

CHALLENGING THE NARRATIVE REGARDING SOIL BIOLOGY

By Dr. Pieter Raath

📞 086 137 0290

🌐 www.labserve.net

STAY CONNECTED     

📍 NELSPRUIT

📍 STELLENBOSCH

📍 TZANEEN



LABSERVE[®]
LABORATORIES

“There is no life in your soils....”

“The fungi:bacteria ratio in your soils is out of balance; it needs to be corrected!”

“Years of fertilizer and chemical use have killed off the biology in your soils....”

 086 137 0290

 www.labserve.net

STAY CONNECTED      

 NELSPRUIT

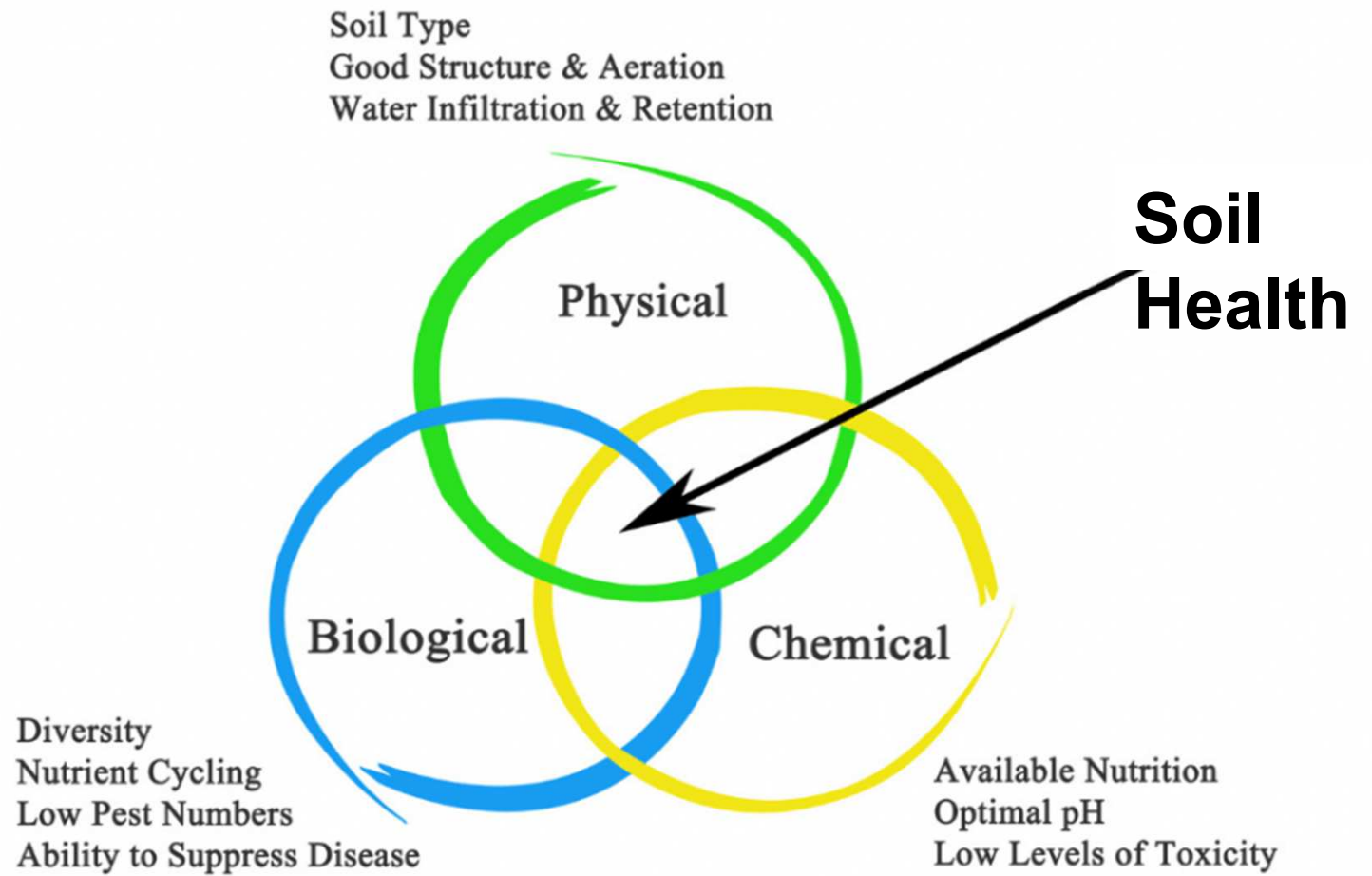
 STELLENBOSCH

 TZANEEN



LABSERVE[®]
LABORATORIES

Principle 1



Principle 2

We're not as smart as we make out....!!!

**Only about half of all the earthworm species
and**

1% of all bacterial species in the soil

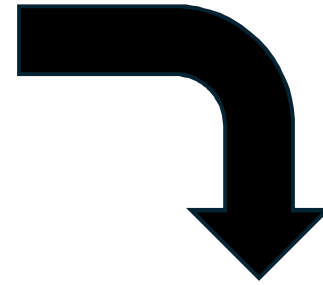
Principle 2

**We're not as smart as we make
out....!!!**

The Comrades = Soil Biological Knowledge



The Comrades = Soil Biological Knowledge



Principle 2

Only about half of all the earthworm species
and

1% of all bacterial species in the soil

**We're not as smart as we make
out....!!!**

**Relatively little is known about the
agricultural significance of
bacteria versus fungal dominated
soil microbial communities.**

Magdoff & van Es, 2021, Cornell and Maryland Universities

Principle 3

The principal source of food for most soil organisms is organic matter, so...

The principal source of food for most soil organisms is organic matter, so... soil life is concentrated in the topsoil

