RainBox

by AgriWater

Effect of RainBox on Soil Life in Mint Fields

SOILCRAFT

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Crop: Mint

Area: USA, Washington

Irrigation type: Pivot

Analysis: BeCrop Test (Biological Soil Test)

Collaborations:

This trial is being conducted in collaboration with SoilCraft to assess the impact of RainBox on soil biology in mint fields.

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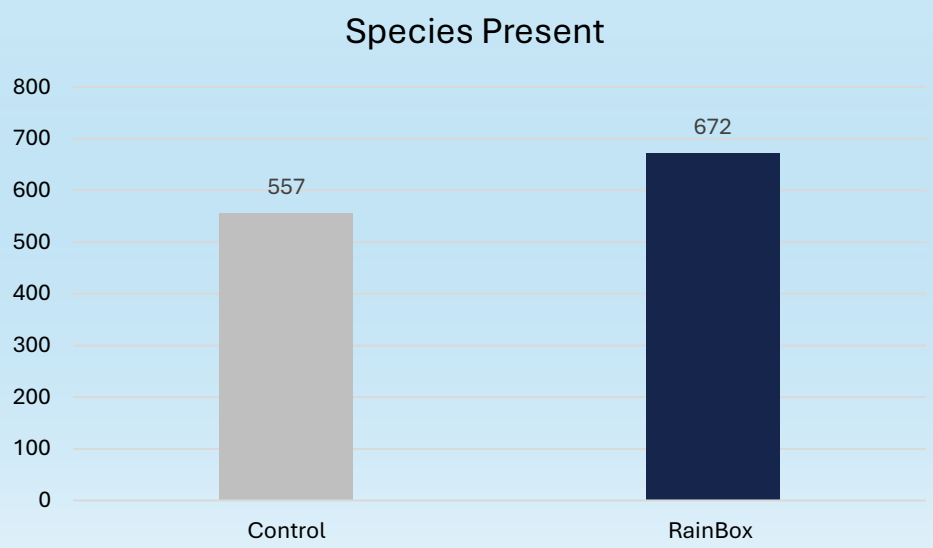
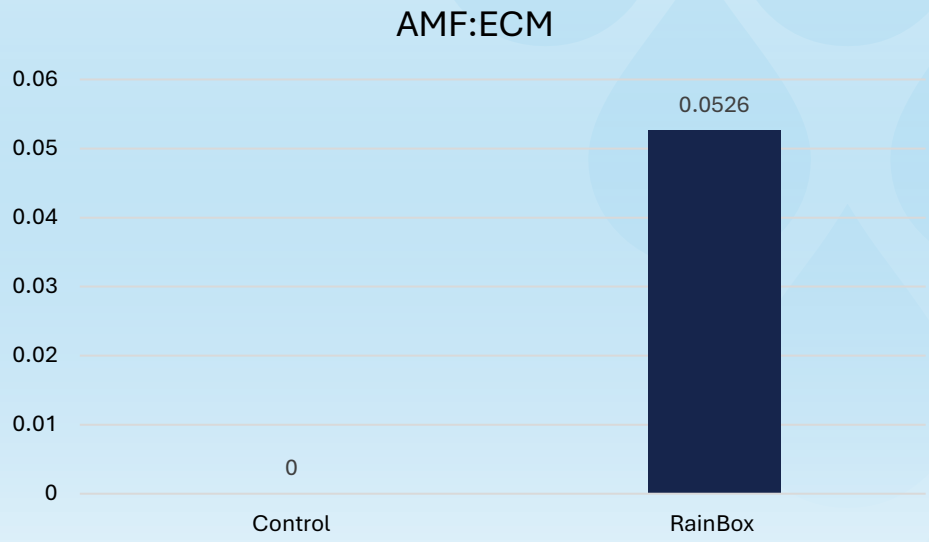
Photos of the control and RainBox treated mint fields

Control

RainBox

Population insight





Overall, the RainBox treatment resulted in a higher number of microbial species compared to the control, indicating enhanced soil biodiversity and a richer microbial ecosystem under RainBox irrigation.

Additionally, the composition of fungal species shifted in a direction more favorable to crops. Notably, **arbuscular mycorrhizal fungi (AMF) (**which are beneficial for most agricultural systems) began to emerge in the RainBox-treated soil. This is important because AMF extend the root network of crops, improving nutrient and water uptake. In contrast, **ectomycorrhizal fungi**, which are more suited to forestry species, remained absent. This shift confirms that the RainBox system not only increases microbial richness but also encourages the development of microbial communities.

