Humiverse®

More Yield the Natural Way

Terra Optima AG
Rathausstrasse14 / CH-6340 Baar
www.humiverse.ch www.terra-optima.ch
info@terra-optima.ch

Company History

From the idea to an innovative product

- **03/2019** **Company foundation "Terra Optima AG"**
  "Worldwide distribution of humic acids and similar products for use in aquacultures and for soil cultivation".
- **05/2020** **Approval „Humiverse®“ as a soil additive according to § 9a DMG in the version of the year 1994**
  Bundesamt für Ernährungssicherheit (Federal Office for Food Safety)
  Spargelfeldstrasse 191, A-1220 Wien
- **11/2020** **Listing in the "Betriebsmittelliste für den ökologischen Landbau" (List of inputs for organic farming) as fertilizers, composts, soils and technical materials (adjuvants and auxiliary materials)**
  FiBL Projekte GmbH, Kasseler Strasse 1a, D-60441 Frankfurt am Main
- **Since 11/2020** **Field trials / further product development**
- **09/2022** **"Terra Optima AG Branch Office Austria„**
  Development and distribution
- **09/2023** **Application for Patent Humiverse Plus**
  „Process for the preparation of a composition containing alkali humate and/or ammonium humate …“
- **2025** **Planned product launch „Humiverse® Dry“**
  Dry product, planned

The effective Benefits of "Humiverse®Plus"

- Promotion of soil life
- Improvement of soil structure and increase of humus formation
- Increasing the availability of macro- and micronutrients
- Increasing the cation exchange capacity
- Increase of water holding capacity
- pH-value balance on (strongly) acidic and alkaline soils
- Improvement of soils contaminated with salt and pollutants
- Enzymatic effect on the formation of important plant hormones
- Protects the plant from UV radiation and increases chlorophyll formation.

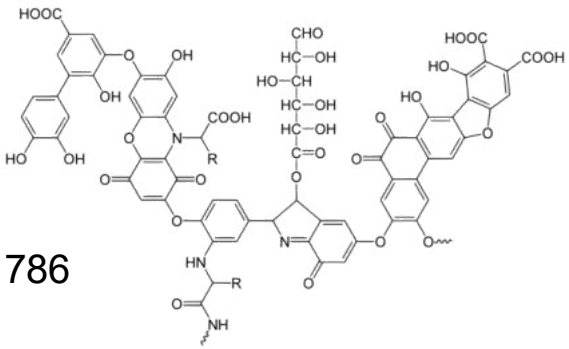
Further Benefits of "HUMIVERSE® Plus" on the Soil

- Improvement of nutrient uptake (activity / root extracts)
- Dissolution of salts and renewed bioavailability
- Increased resistance to abiotic stresses, e.g. drought, heat, UV radiation, frost, salinated soils (due to over fertilisation with NPK fertilisers), nutrient deficiency and pH-value-deviation
- Promotion of root growth (rhizosphere, gravitropism)
- General growth stimulation (seed germination, flowering and fruit development)
- Increase in disease resistance (e.g. fungal diseases, slight hyperglycaemia in the plant)
- Improvement and safeguarding of the qualitative and quantitative properties of the harvested products

"We compared Humiverse®Plus with other products and we realised that it is a new performance class of humic and fulvic acids.
The special purity of the exclusively organic molecules represents a new world standard.“
CEO Terra Optima AG, Heiko Petermann

Humic substances

Forgotten Natural Science



- Humic substances were discovered for the first time by the German chemist and natural scientist Franz Carl Achard in 1786 (among other things, he built the first sugar factory in Kunern/Prussia - today Konary/PL - in 1801).
- Humic substances are high-molecular chemical compounds (molar mass between 800 and 105 Daltons).
- Humic substances can consist of different chemical components
  - Aromatic compounds = nuclei: benzene, quinoline, quinone, pyrrole, pyirdine, furan, naphthalene, indole
  - Bridges: -O-, -NH-, -N=, -CH2-, -C=C-
  - Functional groups: Carboxcyl, Phenol, Amino, Quinone, Methoxyl
- Humic substances are naturally present in humus soil and can act in the soil for up to 1000 years.
  - Black earth soils: 16 g/1000 g soil
  - European soils: 3.5 - 4.5 g/1000 g soil
- Humates are the salts of humic acid, where exchangeable protons are completely or partially replaced by cations such as potassium, calcium, iron or sodium ions, (Potassium/calcium/iron/ sodium humate)
- Humic substances are incorporated in peat and lignite (Leonardite).
- Their heavy metal contamination varies from region to region.

Humic substances

Classification and properties

Humic substances Ø Sum formula Plus the salts	Fluvic/fluvic acid $C_{187}H_{186}O_{89}N_9S$ Fulvates	Humic acids $C_{135}H_{182}O_{95}N_5S_2$ Humates	Humine
Degree of polymerisation	Low →	Spherocolloids highly dispersed silicon dioxide	→ High
Colour	Yellow to red brown	Brown to black	Black
Molecular components	More polysaccharides	Polysaccharides, proteins, phenols and metals	Different
Functional groups	High →		→ Low
Molecular weight (Dalton)	800 - 9,000	Increasingly until 10^5	Different
C (%)	43 - 52	50 - 62	> 60
O (%)	48 →		→ 30
N (%)	0.5 - 2 →	3 - 8	Different
Solubility	Soluble at any pH value	Increasingly soluble at pH > 2 Insoluble at pH > 2	Insoluble at any pH value
Acid character	Strong →		→ Weak
Water retention and Adsorption capacity	Low →	High	← Low
Cation exchange (CAC, mmol (eq)/hg) (z.B. org. Substanz 150-200)	500 ←		← 180
Mobility in soil	Strong ←		← Weak
Origin	Mainly chemical	Predominantly organic	Through ageing of Fulvates and humates
Occurrence	Predominantly in acidic, nutrient-poor soils with low biotic activity	Predominantly in slightly acidic to neutral, nutrient-rich soils with high biotic activity	In all soils

Source: Classification and properties of humic substances, modified after: SCHROEDER, D. (1992), p. 46

Humic substances

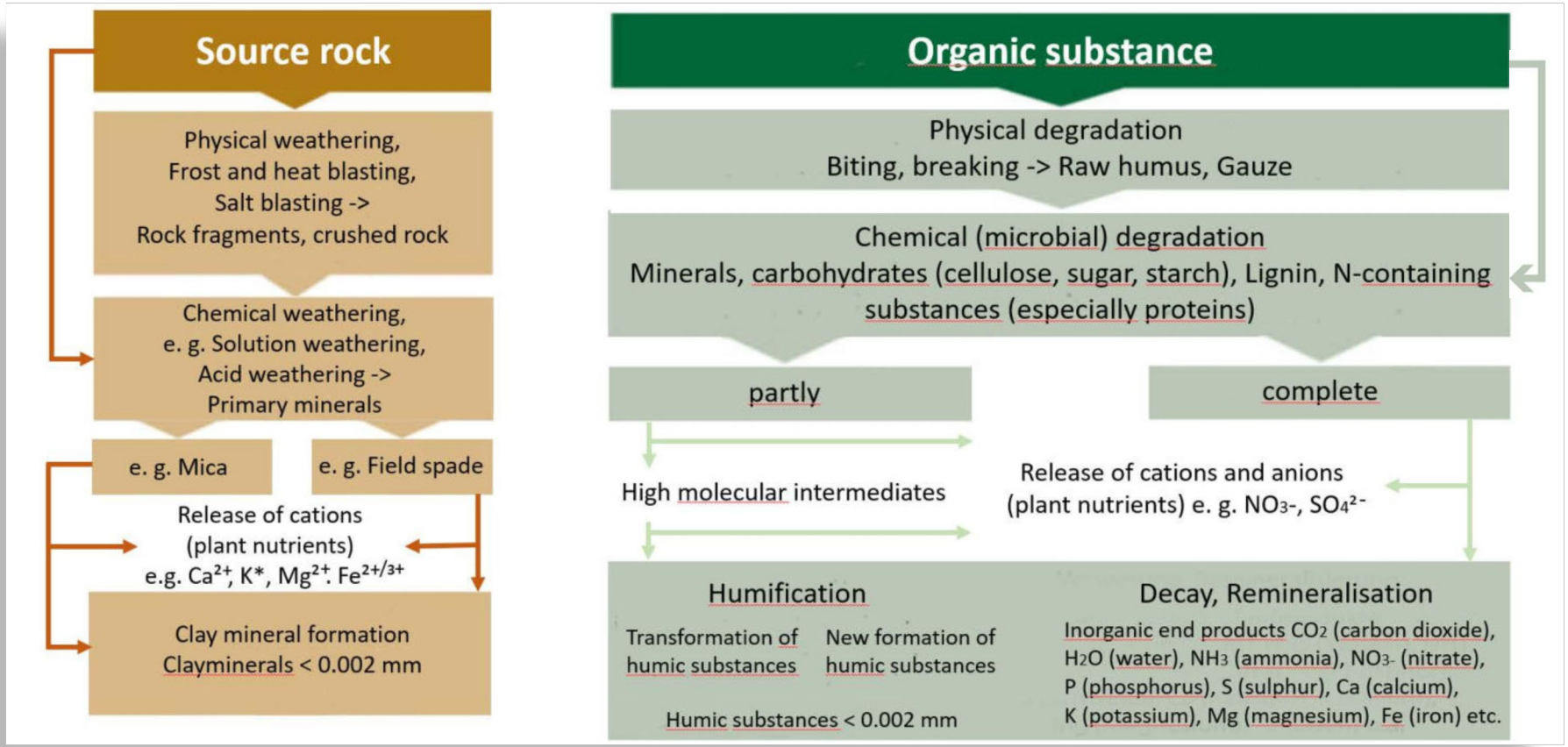
Main effects of the different biostimulant groups