Principle 3

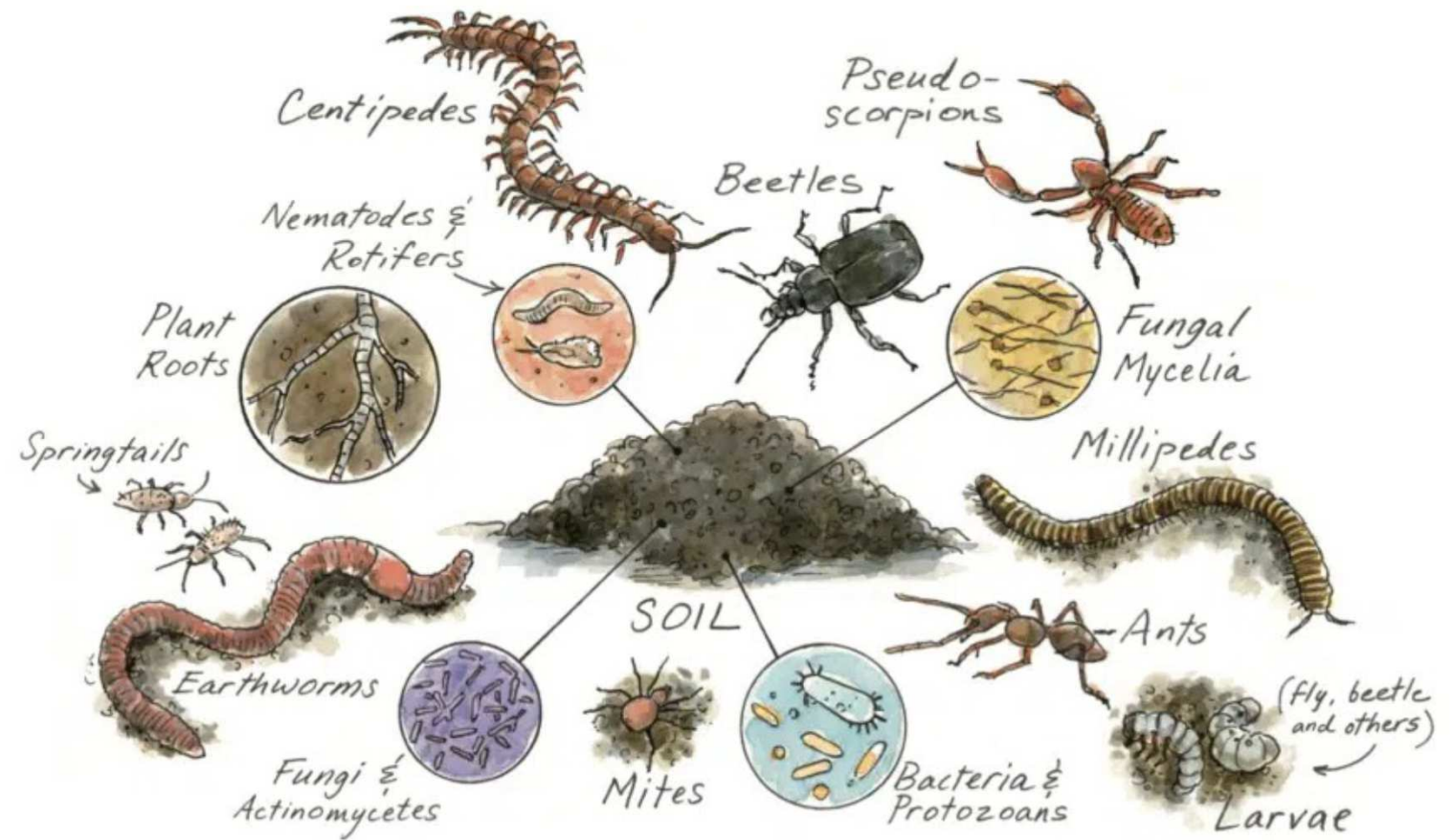


Principle 4

The major function of soil organisms is the decomposition of plant residues and their incorporation into the soil

The major function of soil organisms is the decomposition of plant residues and their incorporation into the soil

Principle 4



Principle 5

Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

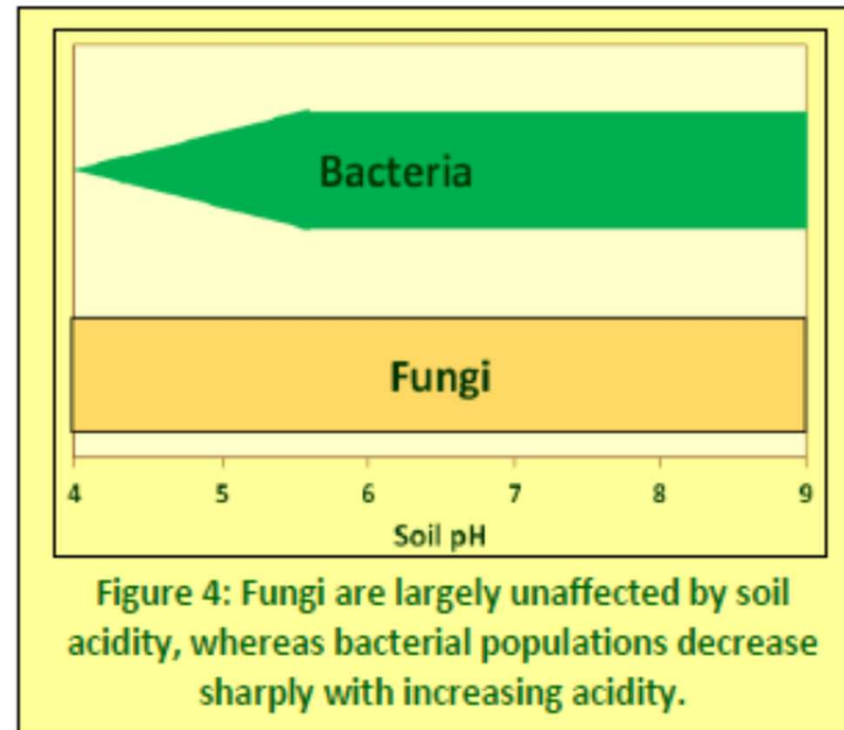
Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

Principle 5



Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

Principle 5



Principle 5

Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

Fertilizers serve to benefit the soil biology – if used at rates required for optimum crop growth

Principle 5

Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

Fertilizers serve to benefit the soil biology – if used at rates required for optimum crop growth

Principle 5

Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

Soil disturbance through tillage destroys the networks of fungal

Principle 5

Because certain scientific laws apply universally, we can deduce what the impact of agricultural management practices on general soil life

**Rotating crops/a diversity of species
is**

Principle 6

Get the **soil fertility** right
and the **soil biology** looks
after itself.