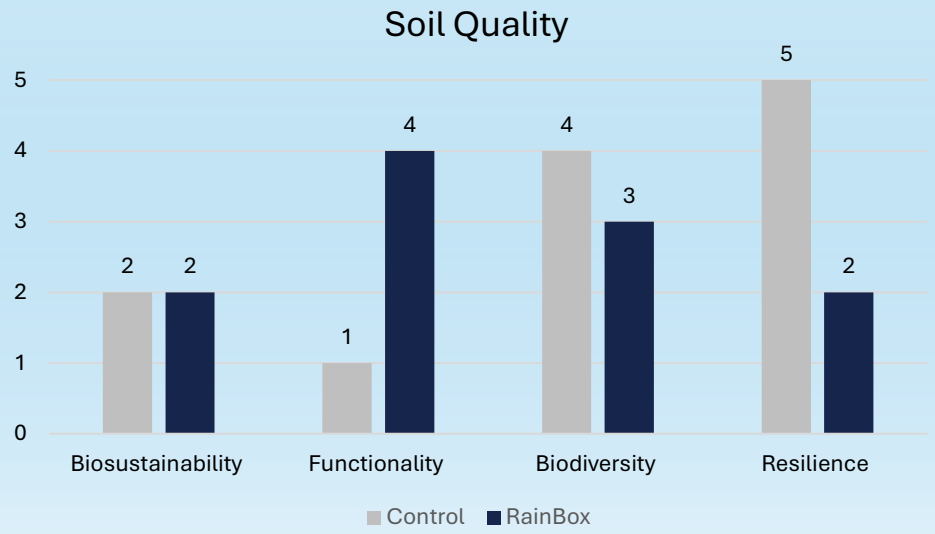
Population Distribution

Fungal Phylum:	Control	RainBox
Ascomycota	33%	**44%**
Mortierellomycota	56%	**29%**

Research has shown that continuous cropping often leads to a decline in the relative abundance of **Ascomycota fungi**, while the abundance of **Mortierellomycota** tends to increase under such conditions.
In this trial, both sections of the field were managed identically in terms of cropping intensity and agronomic practices, except for the RainBox treatment applied to the irrigation water in the treated section.
The impact of RainBox on promoting healthier soil biology is evident when comparing the relative abundances of these fungal groups. In the RainBox-treated section, **Ascomycota abundance is significantly higher** than in the control, while **Mortierellomycota is considerably lower**.

In contrast, the control section, without RainBox treatment, shows a marked increase in Mortierellomycota, indicating a microbial shift typically associated with soil stress or degradation. This highlights the **positive influence of RainBox-treated water on maintaining a more balanced and crop-beneficial soil fungal community**.

Soil Quality



A significant improvement in microbial functionality is observed in the RainBox-treated soil compared to the control.

This indicates that the soil ecosystem is transitioning toward healthier, more productive microbial communities, fostering stronger relationships between microbes and crop roots.
During this transformation phase, it is normal to observe lower resilience scores, as the environment is still adapting and has not yet stabilized.