Biostimulant group	Effect on					
	Soil	Nutrient intake	Groth	Quality	Abiotic stress	Diseases and pests
Algae extracts		x	x	x	x	x
Plant extracts			x	x	x	x
Humic substances	**x**	**x**	**x**	**x**	**x**	**x**
Amino acids and peptides		x	x	x	x	x
Chitosans					x	x
Microorganisms	x	x	x		x	x
Inorganic materials	x		x		x	x

Source: Biostimulants - Natural active ingredients for healthy growth, Georg Ebert, ULmer-Verlag, 2019, S. 33

Humic substances

Pedogenesis - the formation of soils



Humic substances

Humic substances … Nature as a model - here the example in the soil

Humus- Defintion

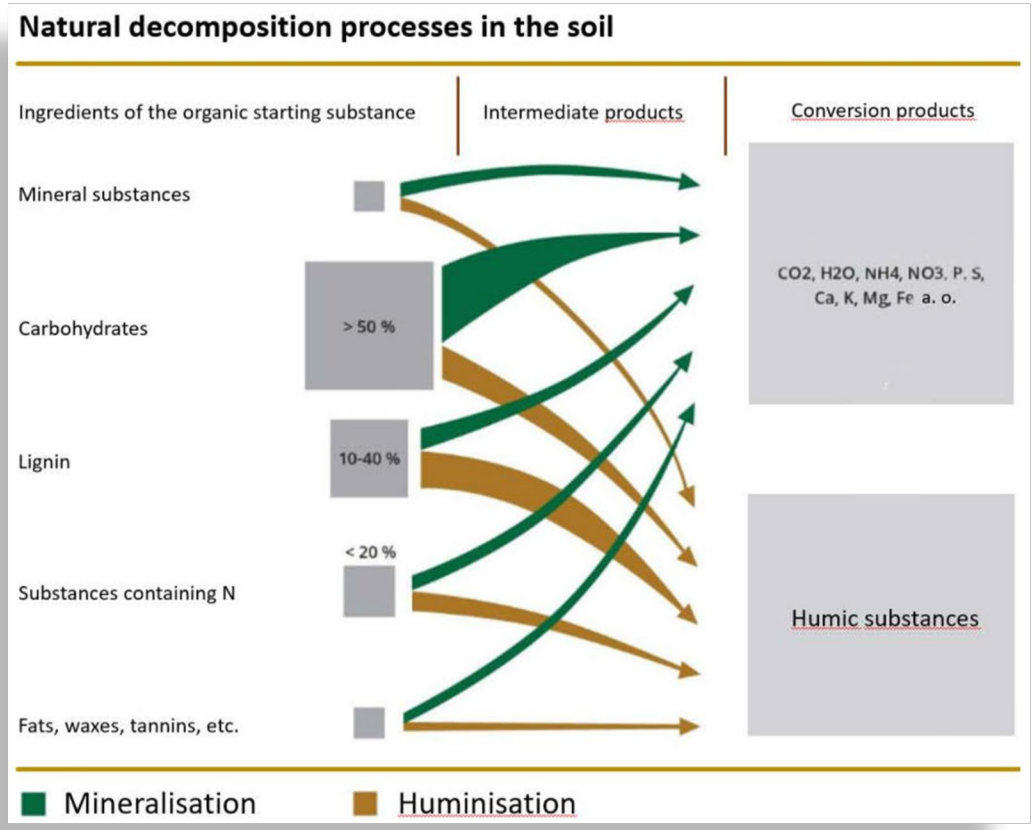
Humus is defined as the totally of the dead organic substances in the soil.
Humus is a complex mixture of organic substances from plant, animal and microbial origin, that is subject to permanent processes of decomposition, conversion and composition.

Source:

BMEL

Additional information

Bundes Umweltamt



Humic substances

Humic substances … Nature as a model - here the example in the soil

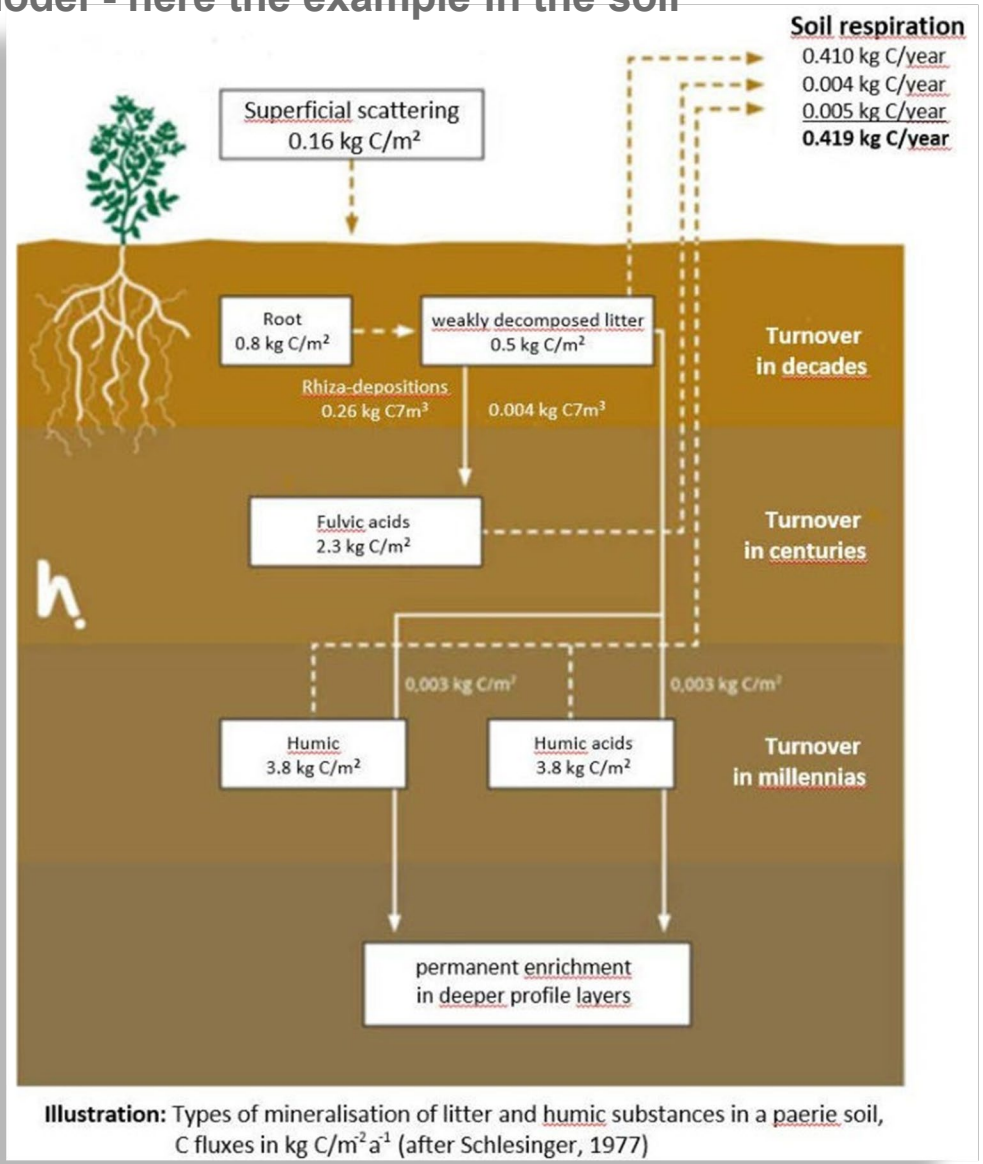
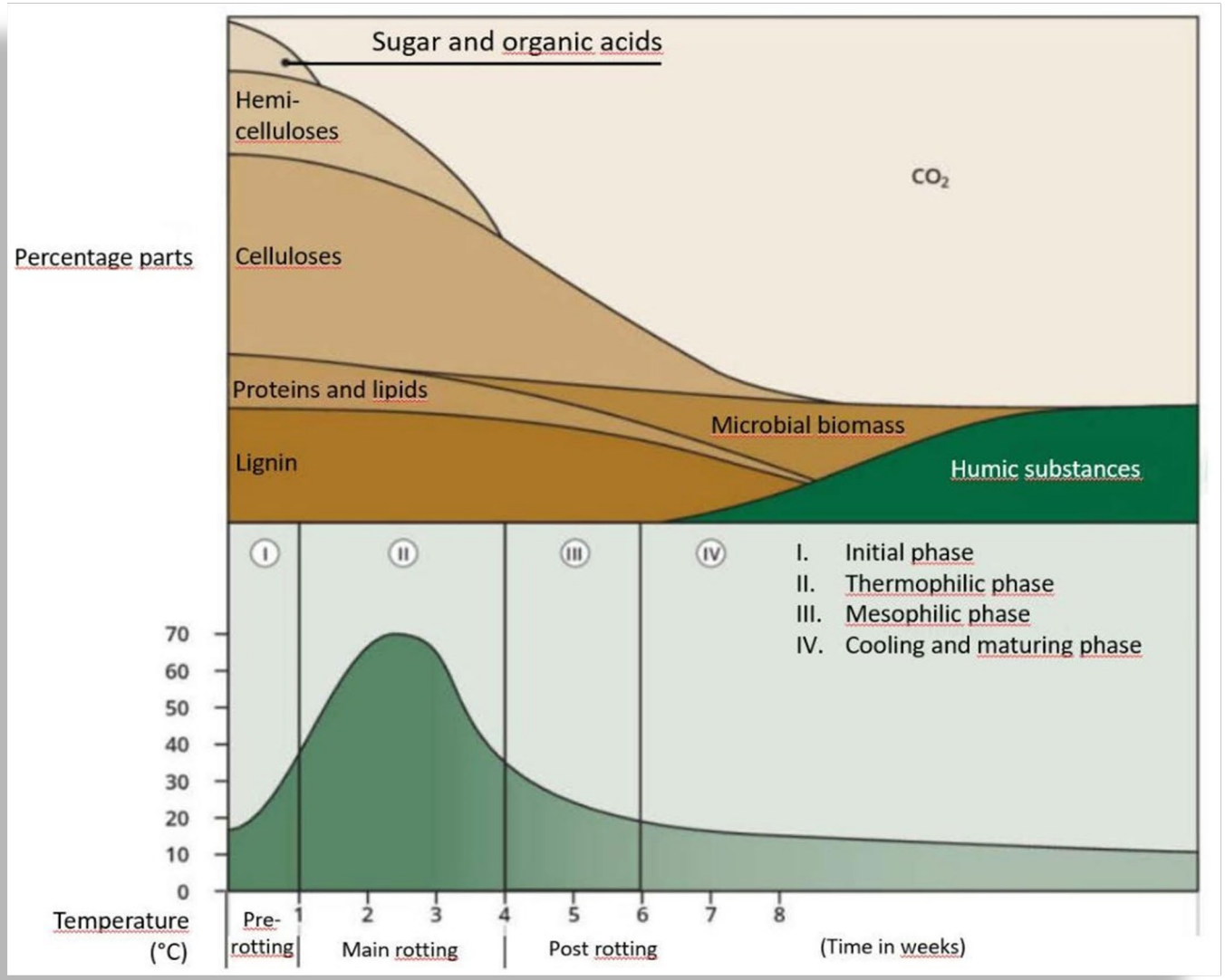


Illustration: Types of mineralisation of litter and humic substances in a paerie soil, C fluxes in kg $C/m^{-2}a^{-1}$ (after Schlesinger, 1977)

Humic substances

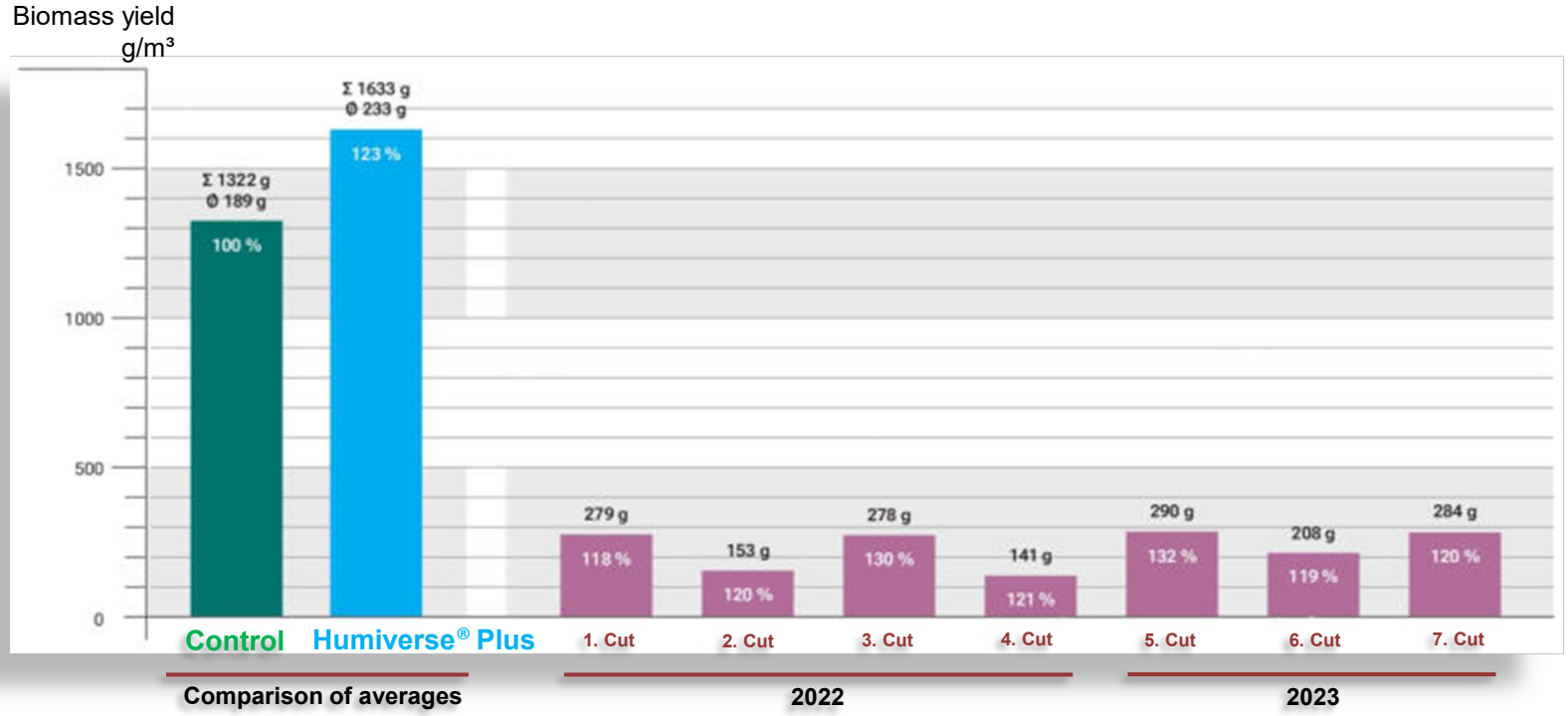
Humic substances … Nature as a model - here the example Compost (organic fertiliser)



HUMIVERSE®Plus - growth substance effect

Greenland and Lysimeter Tests Dr. Naschberger

Comparison of the effect of HUMIVERSE® Plus growth promoters - control on the lawn trial August 2023



