



Improve Seed Production Through Actionable Insights From Soil Biology




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Managing the Soil Microbiome

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A wide-angle photograph of a lush green soybean field. The rows of plants stretch far into the distance under a clear sky. In the background, a line of trees and a few hay bales are visible. A white text box with black and orange text is overlaid on the left side of the image.

20-30% of all fixed carbon is transferred to the rhizosphere through root exudates

A photograph of a cornfield with a text overlay. The corn plants are green and growing in rows. The ground is dry and cracked. The text overlay is white with black and orange text.

Crops are supporting
**soil microbial
communities**



Soil microbial communities

Soilborne pathogens

Organic matter and Nutrient cycling

Plant growth promotion

Biocontrol

Mycotoxins

Soil physical fertility

Herbicide breakdown

How do we quantify the soil microbial communities?

Soil metagenomics

Soil sampling



DNA extraction



Sequencing



Bioinformatics



Indicators



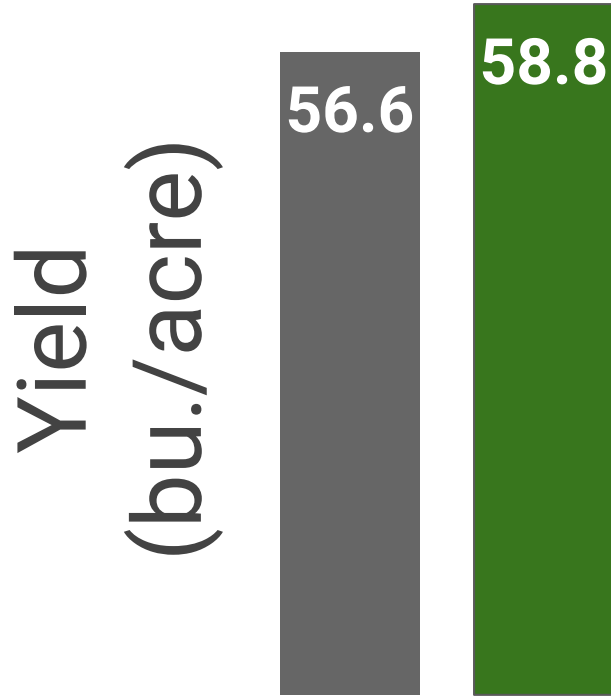


How can we improve crop management with soil metagenomics?



When Is Seed Treatment Worth It?