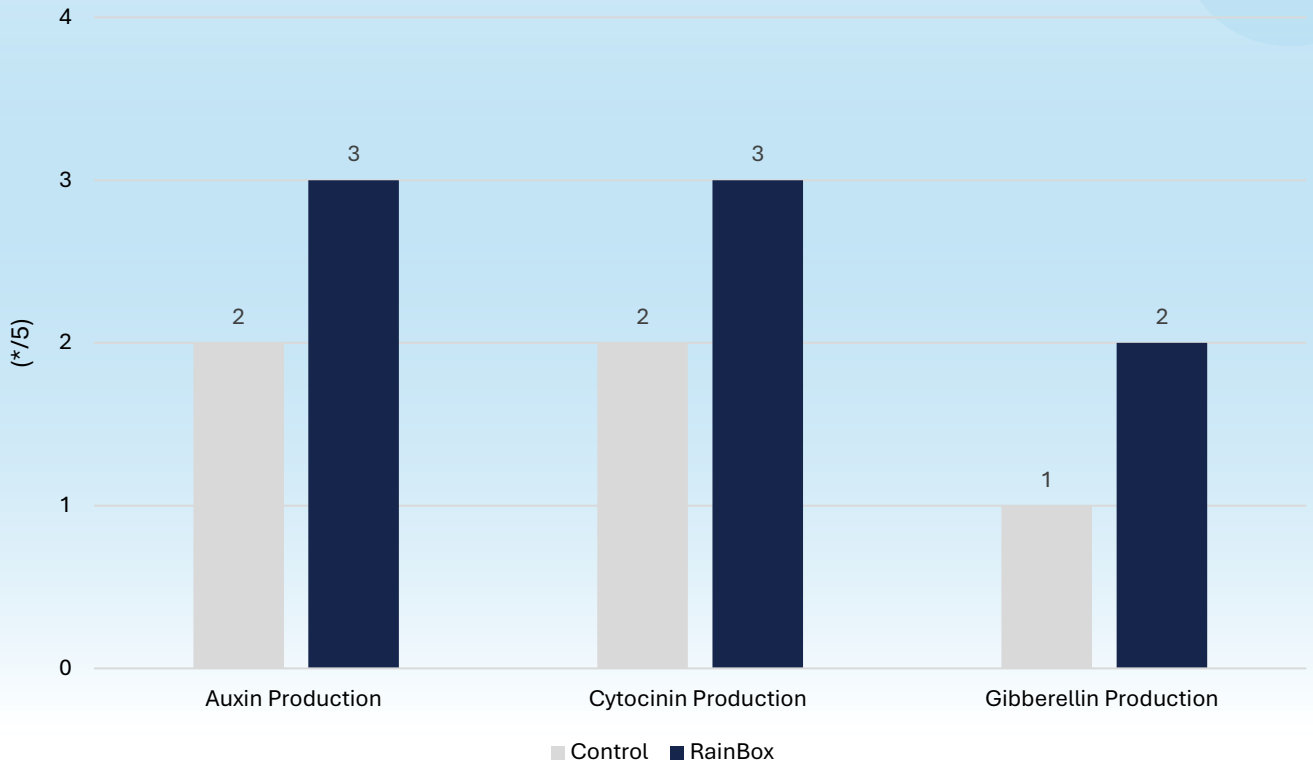
Importantly, the RainBox treatment actively supports this shift, enhancing population structure and offering external reinforcement for long-term soil resilience and health.

Soil Health

	Control	RainBox
Verticillium Wilt	0.03	0
- Risk level (*/5)	5	0
- Related microorganism	Verticillium dahliae	NA

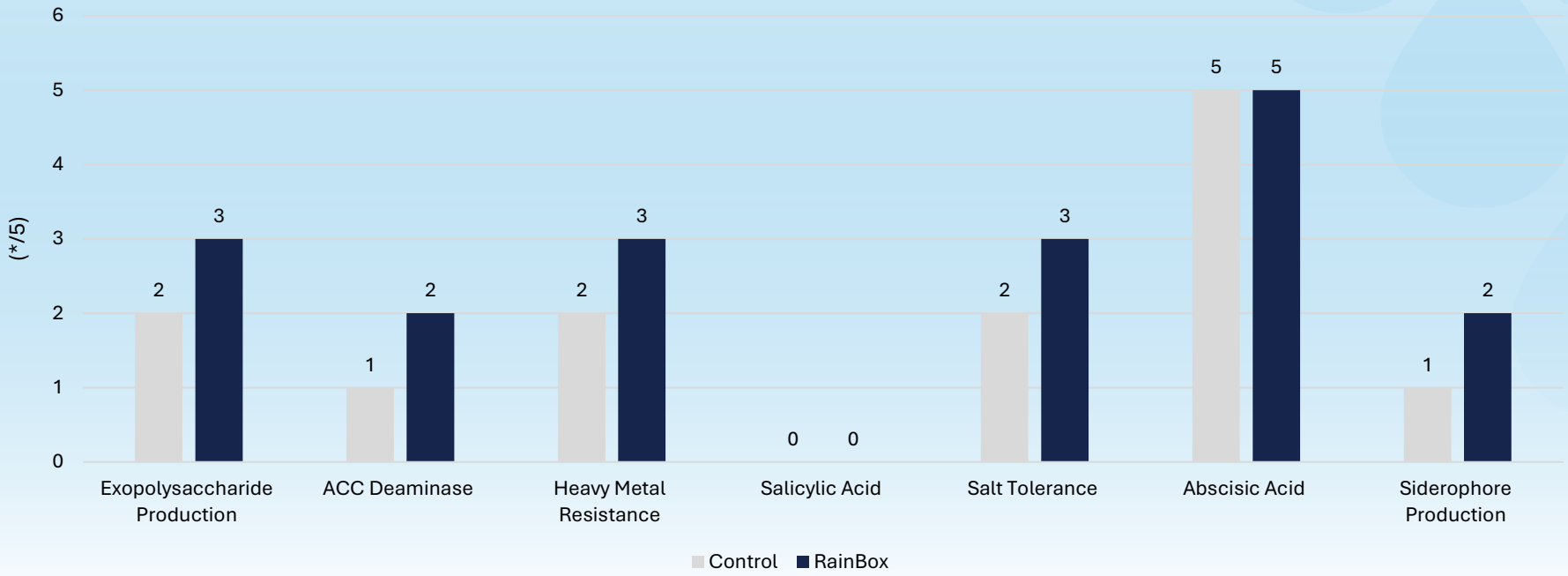
Both *Fusarium solani* and *Verticillium dahliae* are fungal species belonging to the Ascomycota phylum.
Under RainBox treatment, the higher relative abundance and greater microbial species richness result in a more competitive soil environment, where beneficial microbes help outcompete these pathogens. This competition supports plant health by reducing infection risk and limiting pathogen population growth.
The favorable aerobic conditions, along with other soil and crop health benefits promoted by RainBox, have completely suppressed any detectable presence of *V. dahliae* in the treated section.
Additionally, the enhanced stress resistance observed in both soil and crop under RainBox treatment, evident from the hormone production and stress adaptation data, further contributes to infection resilience.
It is well known that both *Fusarium* and *Verticillium* species become more aggressive in stressed plants, especially under water stress. RainBox treatment's impact on improving water infiltration, distribution, and retention plays a key role in supporting more resilient, stress-tolerant crops.