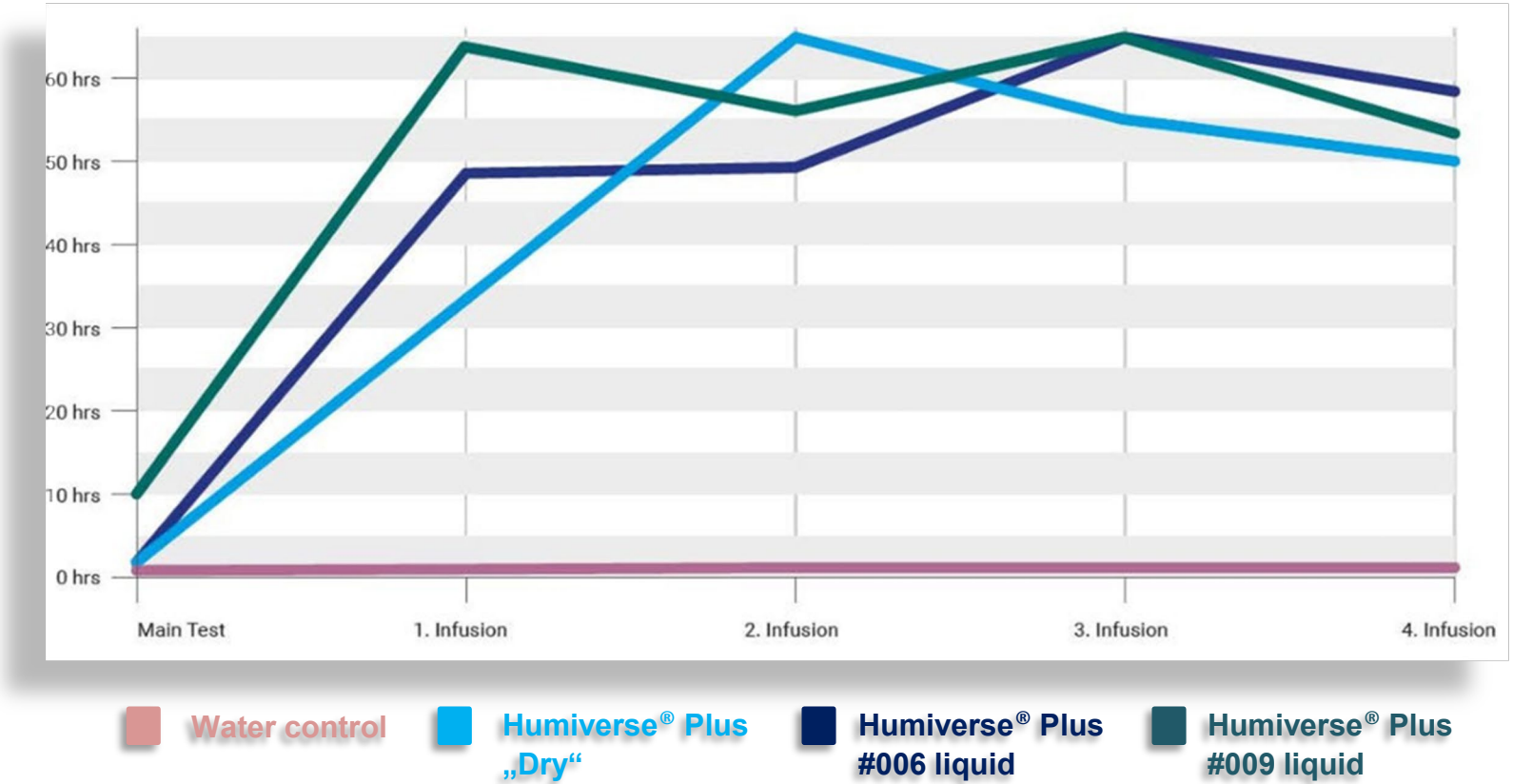
Notes: The trial was set up in May 2022, starting with Humiverse® Plus 10 g/m2 or 100 kg active substance/ha. The second application was made after the 3rd cut in 2023 and was reduced to 5 g/m2 or 50 kg/ha. Fertilisation with 100 g/m2 or 1/tha was applied both in the control and in Humiverse® Plus after the 1st and 3rd cut in 2022 and after the 6th cut (2nd cut in 2023). The first 4 cuts were made in 2022 and the 5th, 6th and 7th cuts were made in 2023. The individual cuts were each compared with the control values collected in parallel.

Resume:The effect of the growth regulator lasted for 15 months, which means that the average yield per harvest was 23 % higher. This is also associated with a 23 % better nutrient utilisation and lower leaching losses.