Average ROI

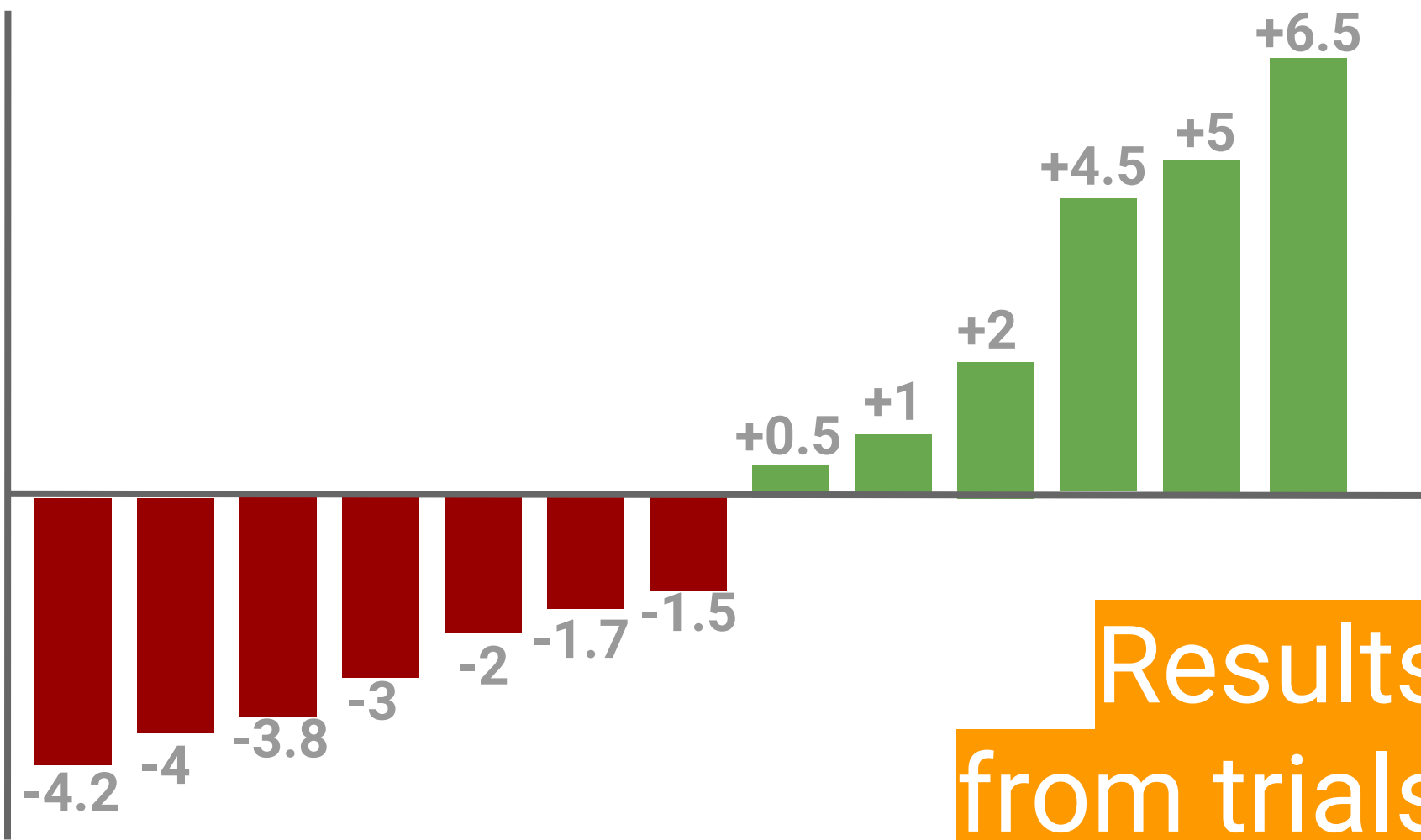


Individual results may vary

+2
bu./acre

Average Yield

Yield difference
(bu./acre)



Results
from trials



60% of the time; It works every time.

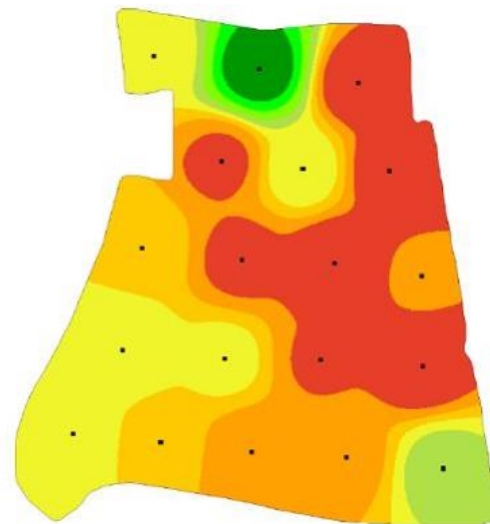
Measuring the risk pre-planting

DISEASE RISK (%)

1 Soilborne Pathogens

The level of inoculum in the soil is measured as log(pg DNA/g soil). The levels known to cause disease are in bold.
 C: Corn, S: Soybean
 ND: Not Detected

Pathogen	Crops	SAMPLE NAME								
		A1	A2	A3	B1	B2	B3	C4	C5	
<i>Colletotrichum graminicola</i>	C, S	1.32	2.22	2.12	ND	1.13	1.02	0.82	1.21	
<i>Fusarium graminearum</i>	S	ND	ND	ND	1.21	1.26	1.17	ND	ND	
<i>Fusarium spp.</i>	C	0.39	1.17	0.43	1.31	1.24	0.21	1.55	1.24	
<i>Fusarium verticillioides</i>	C, S	0.21	0.08	ND	ND	0.72	0.34	0.17	0.11	
<i>Fusarium virguliforme</i>	S	0.71	0.82	0.73	ND	0.60	0.45	ND	1.09	
<i>Macrophomina phaseolina</i>	C, S	0.83	0.91	ND	0.71	ND	0.77	ND	0.88	
<i>Penicillium oxalicum</i>	C	ND	0.13	0.42	0.15	0.18	0.21	0.11	0.71	
<i>Phytophthora sojae</i>	S	1.13	ND	ND	1.32	1.43	1.73	1.92	1.41	
<i>Pythium aphanidermatum</i>	C, S	1.42	0.46	0.76	0.89	ND	ND	0.43	0.21	
<i>Pythium spp.</i>	C	0.03	0.14	0.08	0.23	0.21	0.63	0.14	0.03	
<i>Pythium ultimum</i>	C, S	1.21	0.23	ND	ND	ND	0.41	ND	0.03	
<i>Rhizoctonia solani</i>	C, S	0.02	ND	0.31	ND	ND	ND	0.11	1.02	
<i>Rhizoctonia spp.</i>	C	ND	0.71	ND	0.62	ND	0.60	ND	ND	
<i>Sclerotinia sclerotiorum</i>	S	ND	ND	0.21	ND	0.12	0.28	0.17	ND	