Microbial Hormone Production



With more abundant and diverse microbes capable of forming successful associations with crops under RainBox treatment, a broader foundation for microbial hormone production is established.
This enhances the availability of growth-promoting regulators, signaling molecules, and hormones produced by the soil microbiome, providing crops under RainBox irrigation with improved physiological support.
As a result, rhizosphere synergies are strengthened, leading to enhanced crop performance compared to the control.

Microbial Stress Adaptation



Stress resistance is a key benefit of RainBox-treated irrigation, resulting from both the direct effects of the water treatment and the enhanced resilience provided by a more abundant and diverse community of beneficial microbes active in the soil and interacting with the crop.

Microbial stress adaptation analysis shows consistent improvements across multiple stress response and relief factors in the RainBox-treated section compared to the control.

Microbial Nutrient Mobilization

Carbon Indicator	Control	RainBox
Overall Carbon Score	2	4
Carbon Fixation *(gain)*	5	5
Aerobic Respiration *(loss)*	5	4
Fermentation *(loss)*	1	1
Methanogenesis *(loss)*	3	4
Organic Matter Release *(indirect benefit)*	1	3

The ability of soil microbes to fix and utilize carbon, contributing to active carbon buildup in the soil, is shown to be significantly improved in the RainBox-treated section compared to the control.

When this enhanced microbial function is combined with the enriched irrigation water provided by RainBox, containing both oxygen and carbon dioxide, the overall benefit to soil and crop health is further amplified.
These more productive microbes are supported throughout the entire soil profile, enabling them to carry out complete and healthy carbon cycling, which in turn improves soil structure, fertility, and long-term productivity.

Microbial Nutrient Mobilization

Nitrogen Indicator	Control	RainBox
Nitrogen Cycle (indirect benefit)	1	4

The growth of a more abundant and diverse microbial population in the RainBox-treated section leads to increased nitrogen consumption. However, because this microbial community is also more crop-connected and functionally diverse, the nutrient provisioning by soil microbes becomes more closely aligned with the needs of the crop and surrounding environment.

This benefit is reflected in the improved efficiency of the nitrogen cycle observed in the RainBox-treated section compared to the control.
Additionally, this enhanced microbial function is further supported by the atmospheric nitrogen gas introduced into the soil through RainBox-treated irrigation, contributing to overall nitrogen cycling and availability

Microbial Nutrient Mobilization

Phosphorus Indicator	Control	RainBox
Phosphorus Score (Overall)	1	2
Inorganic P Solubilization *(supply)*	2	2
Inorganic P Consumption *(competition)*	5	4
Organic P Assimilation *(indirect benefit)*	2	3

Similar to carbon and nitrogen, the phosphorous cycle is also found to be more efficient in the RainBox treated section compared to the control. Microbial populations in the RainBox treated section are shown to have the better ability to actively enrich the soil environment with plant available P.

Conclusion: The Impact of RainBox on Soil & Crop Health

The RainBox irrigation treatment significantly improves soil health and microbial biodiversity in mint fields. It fosters beneficial microbial populations, enhances microbial hormone production, and suppresses harmful pathogens like *Verticillium dahliae*. Soil quality indicators such as biosustainability, stress resistance, and nutrient cycling (carbon, nitrogen, phosphorus) all show marked improvement in RainBox-treated areas, suggesting stronger, healthier, and more resilient crop systems.

RainBox transforms soil into a living, resilient, and productive ecosystem - laying the foundation for healthier crops and sustainable agriculture.