HUMIVERSE® Plus - water storage

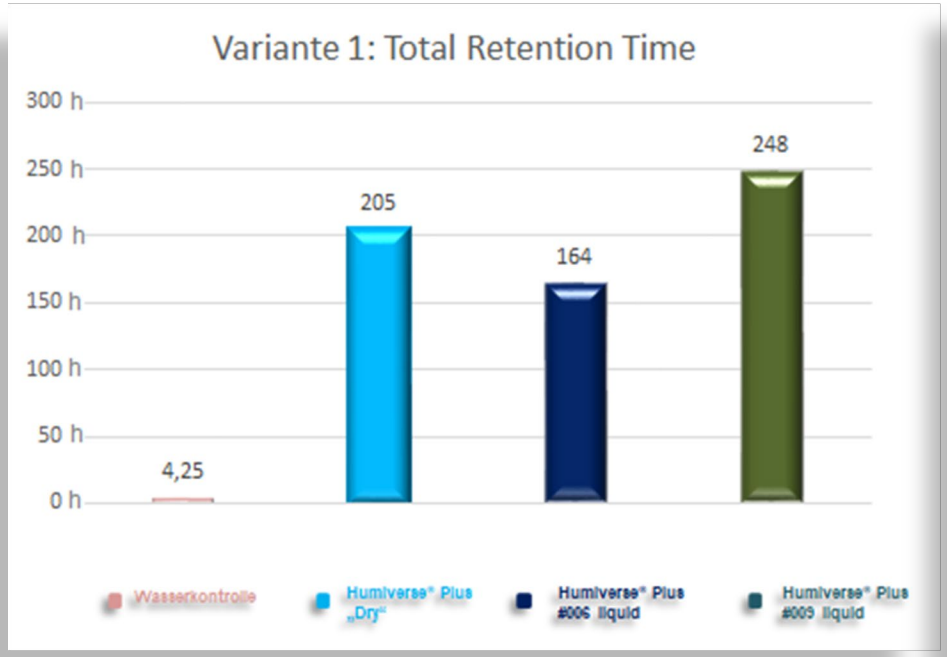
Lysimeter Tests Dr. Naschberger

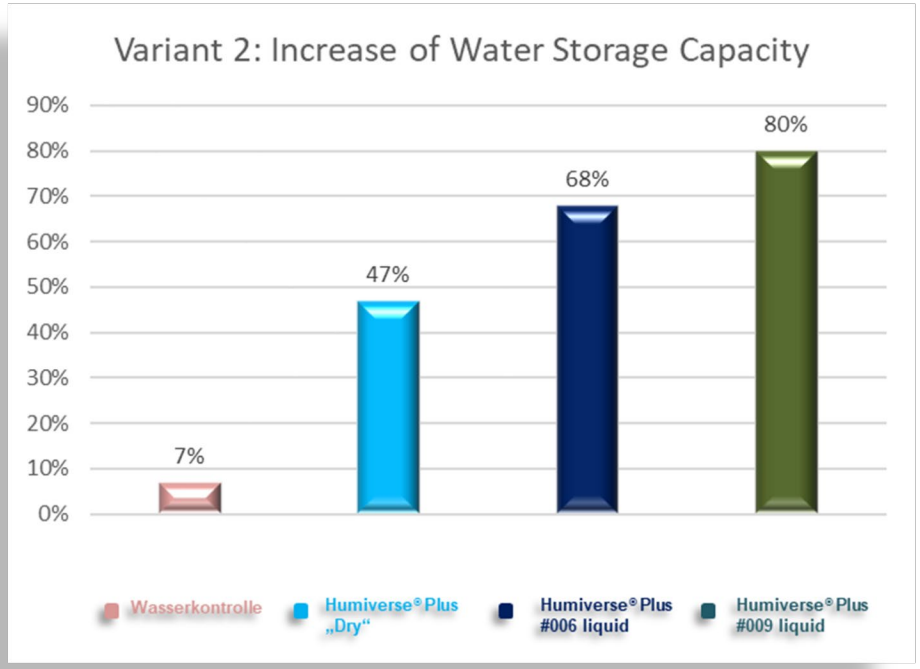
Variant 1: Retention Time



HUMIVERSE®Plus - water storage

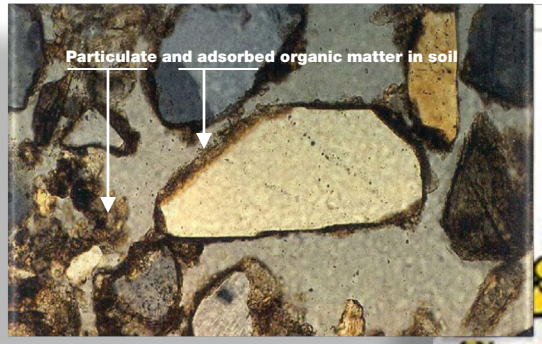
Lysimeter Tests Dr. Naschberger

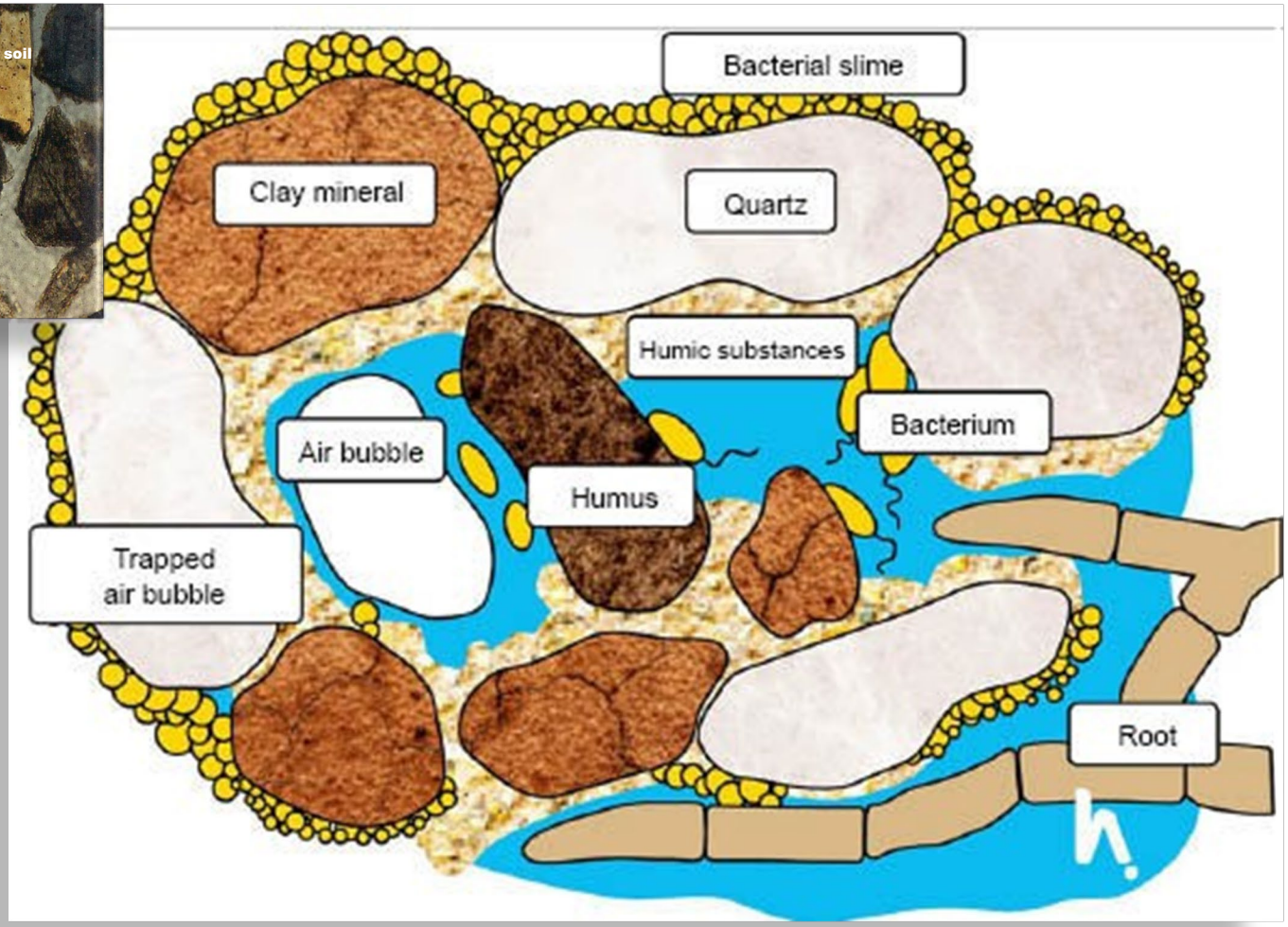




Humic substances

Humic substances…Nature as a Model

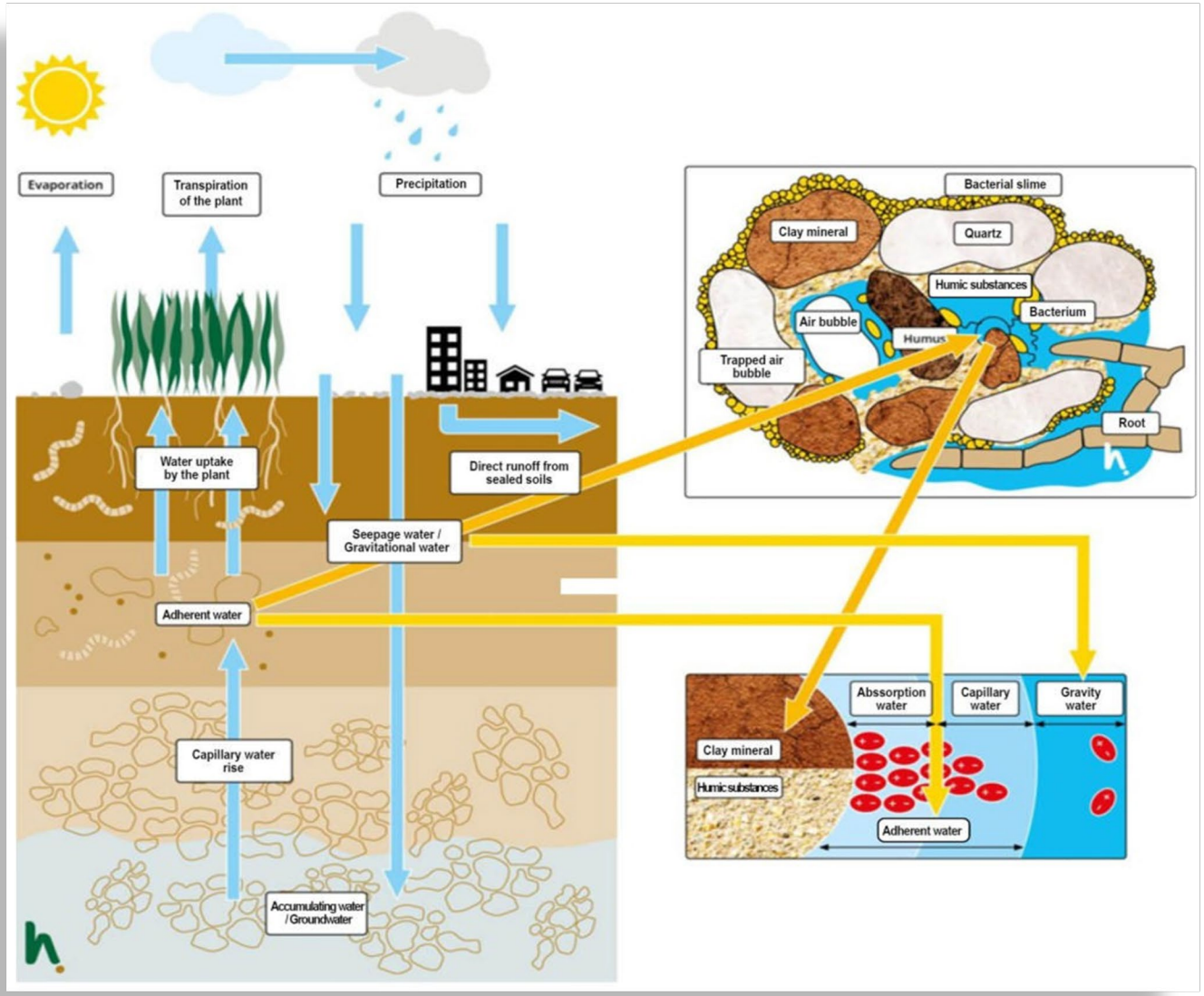




Model of a Humus aggregate: © *Paul & Clark, 1989,*
Changed by Beck, Bayerische Landesanstalt für Landwirtschaft (Bavarian State Institute for Agriculture)