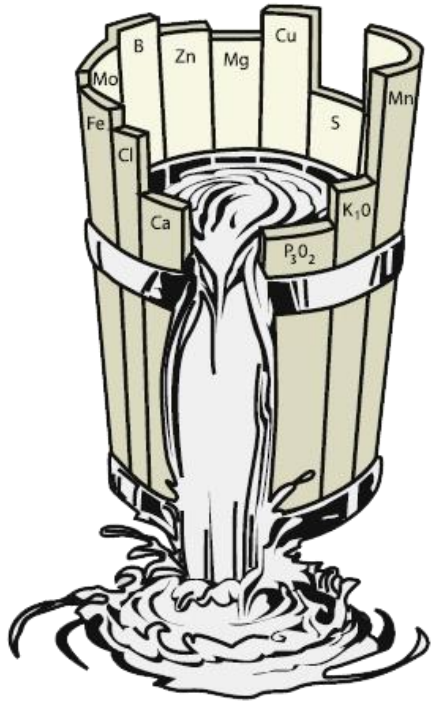


Sudden Death Syndrome
(Fusarium virguliforme)

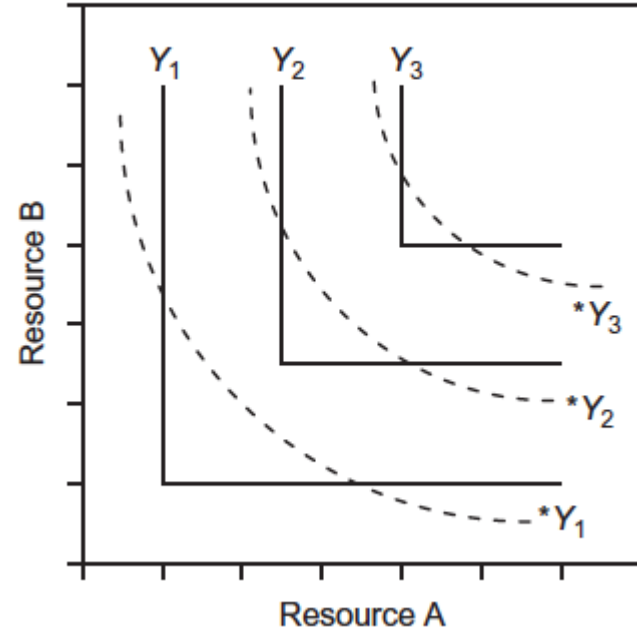
Improving nutrient management



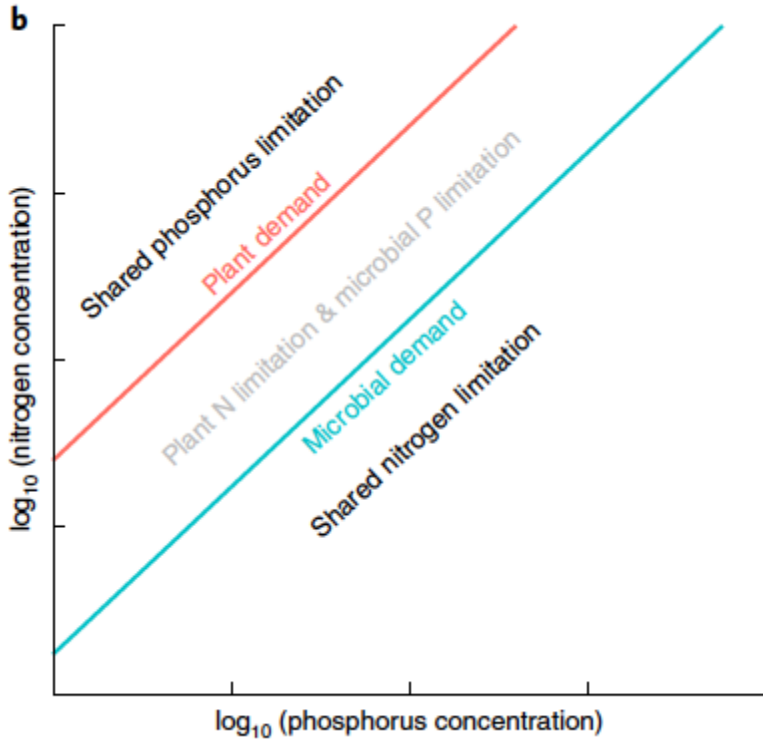
Liebig Law of Minimum



Co-limitation



Cossani and Sadras (2018)