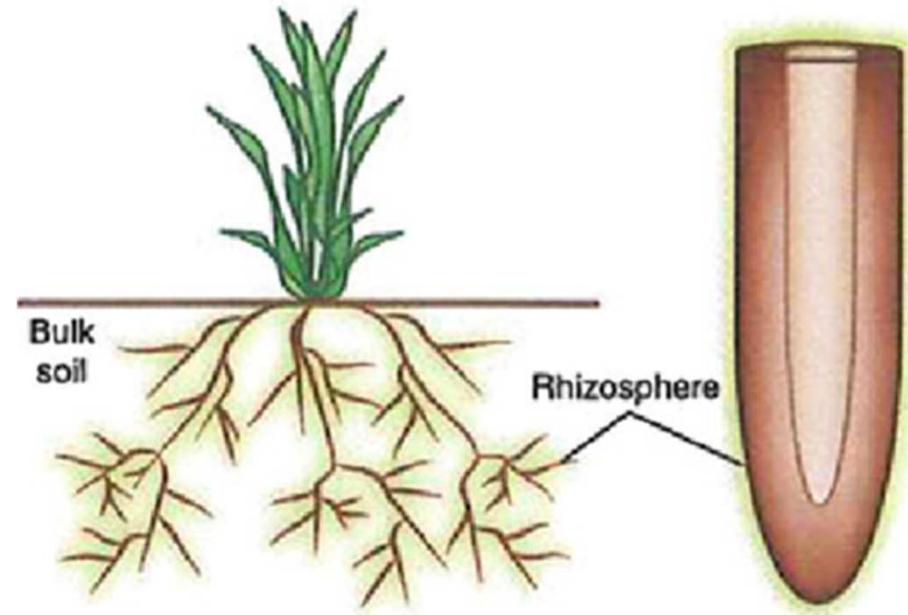
Dr Doug Edmeades, New Zealand

Principle 7

Understand the difference between the soil and the rhizosphere

Understand the difference between the soil and the rhizosphere

Principle 7

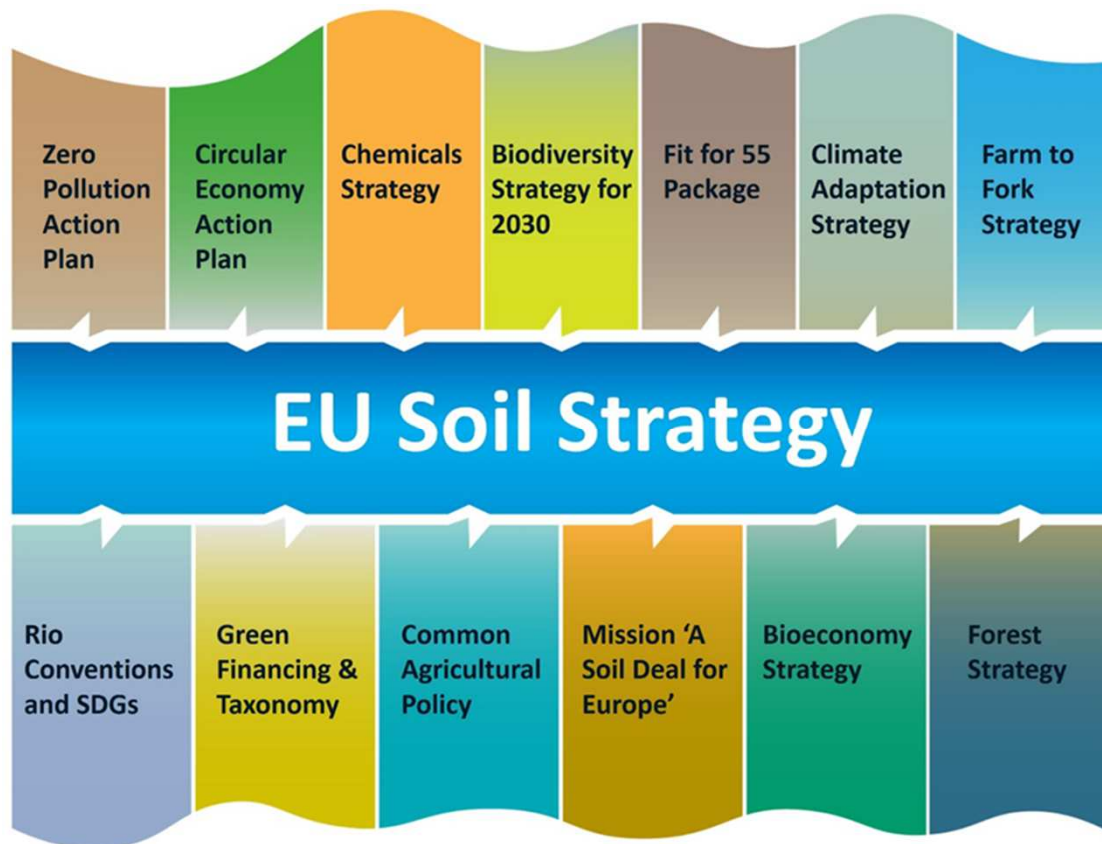


The diverse microbial ecosystem of the plant rhizosphere increases the disease resistance of plants via activation of dormant plant defense systems.

BREAKING NEWS

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

EU Soil Strategy for 2030



**VISION AND OBJECTIVES:
ACHIEVING GOOD SOIL
HEALTH BY 2050**





The rapporteur for the Soil Monitoring Law, Martin Hojsík, was visibly delighted following the vote in the European Parliament on 23 October 2025.

(Photo: Europa-Parlamentets Multimedia Centre.)

Member States must now:

- monitor soil health,
- assist landowners in improving it,
- avoid loss of healthy soil areas,
- and manage contaminated sites.



Phospholipid Fatty Acids (PLFA) analysis

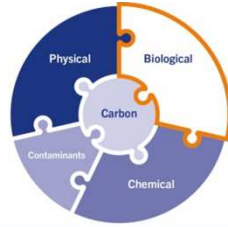
PLFAs are components of the cell membranes of bacteria and fungi.

The different microorganisms possess unique fatty acid chains in their membranes.

