BioCon 25

#stable biology with trace elements

DI (FH) Paul Bock // SCHAUMANN BioEnergy Consult GmbH

huelsenberg holding

Agrarwirtschaft

UNION AGRICOLE

Union Agricole Holding AG

- SCHAUMANN ERFOLG IM STALL
- TSF
- GUT HÜLSENBERG
- UNA-HAKRA
- ligrana
- PragmaVet Zuverlässig. Innovativ. Praxisorientiert.

Biotechnologie

BIOTIC SCIENCE

Biotic Science Holding AG

- LACTOSAN
- senzyme
- PROVITA SUPPLEMENTS
- ALGINURE

Erneuerbare Energien

ENBYCON

Enbycon Holding AG

- SCHAUMANN BioEnergy
- SCHAUMANN BioEnergy consult

Industrietechnologie

DURAG GROUP

Durag Holding AG

- DURAG
- DURAG SALES & SERVICE
- DURAG DATA SYSTEMS
- SMITSVONK
- GRIMM AEROSOL TECHNIK
- ap2e
- JES tunnelsafety.at
- Hegwein

Stiftung

H. WILHELM SCHAUMANN STIFTUNG

H. Wilhelm Schaumann Stiftung

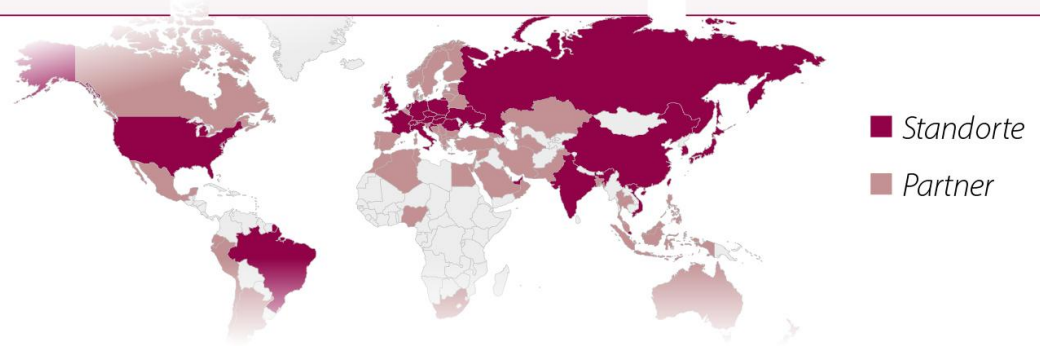
Förderung des wissenschaftlichen Nachwuchses

Hülsenberger Gespräche

Förderpreise für überragende wissenschaftliche Arbeiten

Auszeichnung der besten Dissertationen

Unterstützung gemeinnütziger Institutionen



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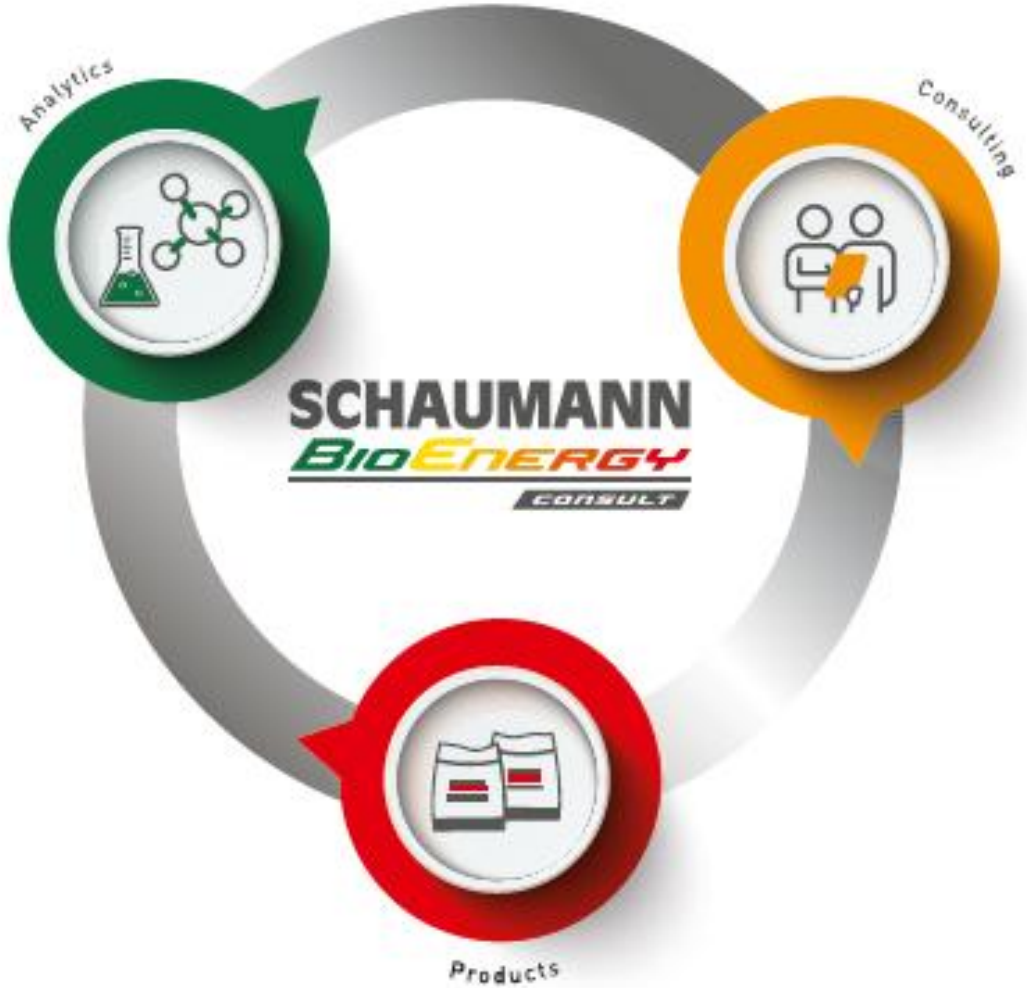
OUR APPROACH - #HANDS-ON



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BIOENERGY

Own farm and AD research center GUT HÜLSENBERG
GERMANY

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OWN SPECIALISED BIOGAS LABORATORY

Our lab processes:

// 25,000 digester samples/a

// 50,000 forage samples/a

// 9,000 TE analyses/a

// 800 BMP tests (gas yield)

Analyses include:

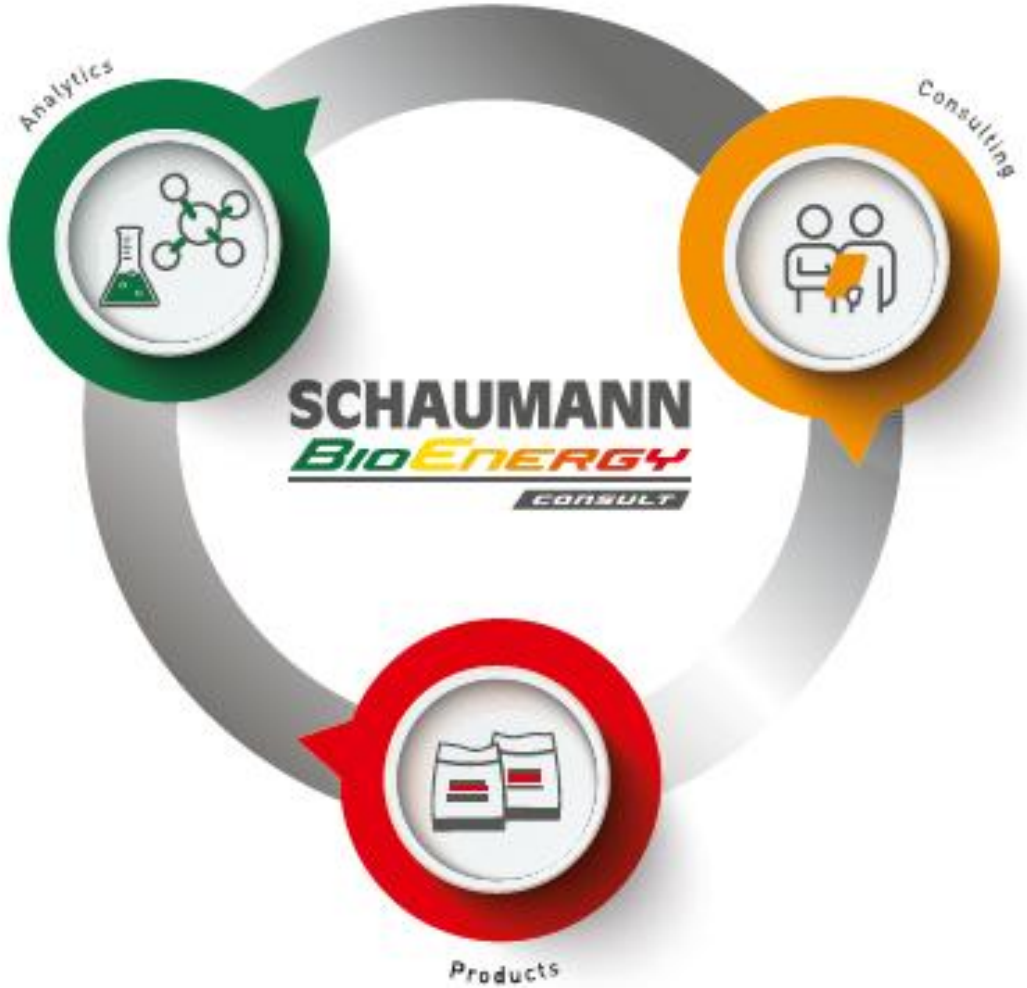
// pH, volatile fatty acids (GC), NH_4, DM, oDM,

// fermentation acids (HPLC), CFU counts yeasts moulds, inhibition assays, fertilizer value (NIR)

// COD

// gas yield tests (BMP)

OUR APPROACH - #HANDS-ON



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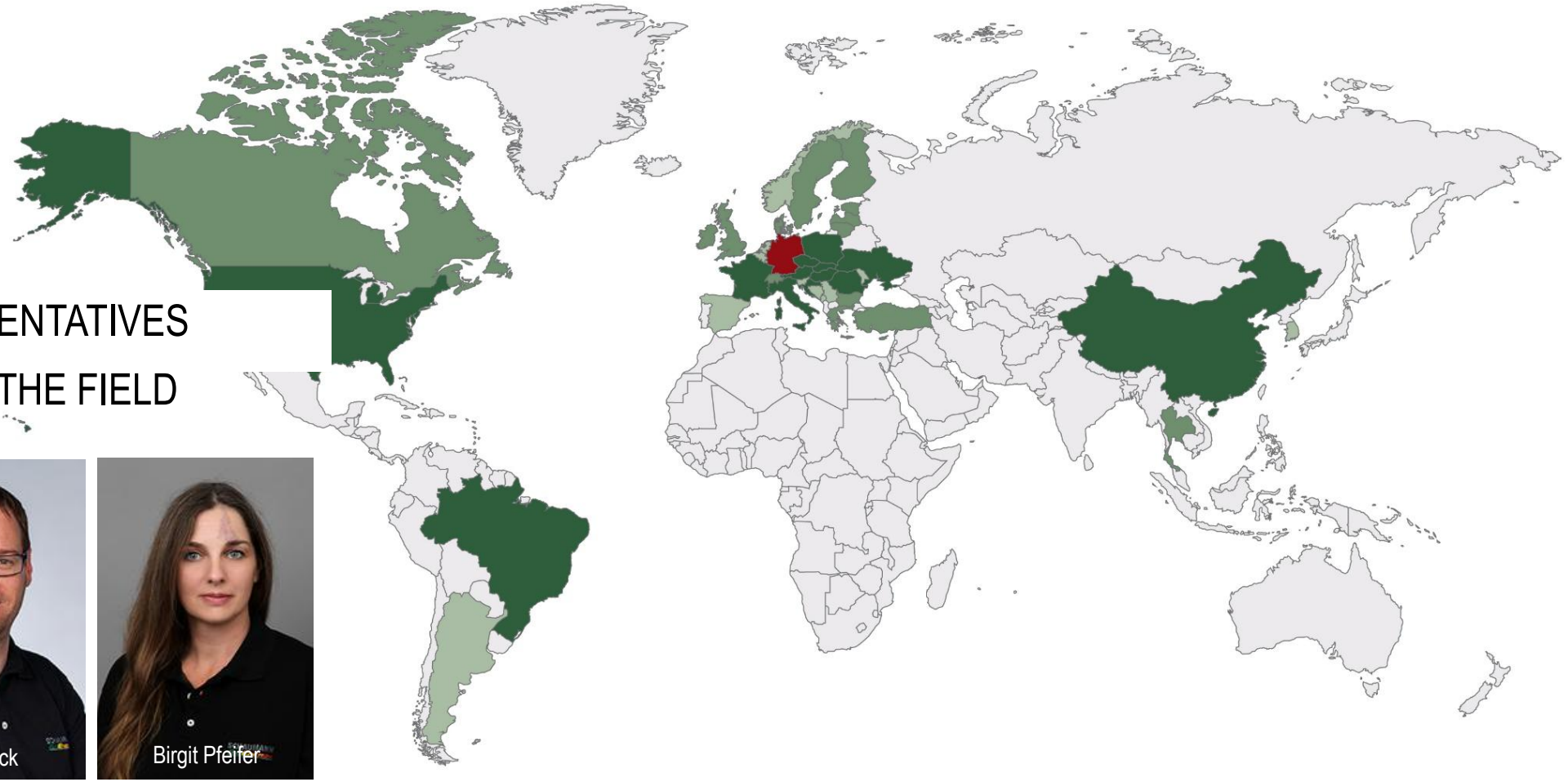
INTERNATIONAL ACTIVITIES IN THE AD BUSINESS