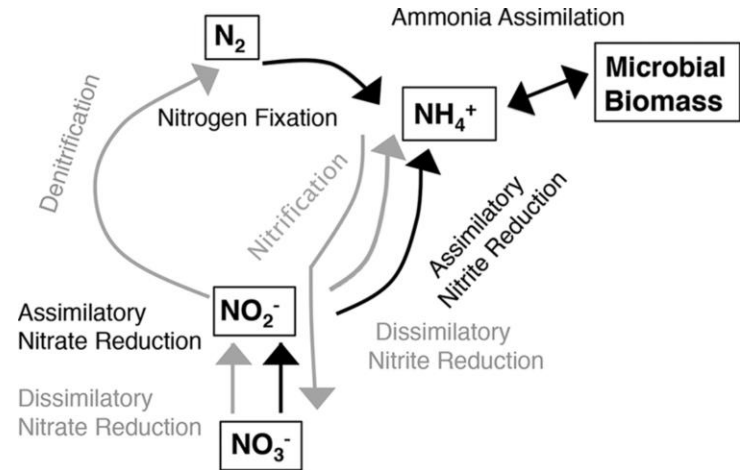
Plant and microbial stoichiometry

ORGANIC MATTER AND NUTRIENT CYCLING

These group of indicators quantify the relative abundance of functional genes involved in processes related to carbon and nutrient cycling in the soil. The values are presented in a scale from 0 to 100 to allow comparisons between samples.

Process	Element	SAMPLE NAME							AVERAGE
		1A	1B	2A	2B	3A	3B	4A	
Sequestration	C (OM)	64	53	59	88	93	76	69	72
Fixation	N	97	98	99	98	98	97	96	98
Denitrification	N	78	95	94	98	76	86	94	89
Nitrification	N	95	90	86	93	74	97	99	91
Volatilization	N	94	94	96	97	99	89	97	95
Mineralization	N	77	92	84	93	92	80	74	85
Solubilization	P	23	49	42	62	66	75	60	54
Mineralization	P	79	87	90	81	82	83	79	83
Mineralization	K	93	85	88	84	77	71	78	82
Mineralization	S	11	8	23	26	22	18	23	19
Mobilization	S	59	73	69	66	58	71	61	65
Solubilization	Zn	82	81	79	73	67	70	76	75

Functional analysis

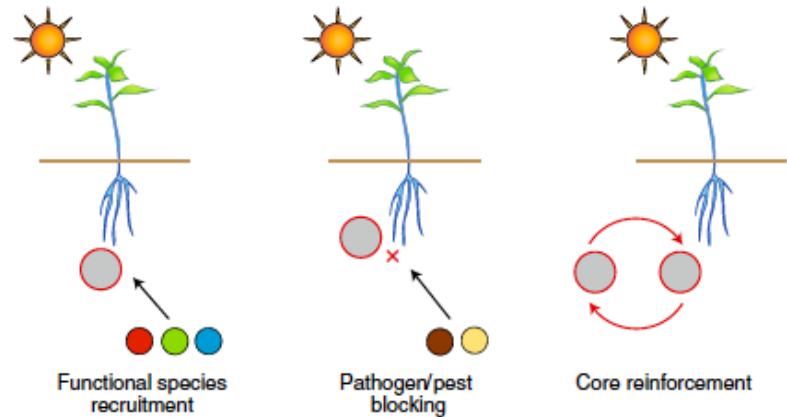
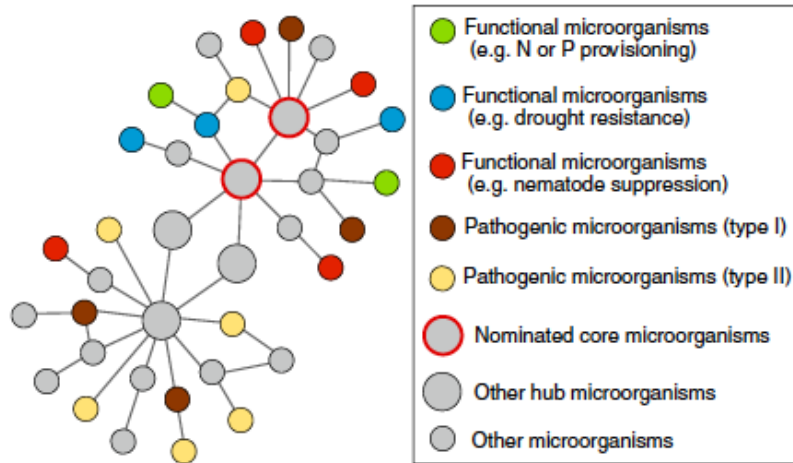


Better nutrient prescriptions

Phosphorus Dry or Field-Moist and Slurry Soil Tests (ppm)					
Soil Test Category	Very Low	Low	Optimum*	High	Very High
Bray P₁ and Mehlich-3 P	0-8	9-15	16-20	21-30	31+
Olsen P	0-5	6-9	10-13	14-18	19+
Mehlich-3 ICP P	0-15	16-25	26-35	36-45	46+
P₂O₅ to apply (lb/acre)					
	100	75	58	0	0

ISA (2013)

Beyond functional microorganisms





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