This method is used to establish:

- the presence of different bacteria, fungi and protozoa, and
- their relative quantities.





Food / Feed
IBL Testing
Street nr. 3
94002 Nove Zamky

Client code: T10000003
Batch code: EUAA38-00000630
Sample number: 202-2025-00000166

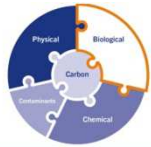
Soil layer: 0 - 25 cm

Sampling date: 12/02/2025
Date of receipt: 17/02/2025
Reporting date: 27/02/2026

	Result	Unit	low	rather low	average	rather high	high
Microbial biomass	17	mg PLFA/kg					
Total Bacteria	13	mg PLFA/kg					
Gram positive	4.3	mg PLFA/kg					
Actinomycetes	1.2	mg PLFA/kg					
Gram negative	8.6	mg PLFA/kg					
Total Fungi	1.5	mg PLFA/kg					
Saprophytes	0.7	mg PLFA/kg					
Mycorrhiza	0.8	mg PLFA/kg					
Protozoa	0.10	mg PLFA/kg					



	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-					
Carbon in microbial biomass	290	mg C/kg					
Carbon in bacterial biomass	120	mg C/kg					
Carbon in fungal biomass	120	mg C/kg					
Fungi/bacteria ratio	1.0	-					
Gram(+)/Gram(-) ratio	0.5	-					
Acidity (pH)	7.3	-					
Soil organic matter (SOM)		%					
Clay	27	%					