3 COUNTRY REPRESENTATIVES

75 CONSULTANS ON THE FIELD


Melanie Hecht, PhD


Paul Bock

Birgit Pfeifer

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ON-SITE CONSULTANCY

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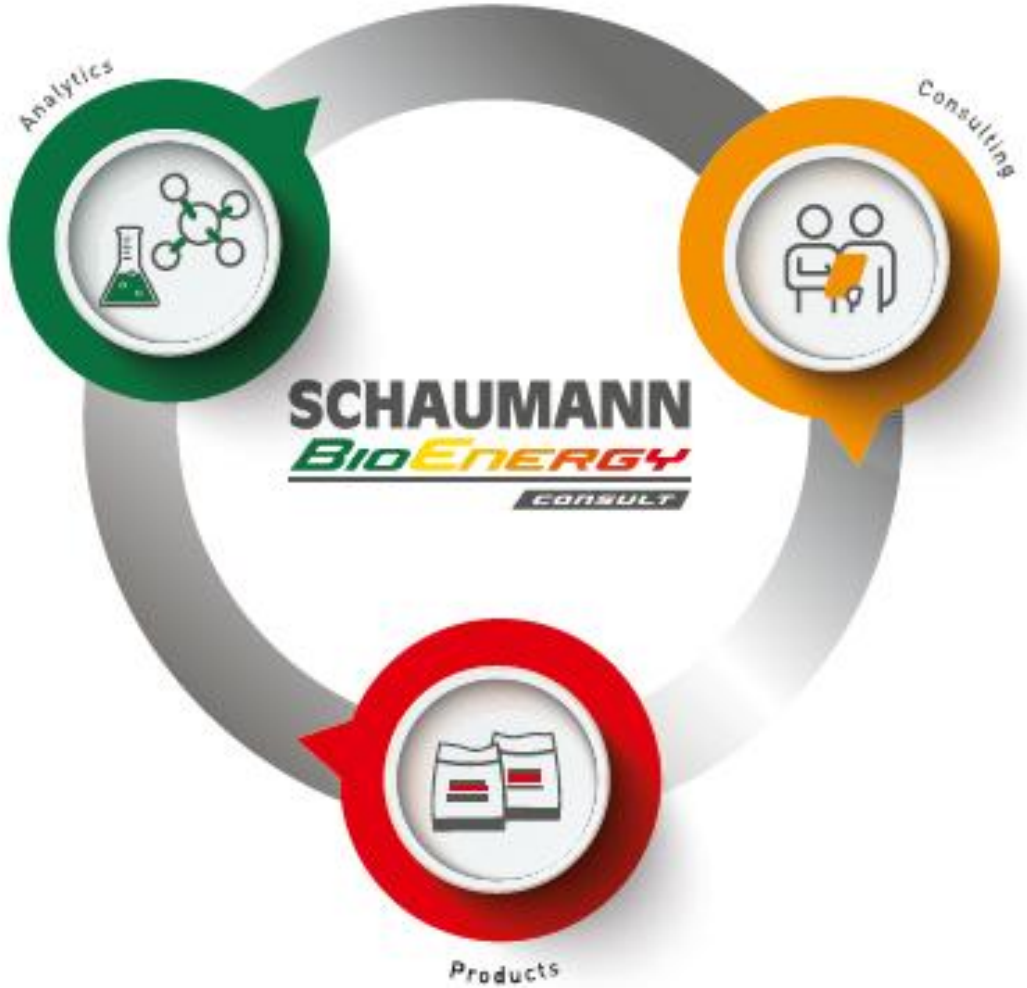
OUR APPROACH - #HANDS-ON



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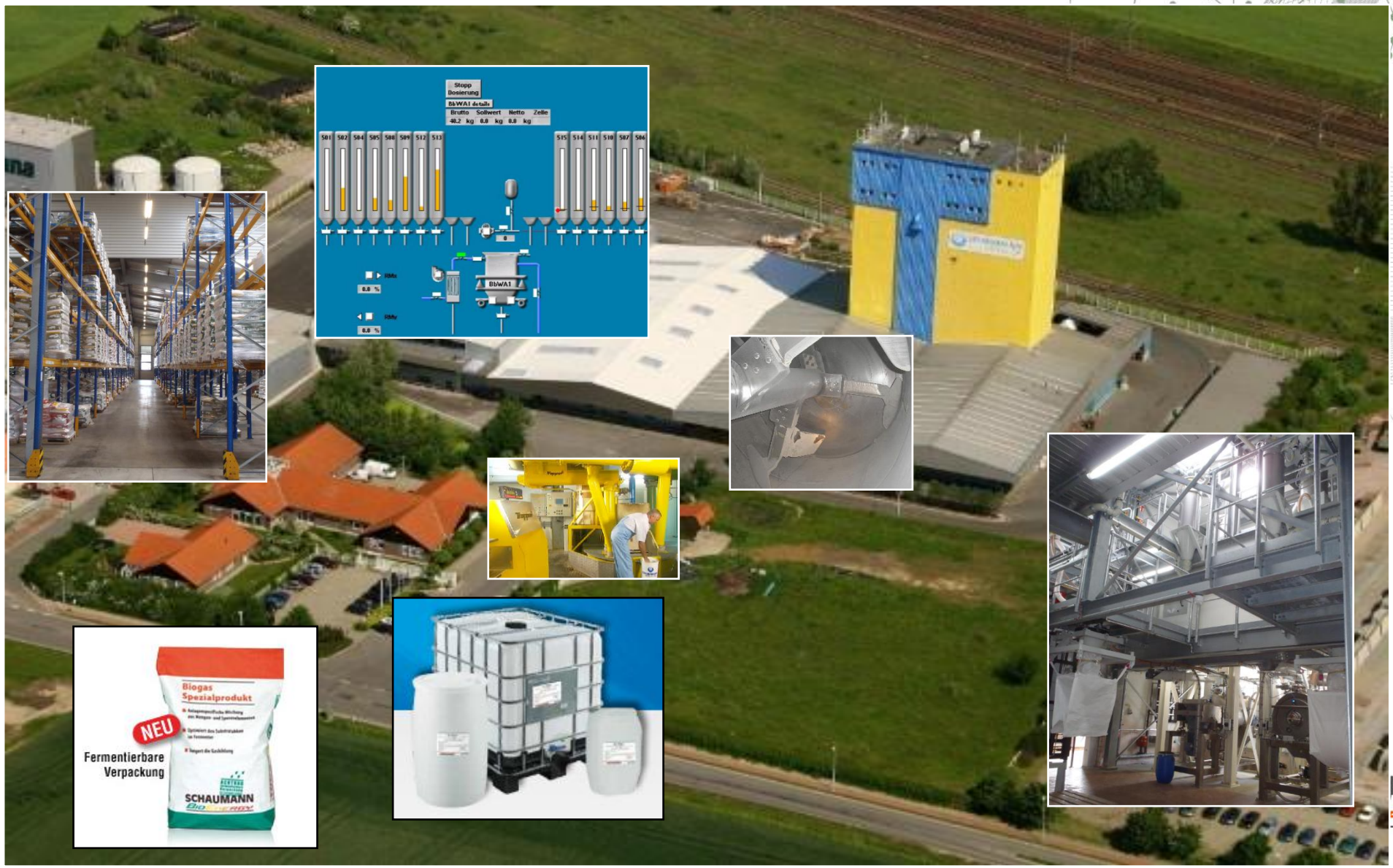
Own production in Eilsleben
GERMANY