Humic substances

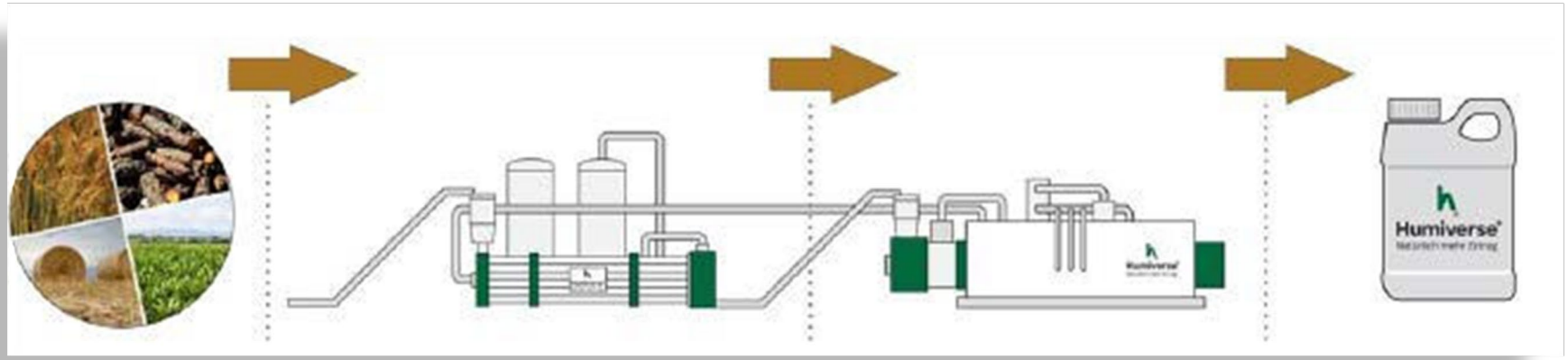
Their function for example, in water balance of the soil



Model of a Humus aggregate: © *Paul & Clark, 1989, Changed by Beck, Bayerische Landesanstalt für Landwirtschaft (Bavarian State Institute for Agriculture)*

Humic substances

HUMIVERSE® ...natural processes implemented in innovative technology



Biomass | Biochar reactor | Humiverse® technology | Product

Benchmarketing "Humic substances“

Humic material analysis according to ISO 19822

Product Manufacturer/Supplier Raw material	**HUMIVERSE®** Terra Optima AG Wood **Renewable**		**Benchmarking** **Product 1** Leonardit / Brown soft coal **Fossil**		**Benchmarking** **Product 2** Leonardit / Brown soft coal **Fossil**		
Laboratory	FITOSOIL LABORATORIOS, S.L., Laboratory entrance: 21.07.2022, Result: 05.10.2022						Method
Characteristics:							
Moisture	0,67 %		4,64 %		15,64 %		PTA-FQ-024, drying at 105ºC
Dry material	99,30 %		95,40 %		84,40 %		PTA-FQ-024, drying at 105ºC
Raw material	FM	**DM**	FM	**DM**	FM	**DM**	
Nutrients							
Total sulphur SO_3	3,810 %	**3,840 %**	4,850 %	**5,890 %**	0,662 %	**0,784 %**	PTA-FQ-027, ICP-AES based on UNE-EN 16963
Humic acid, total content	96,64 %	**97,30 %**	52,90 %	**54,98 %**	52,84 %	**62,72 %**	
Specific total							
Hydrophobic fulvic acids	8,24 %	**8,30 %**	13,50 %	**13,68 %**	4,24 %	**5,02 %**	PTA-FQ-124, calcination, based on ISO 19822 PTA-
Hydrophobic humic acids	88,40 %	**89,00 %**	39,40 %	**41,30 %**	48,60 %	**57,70 %**	FQ-124, calcination, based on ISO 19822

FM = fresh mass
DM = dry mass
Data = Weight percentages

The analyses carried out in this report to verify the conformity of fertilisers in the European Union in accordance with Regulation (EU) 2019/1009 and RD 506/2013 of 28 June have been carried out in a reliable and reproducible manner as they have been carried out in accordance with standards or parts thereof harmonised standards, the references of which have been published in the Official Journal of the European Union and in Annex VI of RD 506/2013 of 28 June, following internal procedures indicated in the field "Methodology". Some of these assays may follow equivalent or alternative methods supported by validation and comparative tests if no harmonised standard is followed or available.

Benchmarketing "Humic substances“

Physical properties + harmful elements

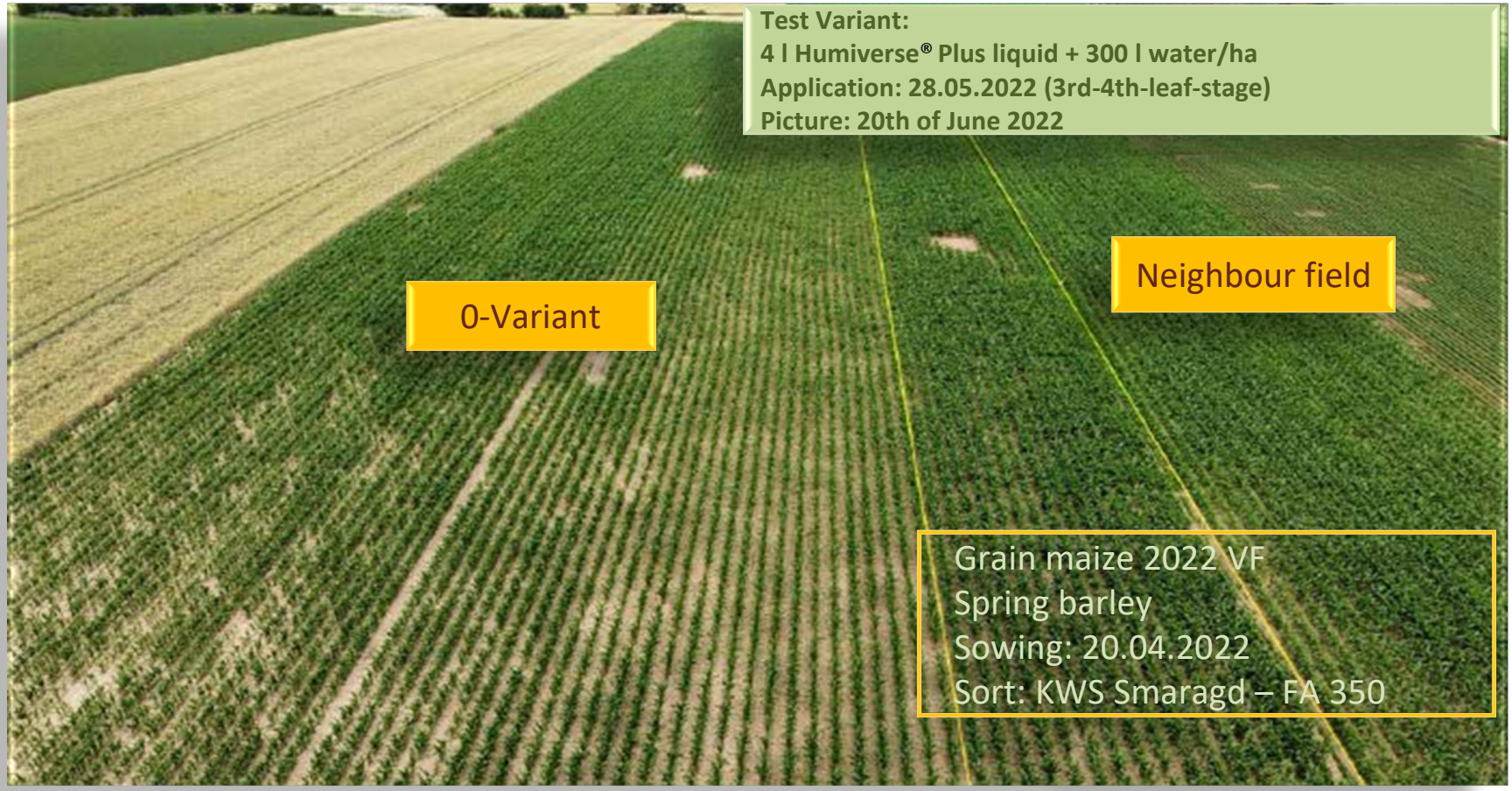
Product			HUMIVERSE®		Benchmarking Product 1		Benchmarking Product 2		Benchmarking Product 3	
Manufacturer/Supplier			Terra Optima AG		Leonardit/ Brown softcoal		Leonardit/ Brown softcoal		Leonardit/ Brown softcoal	
Raw material			Wood Renewable		Fossil		Fossil		Fossil	
Laboratory			Assigned Laborory: AGES, Spargelfeld 191, A-1220 Wien , in Januar 2022							
Physical properties										
pH-value (CaCL2)			9,6	101%	9,5	100%	12,3	129%	4,0	42%
Dry substance		Mass-%	65,3	78%	83,6	100%	94,5	113%	83,2	100%
Organic substance (in DS.)		Mass-%	42,2	59%	72,1	100%	61,2	85%	81,2	113%
Organischer Kohlenstoff (TOC) (in DS.)		Mass-%	60,80	145%	41,90	100%	35,60	85%	52,30	125%
Cewe Laboratory Analysis data Compost(% in DS.) (sample analysis)		AVT-00048	13,6	22,4%	13,6	32,5%	13,6	38,2%	13,6	26,0%
C/N- ratio		Mass-%	160,1	513%	31,2	100%	22,6	72%	48,2	154%
Electrical conductivity		mS/cm	771	6%	13075	100%	34750	266%	2275	17%
In simple terms, the EC value is the salt concentration in the substrate or nutrient solution; high values have a negative effect on plant tolerance!										
Harmful elements										
Lead (Pb), (in DS.)	<LoD 10,0	mg/kg		0%		0%		0%		0%
Cadmium (Cd), (in DS.)	<LoD 0,2	mg/kg		0%	1,10	100%	0,30	27%		0%
Chrome (Cr), (in DS.)	<LoD 5,0	mg/kg		0%	46,00	100%	6,60	14%		0%
Nickel (Ni), (in DS.)	<LoD 5,0	mg/kg		0%	37,80	100%	22,80	60%		0%
Mercury (Hg), (in DS.)		mg/kg	0,031	11%	0,271	100%	0,081	30%	0,232	86%
Quecksilber (Hg)		mg/kg	0,020	9%	0,227	100%	0,076	33%	0,193	85%
Arsenic (As)		mg/kg	0,700	2%	41,50	100%	8,60	21%	9,500	23%