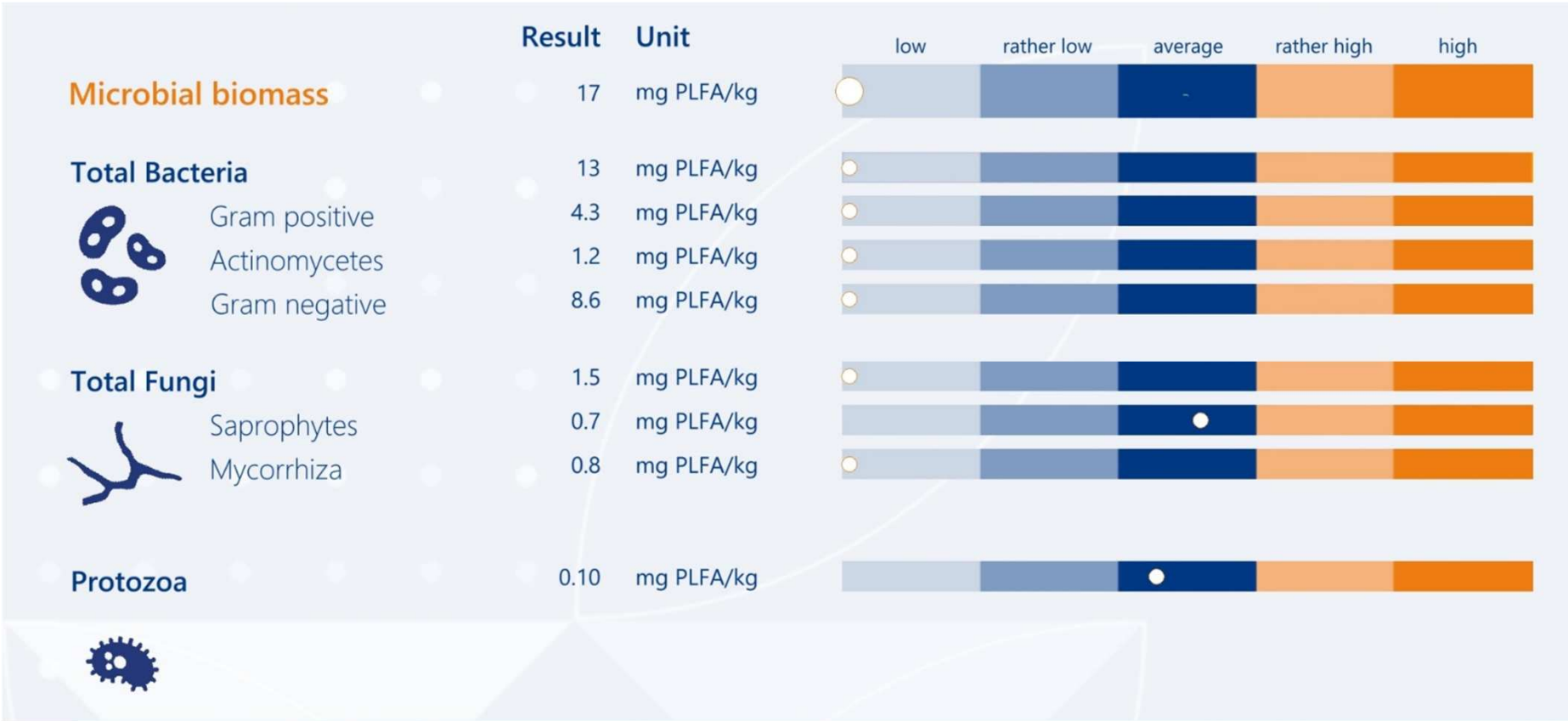


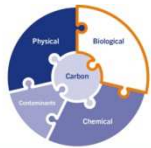
Food / Feed
IBL Testing
Sheet nr: 3
94002 Nove Zamky