WHAT CAN POSSIBLY GO WRONG ON A BIOGAS PLANT

Acidification

Overfeeding

Inhibition of methanogens

Temperature change

Trace element deficiency

Low gas yields

Poor feedstock quality

Nutrient deficiency

Inhibition

Disruption of hydrolysis

Inadequate mixing

Mechanical problems

Foaming

Gas quality

Maintenance/repairs

Floating layers

sedimentation

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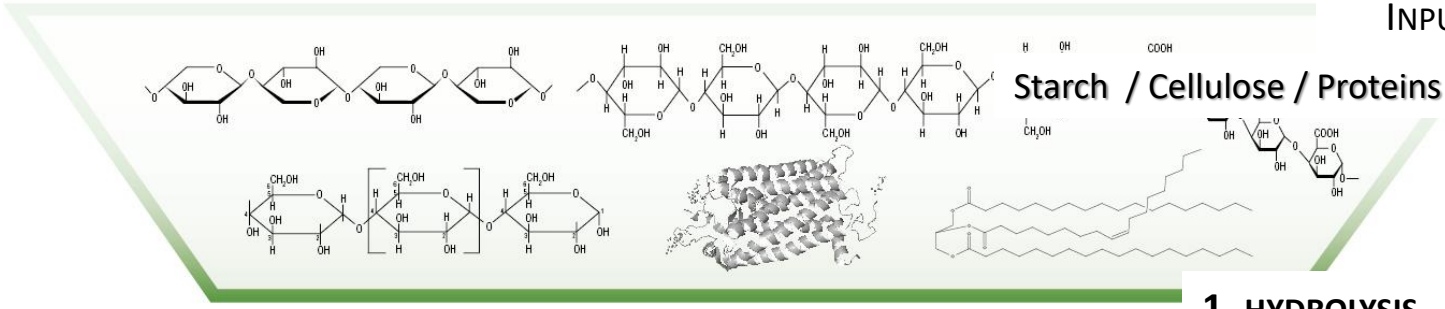
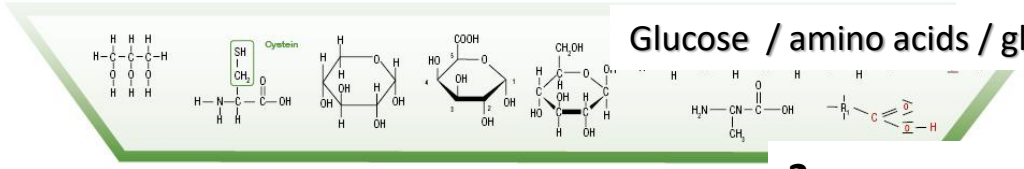
THE 4 STAGES OF ANAEROBIC DIGESTION