DS = Dry Substance
TOC = Total organic Carbon
LoD = Limit of Determination

Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 1 - Organic market fruit farm in Lower Austria



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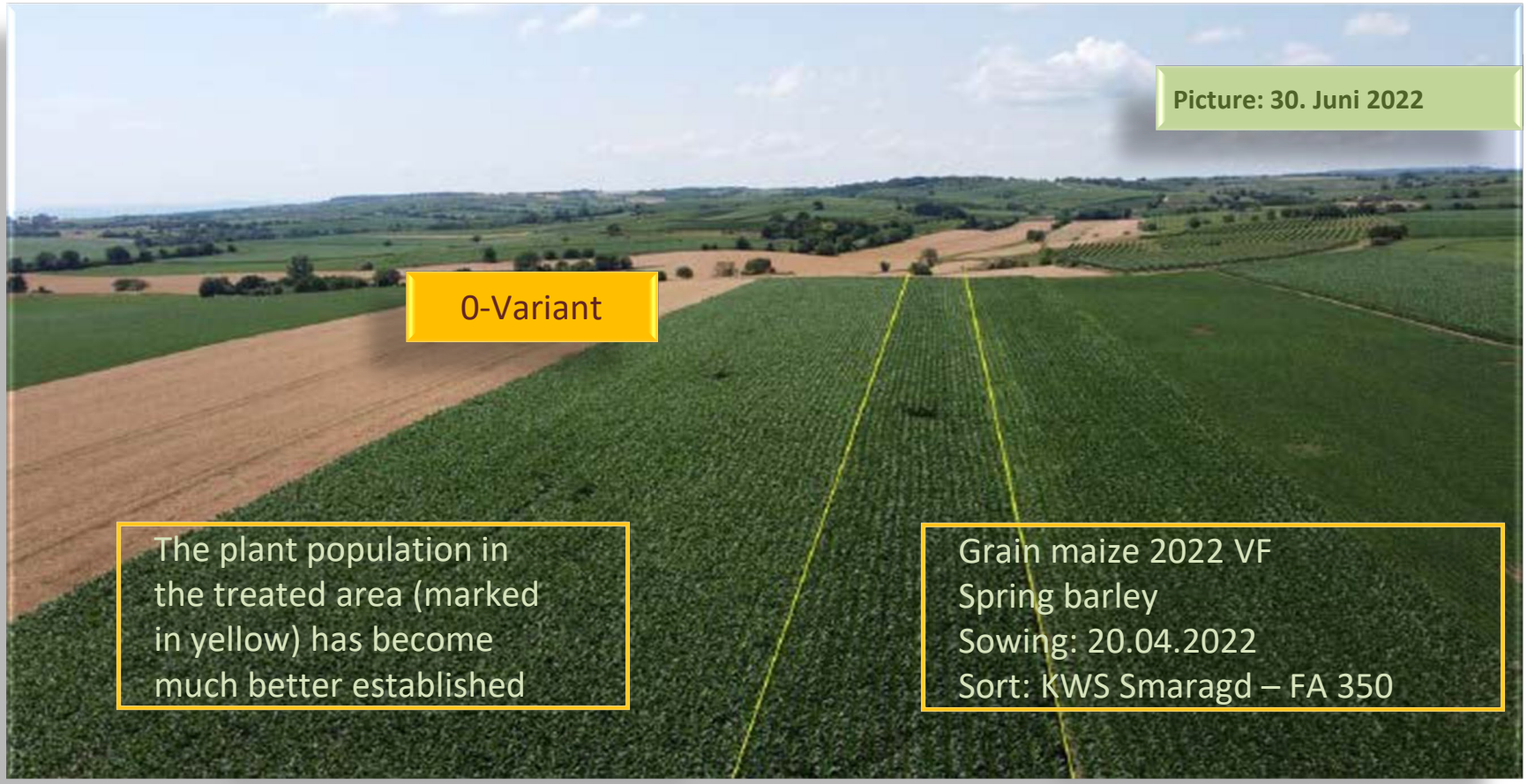

Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 1 - Organic market fruit farm in Lower Austria

Field inspection on 30th of September 2022

Operations Manager Mathias Holzer, A-3470 Großriedenthal (left)

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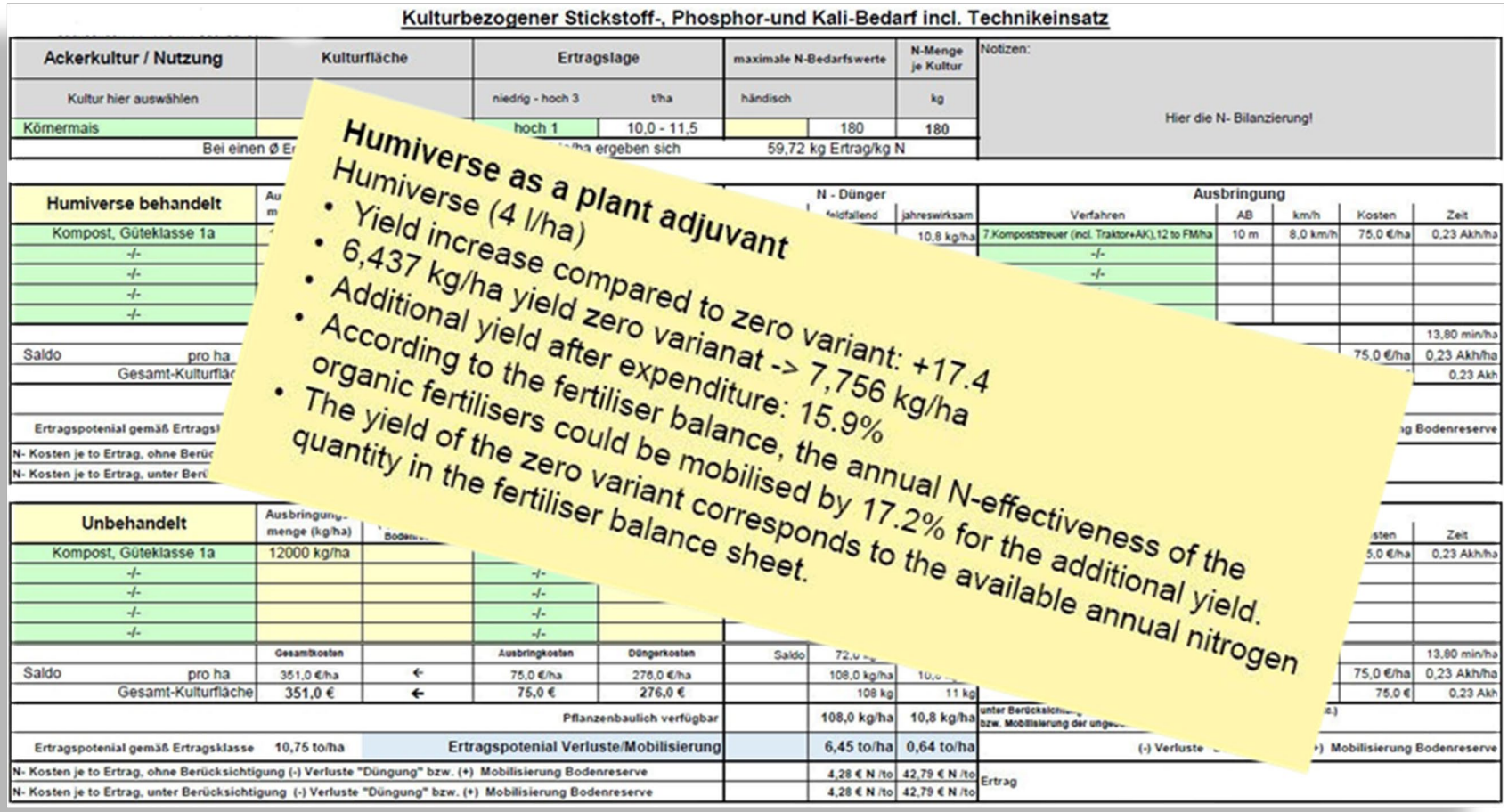


