly. Instead, they assess the biological processes performed by soil microorganisms that influence how nutrients move through the soil ecosystem and become available to plants.

Nutrition

Major Nutrients

Nitrogen Pathways

N

Nitrogen

VERY HIGH

Nitrogen is a major component of plant DNA, proteins, and chlorophyll, playing a fundamental role in crop yield. The mineralization of organic to inorganic nitrogen, fixation of atmospheric nitrogen, and process of nitrification by microorganisms supplies N in readily available forms (nitrate and ammonia) for plants.

LOW values indicate low nitrogen mobilization potential by microbes.

Gain

NITROGEN FROM GAS

Nitrogen fixation, or the microbial transformation of atmospheric nitrogen into forms that plants and soil microbes can use.

NITROGEN TO AMMONIA

Nitrogen mineralization, or the microbial transformation of organic nitrogen into inorganic forms (ammonia).

NITROGEN TO NITRATE

Nitrification, or the microbial conversion of intermediate nitrogen forms to nitrate that plants can use.

Loss

NITROGEN TO GAS

Denitrification, or the microbial conversion of nitrate into nitrogen gas that is lost to the atmosphere.

UREA BY VOLATILIZATION

Nitrogen volatilization, or the microbial conversion of urea to nitrogen gas that is lost to the atmosphere.

NITROGEN TO BIOMASS

Immobilization, or the microbial conversion of inorganic nitrogen compounds to organic forms in microbial biomass.

Nutrition

Major Nutrients

Phosphorus Pathways

Phosphorus is a fundamental nutrient required in the regulation of protein synthesis and plant growth. It enhances the development of roots, while its deficiency leads to stunted growth, dark purple color of leaves, and inhibition of flowering. Low values indicate that the microbial processes that make phosphorus available for plants are low.

Nutrient Supply

INORGANIC PHOSPHORUS SOLUBILIZATION

Certain soil microorganisms are capable of dissolving insoluble phosphorus from minerals and rocks. They convert insoluble phosphorus in the soil into a form that plants can access, improving their growth and yield. Major portions of conventional phosphorus fertilizers applied to fields end up locked in this insoluble form, so higher levels of phosphorus solubilizing microbes can improve phosphorus fertilizer use efficiency.

Nutrient Competition

INORGANIC PHOSPHORUS CONSUMPTION

Both plants and microbes require phosphorus to support their metabolic functions. High values indicate high competition/immobilization of phosphorus by soil microbes.

Nutrition

Major Nutrients

Potassium Pathways

Potassium is a regulator of metabolic activities, especially those involved in producing proteins and sugars and regulating crop evapotranspiration. When bioavailable potassium is deficient it causes leaf curl and sensitivity to droughts.

LOW values indicate that the microbial processes that make potassium available for plants are low.

Nutrient Supply

POTASSIUM EXPORT

Certain soil microorganisms export potassium ions from inside their cells to the surrounding environment, making them more available for plant uptake, improving their growth and yields.

Nutrient Competition

POTASSIUM CONSUMPTION

Both plants and microbes require potassium for their functioning. High values indicate a high potential for microbes to compete with the plant by assimilating this nutrient.

Nutrition

Minor Nutrients

Elements with less influence on the crop's nutritional status yet still serve important roles in plant growth and development.

IRON (Iron Mobilization)

Iron is abundant in most soils but is often present in forms that are not readily available to plants. This metric evaluates microbial functions associated with iron mobilization and assimilation. Medium to high values indicate a sufficient microbial potential to support iron availability.

CALCIUM (Calcium Transport)

Calcium plays an important role in nutrient assimilation, soil structure, and plant development. This metric evaluates microbial functions associated with calcium transport. Higher values indicate a greater microbial potential to support calcium movement and soil stability.

ZINC (Zinc Transport Equilibrium)

Zinc is an essential micronutrient involved in enzyme activity, protein synthesis, and hormone production. This metric evaluates microbial functions associated with zinc transport and balance. Medium to high values indicate a sufficient microbial potential to support zinc availability.

COPPER (Copper Export)

Copper is an essential micronutrient involved in plant metabolism and enzyme activity. This metric evaluates microbial functions associated with copper transport and export. Very high values may indicate conditions associated with excess copper in the soil.

MANGANESE (Manganese Transport Equilibrium)

Manganese plays important roles in photosynthesis, respiration, and nitrogen metabolism. This metric evaluates microbial functions related to manganese transport and balance within the soil ecosystem. Medium values are generally considered optimal.

MAGNESIUM (Magnesium Transport)

Magnesium is a key component of chlorophyll and is essential for photosynthesis and nutrient transport. This metric evaluates microbial functions associated with magnesium transport and availability. Higher values are generally favorable.

SULFUR (Sulfur Cycle Equilibrium)

Sulfur is required for protein synthesis and plant metabolism. This metric evaluates microbial functions involved in sulfur cycling and transformation. Medium to high values indicate a balanced sulfur cycle.

CHLORINE (Chlorine Transport)

Chlorine contributes to several physiological processes, including water regulation and stress tolerance. This metric evaluates microbial functions related to chlorine transport. Medium to high values generally indicate balanced microbial activity.

Annex
Physicochemical Analysis

Introduction

The physicochemical section complements the biological information provided by BeCrop by incorporating laboratory measurements generated by a third-party soil analysis laboratory.

The specific parameters included in this section may vary depending on the laboratory, methodology, and analytical package selected for the project. As a result, the metrics displayed in your report may differ from the examples shown in this guide.

Depending on the laboratory and analytical package selected, the physicochemical section may include measurements such as soil organic matter, organic carbon, pH, nutrient concentrations, cation exchange capacity (CEC), electrical conductivity, soil texture, and other laboratory-specific parameters.

For interpretation of individual physicochemical parameters, please refer to the methodology and reference ranges provided by the analytical laboratory.

Annex
How BeCrop Works

When a soil sample is submitted to Biome Makers, the soil microbiome is analyzed using advanced DNA sequencing technology. This process identifies the bacteria and fungi present in the soil and evaluates the biological functions they perform within the soil ecosystem.

The resulting data is processed through Biome Makers' proprietary analytical platform to generate a comprehensive biological assessment of the soil. The report provides insights into key areas such as nutrient cycling, crop health, stress adaptation, and overall biological performance.

All identified microorganisms and their relative abundances can be explored in greater detail through the BeCrop online platform.

To provide meaningful context, each indicator and metric is benchmarked against Biome Makers' crop-specific soil microbiome database. This allows results to be compared with similar production systems and helps identify biological strengths, limitations, and opportunities for improvement.

BECROP

A BIOME MAKERS TECHNOLOGY

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