INPUT

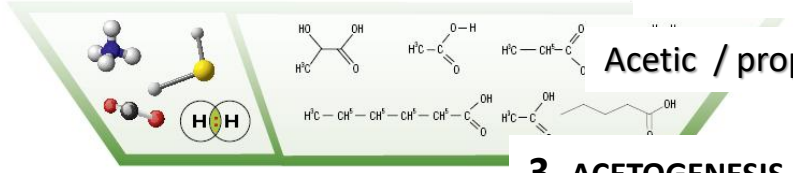
Starch / Cellulose / Proteins / Fats

1. HYDROLYSIS



Glucose / amino acids / glycerine / fatty acids

2. ACIDOGENESIS

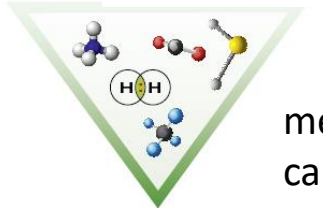


Acetic / propionic / butyric / valeric acid / …

3. ACETOGENESIS

Acetic acid & H_2 + CO_2

4. METHANOGENESIS



methane: CH_4
carbon dioxide: CO_2

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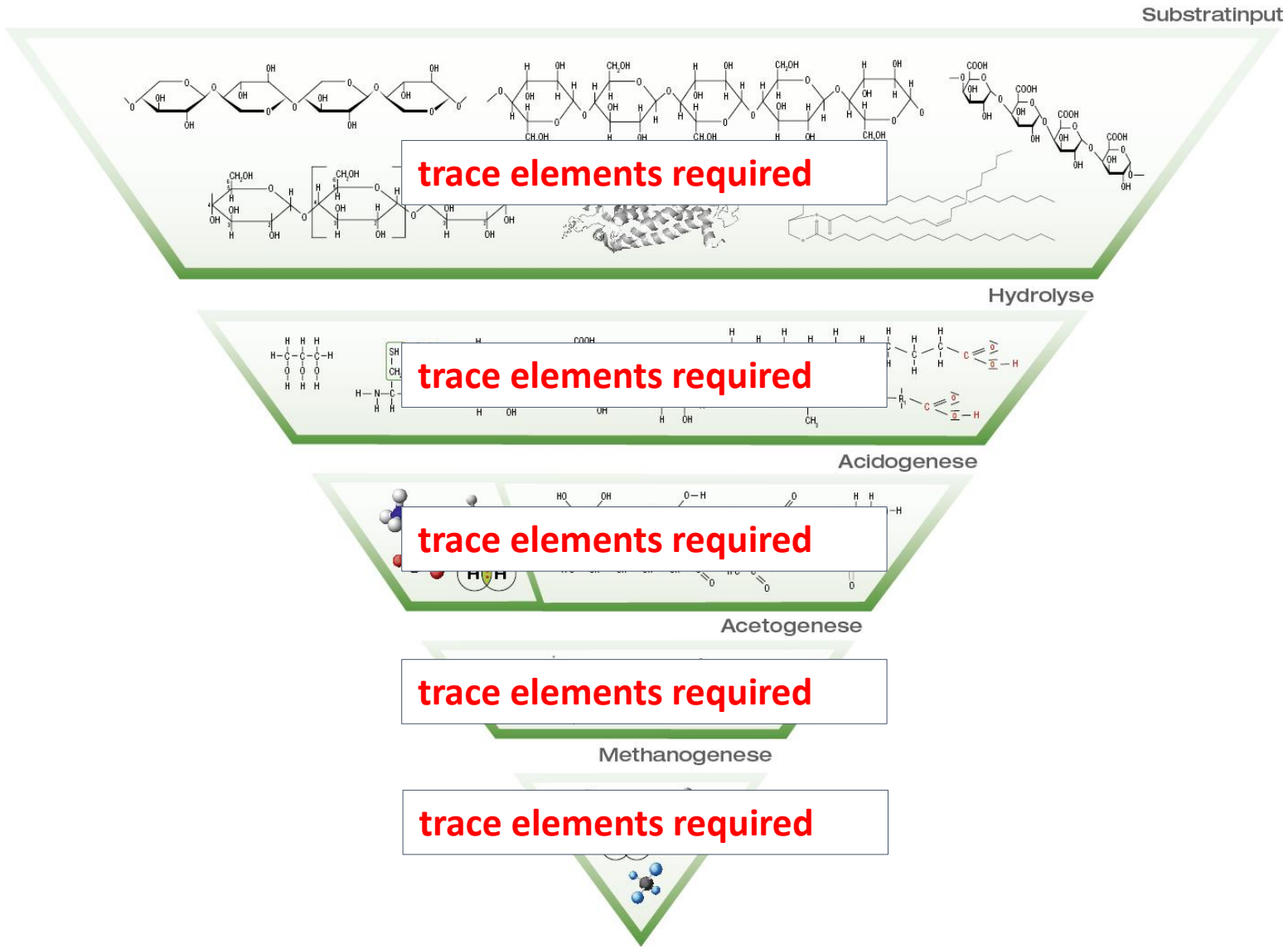
THE ANAEROBIC DIGESTION PROCESS



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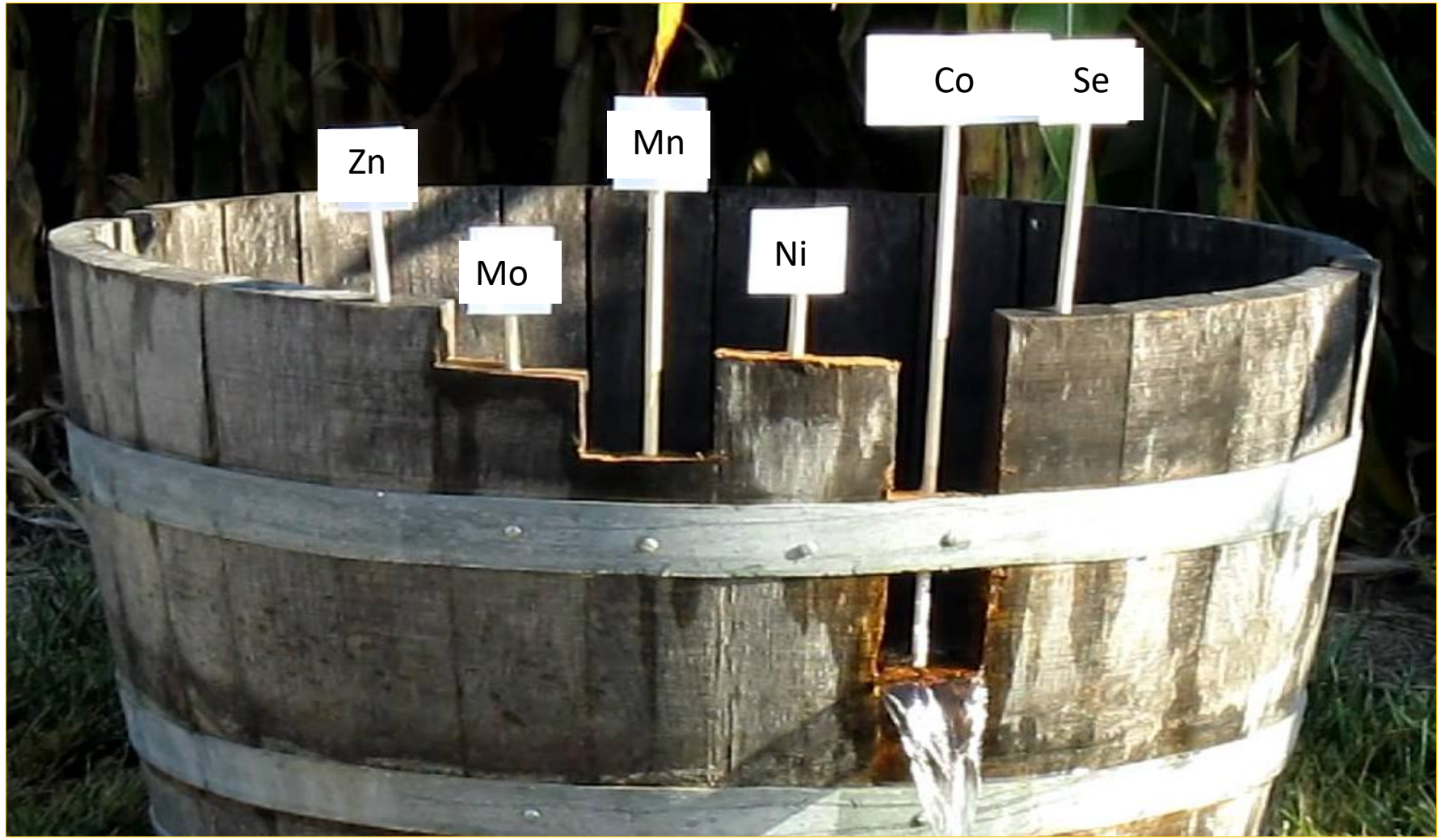
TRACE ELEMENT (= MICRONUTRIENT) DEFICIENCY