Client code: T10000003 Soil layer: 0 - 25 cm Sampling date: 12/02/2025
Batch code: EUAA38-00000630 Date of receipt: 17/02/2025
Sample number: 202-2025-00000166 Reporting date: 27/02/2026

	Result	Unit	low	rather low	average	rather high	high
Microbial biomass	17	mg PLFA/kg	[Progress bar]				
Total Bacteria	13	mg PLFA/kg	[Progress bar]				
Gram positive	4.3	mg PLFA/kg	[Progress bar]				
Actinomycetes	1.2	mg PLFA/kg	[Progress bar]				
Gram negative	8.6	mg PLFA/kg	[Progress bar]				
Total Fungi	1.5	mg PLFA/kg	[Progress bar]				
Saprophytes	0.7	mg PLFA/kg	[Progress bar]				
Mycorrhiza	0.8	mg PLFA/kg	[Progress bar]				
Protozoa	0.10	mg PLFA/kg	[Progress bar]				

	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-	[Progress bar]				
Carbon in microbial biomass	290	mg C/kg	[Progress bar]				
Carbon in bacterial biomass	120	mg C/kg	[Progress bar]				
Carbon in fungal biomass	120	mg C/kg	[Progress bar]				
Fungi/bacteria ratio	1.0	-	[Progress bar]				
Gram(+)/Gram(-) ratio	0.5	-	[Progress bar]				
Acidity (pH)	7.3	-	[Progress bar]				
Soil organic matter (SOM)		%	[Progress bar]				
Clay	27	%	[Progress bar]				





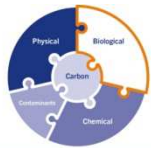
Food / Feed
 IBL Testing
 Street nr. 3
 94002 Nove Zamky

Client code: T10000003 Soil layer: 0 - 25 cm Sampling date: 12/02/2025
 Batch code: EUAA38-00000630 Date of receipt: 17/02/2025
 Sample number: 202-2025-00000166 Reporting date: 27/02/2026

	Result	Unit	low	rather low	average	rather high	high
Microbial biomass	17	mg PLFA/kg					
Total Bacteria	13	mg PLFA/kg					
Gram positive	4.3	mg PLFA/kg					
Actinomycetes	1.2	mg PLFA/kg					
Gram negative	8.6	mg PLFA/kg					
Total Fungi	1.5	mg PLFA/kg					
Saprophytes	0.7	mg PLFA/kg					
Mycorrhiza	0.8	mg PLFA/kg					
Protozoa	0.10	mg PLFA/kg					

	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-					
Carbon in microbial biomass	290	mg C/kg					
Carbon in bacterial biomass	120	mg C/kg					
Carbon in fungal biomass	120	mg C/kg					
Fungi/bacteria ratio	1.0	-					
Gram(+)/Gram(-) ratio	0.5	-					
Acidity (pH)	7.3	-					
Soil organic matter (SOM)		%					
Clay	27	%					

	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-					
Carbon in microbial biomass	290	mg C/kg					
Carbon in bacterial biomass	120	mg C/kg					
Carbon in fungal biomass	120	mg C/kg					
Fungi/bacteria ratio	1.0	-					
Gram(+)/Gram(-) ratio	0.5	-					
Acidity (pH)	7.3	-					
Soil organic matter (SOM)		%					
Clay	27	%					



Food / Feed
 IBL Testing
 Street nr. 3
 94002 Nove Zamky

Client code: T10000003 Soil layer: 0 - 25 cm Sampling date: 12/02/2025
 Batch code: EUAA38-00000630 Date of receipt: 17/02/2025
 Sample number: 202-2025-00000166 Reporting date: 27/02/2026

	Result	Unit	low	rather low	average	rather high	high
Microbial biomass	17	mg PLFA/kg					
Total Bacteria	13	mg PLFA/kg					
Gram positive	4.3	mg PLFA/kg					
Actinomycetes	1.2	mg PLFA/kg					
Gram negative	8.6	mg PLFA/kg					
Total Fungi	1.5	mg PLFA/kg					
Saprophytes	0.7	mg PLFA/kg					
Mycorrhiza	0.8	mg PLFA/kg					
Protozoa	0.10	mg PLFA/kg					

	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-					
Carbon in microbial biomass	290	mg C/kg					
Carbon in bacterial biomass	120	mg C/kg					
Carbon in fungal biomass	120	mg C/kg					
Fungi/bacteria ratio	1.0	-					
Gram(+)/Gram(-) ratio	0.5	-					
Acidity (pH)	7.3	-					
Soil organic matter (SOM)		%					
Clay	27	%					

	Result	Unit	low	rather low	average	rather high	high
Diversity Index	1.2	-					
Carbon in microbial biomass	290	mg C/kg					
Carbon in bacterial biomass	120	mg C/kg					
Carbon in fungal biomass	120	mg C/kg					
Fungi/bacteria ratio	1.0	-					
Gram(+)/Gram(-) ratio	0.5	-					
Acidity (pH)	7.3	-					
Soil organic matter (SOM)		%					
Clay	27	%					

“Wonder at soil biology’s complexity, marvel at its diversity, but don’t overthink its management.”

Dr Andrew McGuire, Washington State University

6 CORE PRINCIPLES OF REGENERATIVE AGRICULTURE



☎ 086 137 0290

🌐 www.labserve.net

STAY CONNECTED     

📍 NELSPRUIT

📍 STELLENBOSCH

📍 TZANEEN



LABSERVE[®]
LABORATORIES

Factor and its influence		Status on farm	Impact	
			Biological diversity	Microbial biomass
Soil disturbance	Soil disturbance destroys the networks of fungal hyphae and reduces Gram (+) bacteria, i.e., decreases diversity.			
Crop rotation/ species diversity	Favours proliferation and diversity of the microbial ecosystem of the plant rhizosphere, which increases the disease resistance of plants.			
Soil cover	Avoid topsoil erosion. Protects topsoil – reduces evaporation and temperature fluctuations. Improves infiltration.			
Living roots (rhizosphere)	The rhizosphere is characterized by a high level of biological activity due to the presence of substances secreted by roots (sugars, amino acids, organic acids, various secondary metabolites) that serve as nutrients for microorganisms, fostering a rich and dynamic microbial community around plant roots.			
Animal component	Manure is a natural biological inoculant - it introduces and feeds a diverse range of beneficial microbes. Light herbivore grazing has been shown to improve and maintain soil nematode communities and ecosystem multifunctionality as well as soil C.			
Depth of topsoil	Biological activity is mostly in the topsoil, where plant roots proliferate. Depth of the topsoil, as well as soil sampling, has significant effects on soil C and biological activity.			
Soil organic C	Food source and improves soil aeration. A positive linear regression between microbial diversity to soil organic carbon.			
Soil salinity	If high, detrimental, and imbalanced nutrition - decreased rhizosphere activity			
Soil texture	Affects soil susceptibility to compaction, level of aeration, pH buffer capacity, rate of nutrient leaching, soil C: clay stabilises soil organic C.			
Soil pH	If low, detrimental to bacteria. pH _{KCl} is 5.5 – 6.5: beneficial to diversity.			
Soil Ca:Mg ratio	If high, good soil structure.			
Soil P	If optimal to high, suppresses phosphatase-excreting organisms.			
Overall expected soil biological status				

**We know a lot of things
but what we don't know
is a lot more.**

Prof Edward Witten, Princeton University

 086 137 0290

 www.labserve.net

STAY CONNECTED      


 NELSPRUIT

 STELLENBOSCH

 TZANEEN



LABSERVE[®]
LABORATORIES



“Wonder at soil biology’s complexity, marvel at its diversity, but don’t overthink its management.”

Dr Andrew McGuire, Washington State University

Thank you

Acknowledgement to:
Niel Miles – some of the introductory remarks comes from an article by him.

📞 086 137 0290

🌐 www.labserve.net

STAY CONNECTED     

📍 NELSPRUIT

📍 STELLENBOSCH

📍 TZANEEN



LABSERVE[®]
LABORATORIES