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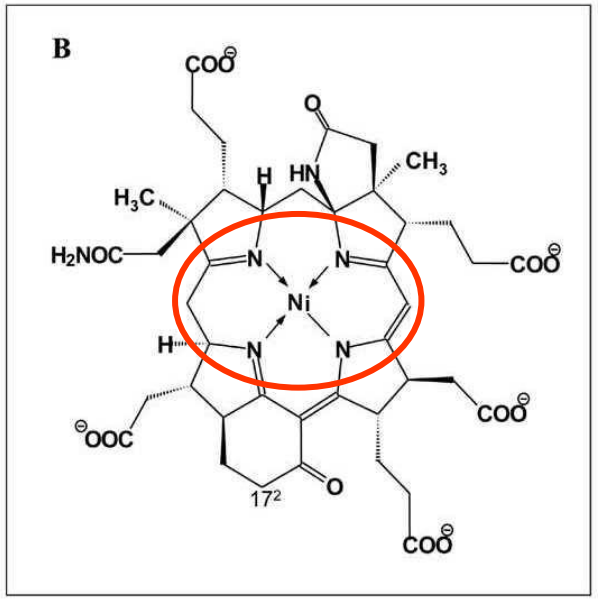
FUNCTION OF TRACE ELEMENTS IN THE AD PROCESS

Enzyme structure ⟷ **Biomass growth**



z.B. Coenzyme F430

Macro nutrients	Micro nutrients
N	Fe
P	W
K	Mo
S	Mn
Ca	Co
Mg	Se
Na	Ni

Anaerobic bacteria/ archaea

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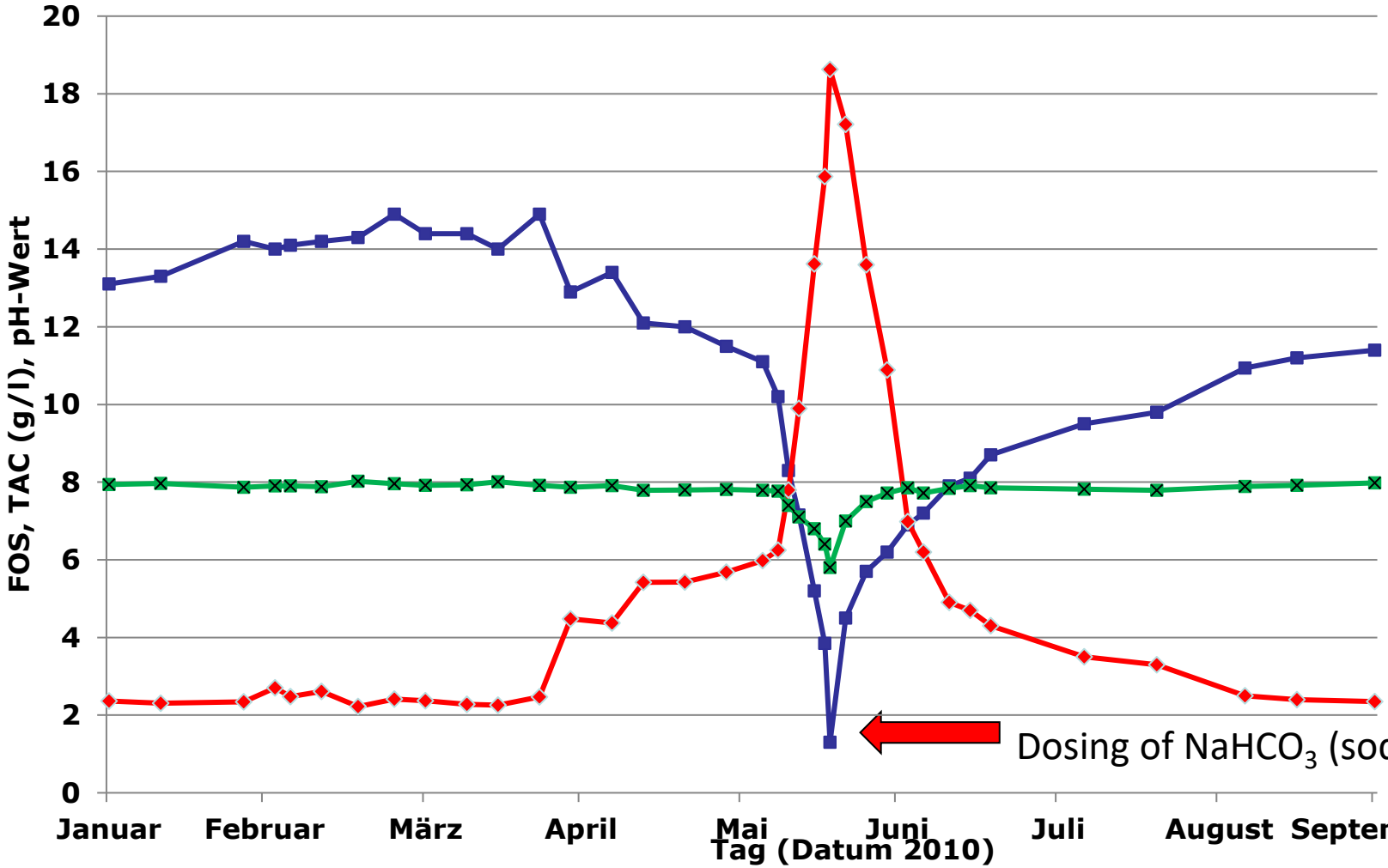
LACK IN TRACE ELEMENTS → ACIDIFICATION: REMEDY



Dosing of $NaHCO_3$ (sodium bicarbonate) and trace elements

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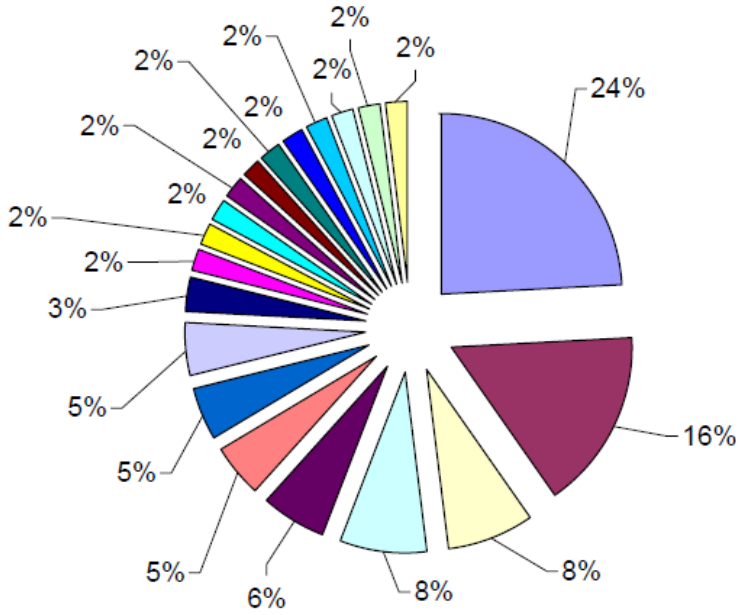
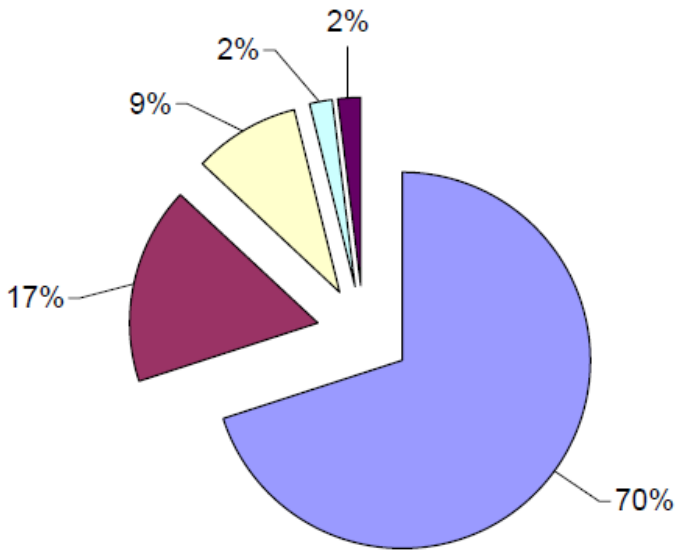
EFFECTS OF PROCESS DISRUPTION ON MICROBIOLOGY

Reinoculate after disruptions

Stable operation



After disruption



Dahlhoff, 2008

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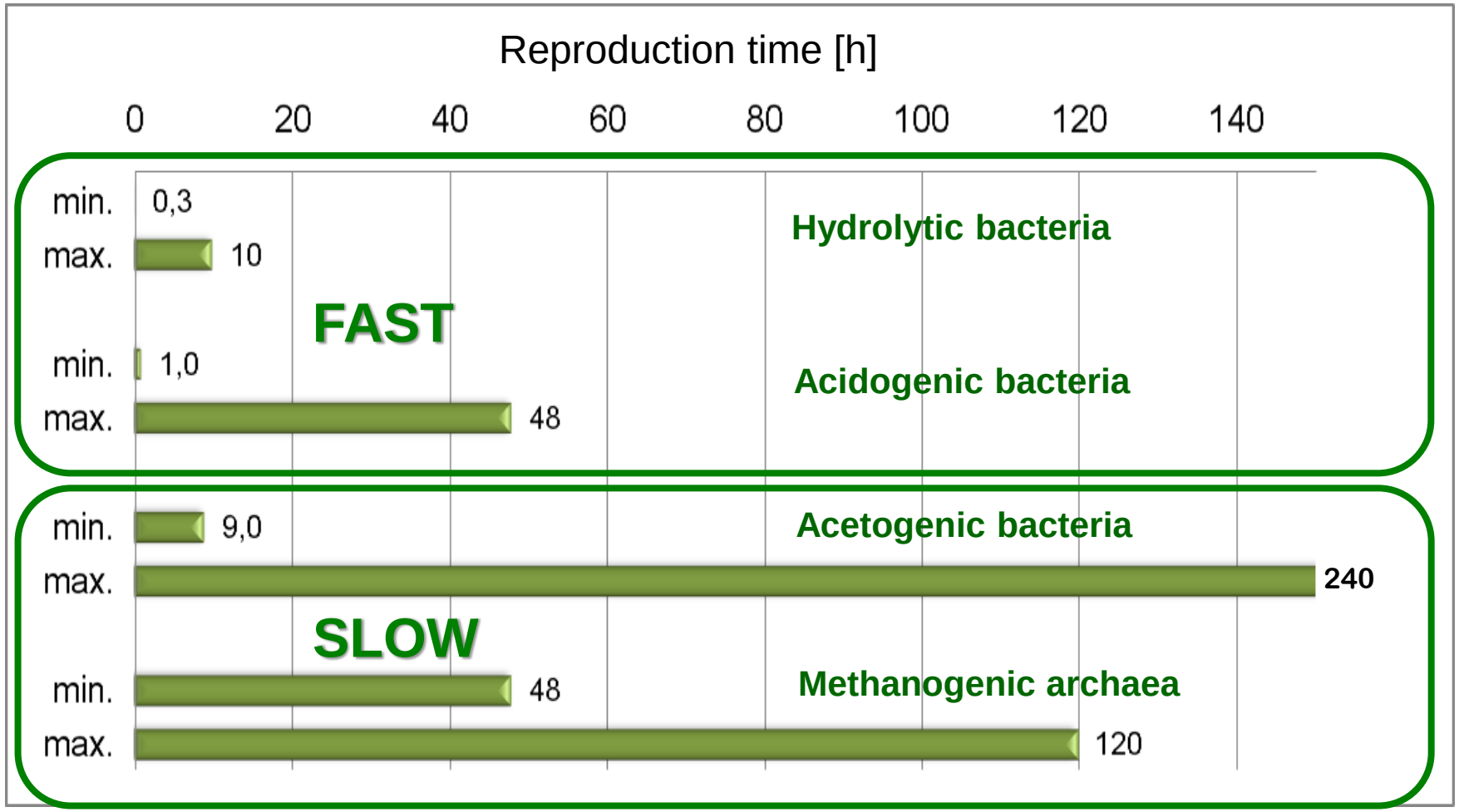
MICROBIAL REPRODUCTION TIMES: BE PATIENT



Weiland, 2006

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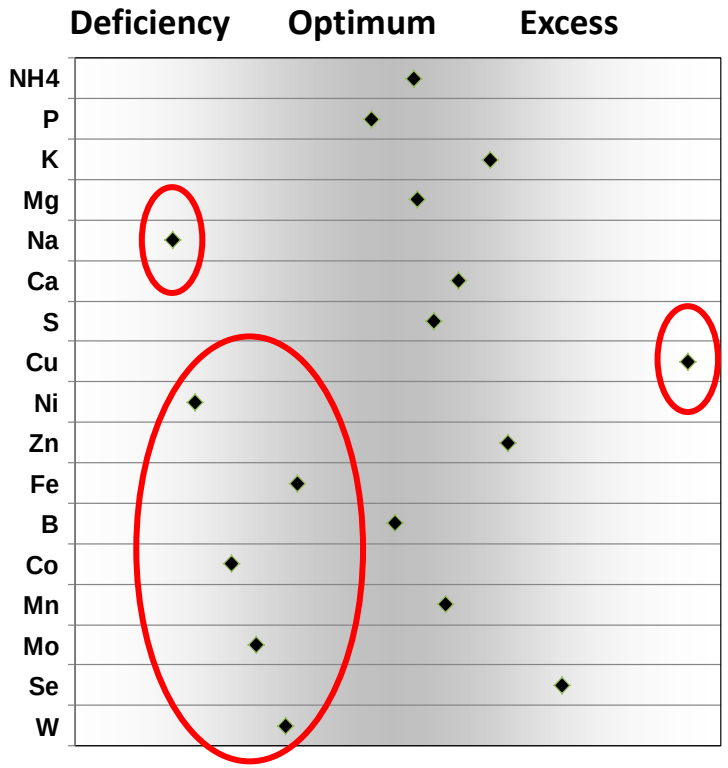
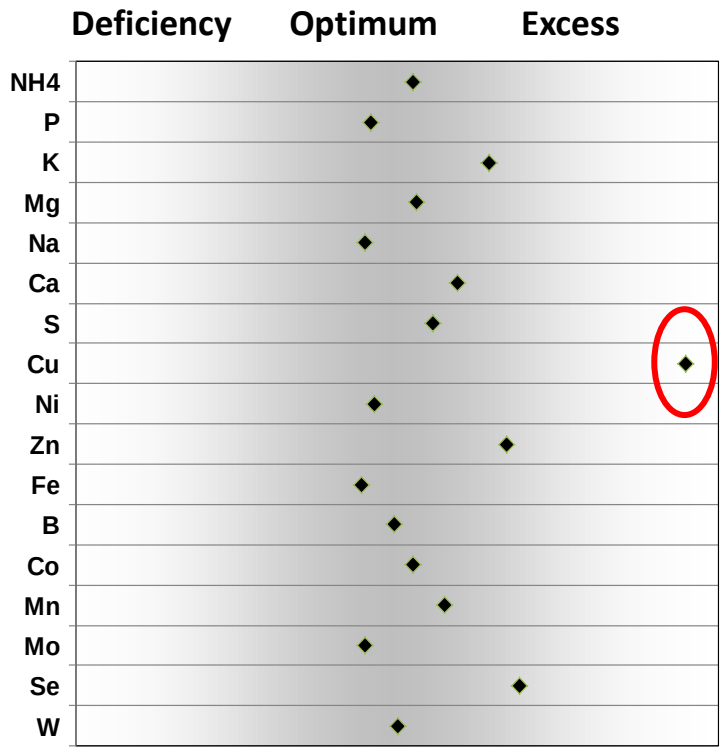
BESPOKE MICRONUTRIENT FORMULATIONS
BASED ON ACCURATE MICRONUTRIENT ANALYSIS



Initial analysis



After micronutrient dosage

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TRACE ELEMENT DEFICIENCY: SIGNALS

Customer | **Sample Type** Digester content | **Sampling Location** Digester 1

BASIS						DM/oDM		GC								
pH	EC [mS/cm]	VOA [g HAceq/l]	TIC [g CaCO3/l]	VOA/ TIC	NH4+-N [g/l]	DM [g/kg]	oDM [g/kg]	AA [mg/l]	PA [mg/l]	BA [mg/l]	iBA [mg/l]	VA [mg/l]	iVA [mg/l]	CA [mg/l]	HAc-EQ [mg HAc_{eq}/l]	Issue Date
7,5		9,48	9,09	1,04	3,42	29,1	23,5	6577	1308	332	387	104	596	32	8556	28.11.2022
7,8		3,75	12,4	0,30	3,28	35,0	29,2	1492	154	<30	34	<30	<30	<30	1640	24.04.2023
7,9		4,47	12,6	0,35	3,60	27,8	22,2	2127	206	<30	47	<30	<30	<30	2326	18.07.2023
8,0		3,55	12,7	0,28	3,47	31,1	26,1	1286	56	<30	94	<30	362	<30	1609	09.10.2023

Customer | **Sample Type** Digester content | **Sampling Location** Digester 2

BASIS						DM/oDM		GC								
pH	EC [mS/cm]	VOA [g HAceq/l]	TIC [g CaCO3/l]	VOA/ TIC	NH4+-N [g/l]	DM [g/kg]	oDM [g/kg]	AA [mg/l]	PA [mg/l]	BA [mg/l]	iBA [mg/l]	VA [mg/l]	iVA [mg/l]	CA [mg/l]	HAc-EQ [mg HAc_{eq}/l]	Issue Date
7,8		3,95	11,7	0,34	3,17	24,7	19,5	1825	231	52	49	<30	53	<30	2112	28.11.2022
7,9		3,45	12,5	0,28	3,30	33,4	27,5	1225	121	<30	<30	<30	<30	<30	1323	24.04.2023
7,9		3,50	13,5	0,26	3,60	29,6	24,3	1154	93	<30	<30	<30	<30	<30	1229	18.07.2023
8,0		4,20	13,0	0,32	3,52	38,1	30,8	1960	117	<30	65	<30	108	<30	2163	09.10.2023

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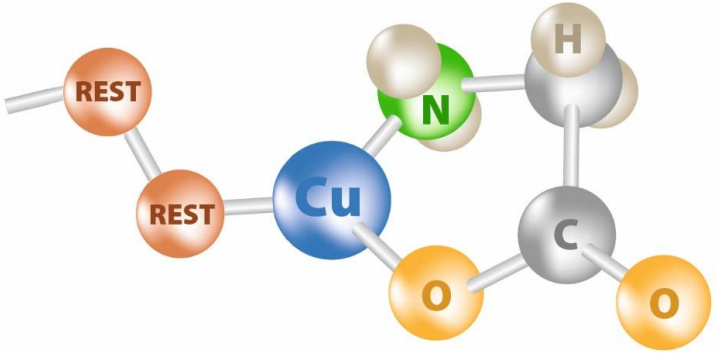
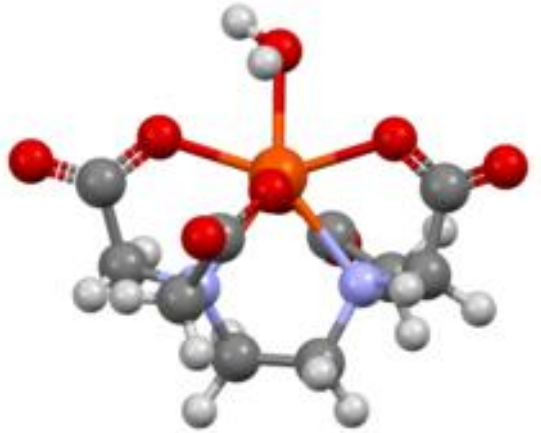
BESPOKE MICRONUTRIENT FORMULATIONS

BC.MAGXX



BC.TEPLEX



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Thank you very much for your attention!

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