Kulturbezogener Stickstoff-, Phosphor-und Kali-Bedarf incl. Technikeinsatz

Ackerkultur / Nutzung	Kulturfläche	Ertragslage		maximale N-Bedarfswerte		N-Menge je Kultur	Notizen:
Kultur hier auswählen		niedrig - hoch 3	t/ha	händisch		kg	Hier die N- Bilanzierung!
Körnermais		hoch 1	10,0 - 11,5		180	180	
Bei einen Ø Er			ha ergeben sich		59,72 kg Ertrag/kg N		

Humiverse as a plant adjuvant

Humiverse (4 l/ha)

- Yield increase compared to zero variant: +17.4
- 6,437 kg/ha yield zero varianat -> 7,756 kg/ha
- Additional yield after expenditure: 15.9%
- According to the fertiliser balance, the annual N-effectiveness of the organic fertilisers could be mobilised by 17.2% for the additional yield.
- The yield of the zero variant corresponds to the available annual nitrogen quantity in the fertiliser balance sheet.

Humiverse behandelt		N - Dünger feldfallend	N - Dünger jahreswirksam	Ausbringung Verfahren	AB	km/h	Kosten	Zeit
Kompost, Güteklasse 1a			10,8 kg/ha	7.Kompoststreuer (incl. Traktor+AK),12 to FM/ha	10 m	8,0 km/h	75,0 €/ha	0,23 Akh/ha
-/-				-/-				
-/-				-/-				
-/-								
-/-								
								13,80 min/ha
Saldo pro ha							75,0 €/ha	0,23 Akh/ha
Gesamt-Kulturfläc								0,23 Akh
Ertragspotenial gemäß Ertragsk								g Bodenreserve
N- Kosten je to Ertrag, ohne Berüc								
N- Kosten je to Ertrag, unter Berü								

Unbehandelt	Ausbringungsmenge (kg/ha)	Bodenart							Zeit
Kompost, Güteklasse 1a	12000 kg/ha		-/-					5,0 €/ha	0,23 Akh/ha
-/-			-/-						
-/-			-/-						
-/-			-/-						
	Gesamtkosten		Ausbringkosten	Düngerkosten	Saldo	72,0			13,80 min/ha
Saldo pro ha	351,0 €/ha	←	75,0 €/ha	276,0 €/ha		108,0 kg/ha	10,8	75,0 €/ha	0,23 Akh/ha
Gesamt-Kulturfläche	351,0 €	←	75,0 €	276,0 €		108 kg	11 kg	75,0 €	0,23 Akh
			Pflanzenbaulich verfügbar			108,0 kg/ha	10,8 kg/ha		
Ertragspotenial gemäß Ertragsklasse	10,75 to/ha		Ertragspotenial Verluste/Mobilisierung			6,45 to/ha	0,64 to/ha		
N- Kosten je to Ertrag, ohne Berücksichtigung (-) Verluste "Düngung" bzw. (+) Mobilisierung Bodenreserve						4,28 € N /to	42,79 € N /to		
N- Kosten je to Ertrag, unter Berücksichtigung (-) Verluste "Düngung" bzw. (+) Mobilisierung Bodenreserve						4,28 € N /to	42,79 € N /to		

Ausbringung: unter Berücksichtigung bzw. Mobilisierung der ungel... (-) Verluste ... (+) Mobilisierung Bodenreserve

Ertrag

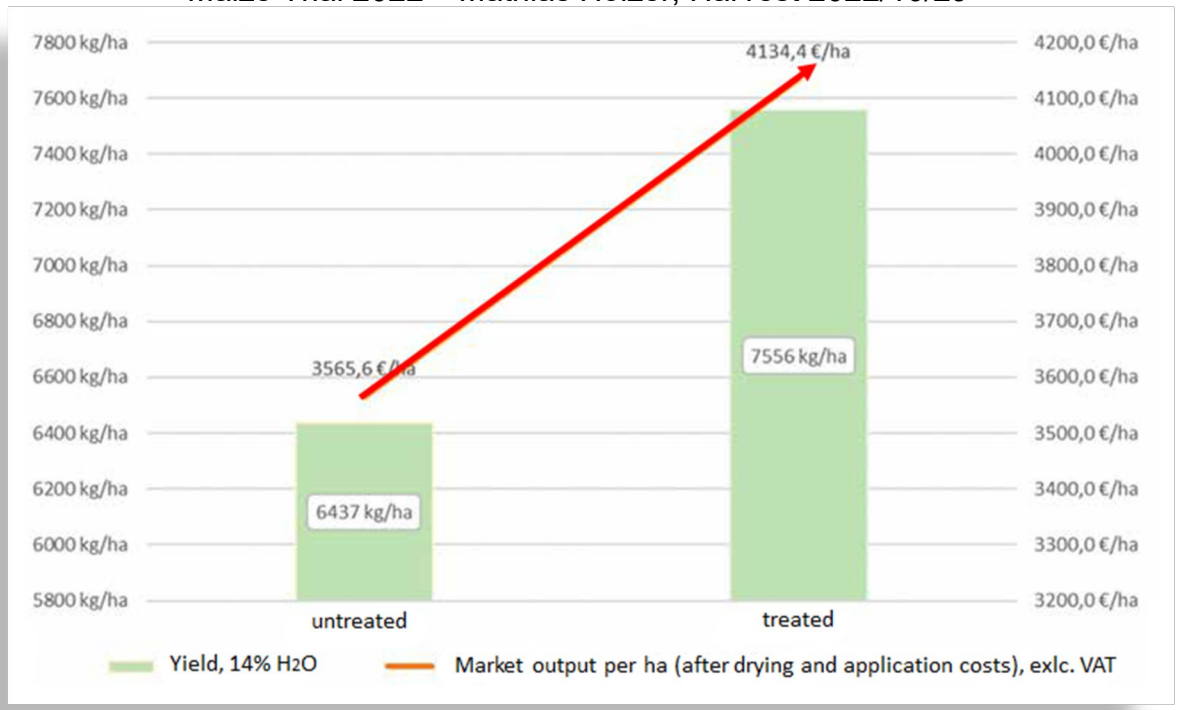
Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 1 - Organic market fruit farm in Lower Austria

Yield increase through the use of Humiverse® Plus

Maize Trial 2022 – Mathias Holzer, Harvest 2022/10/29



Humiverse treateted **-> Additional Yield 17%** **-> 568,80 €/ha additional revenue**

Application costs: 28,20 €/ha **Humiverse® Plus** + 24,80 €/ha Field sprayer/Tractor/Manpower = 53,00 €/ha excl. VAT
Market price Bio 475 €/t excl. VAT (Calendar week 43/2022) at 14% H_2O, Weight correction factor 1,325

Climate-friendly soils through innovations

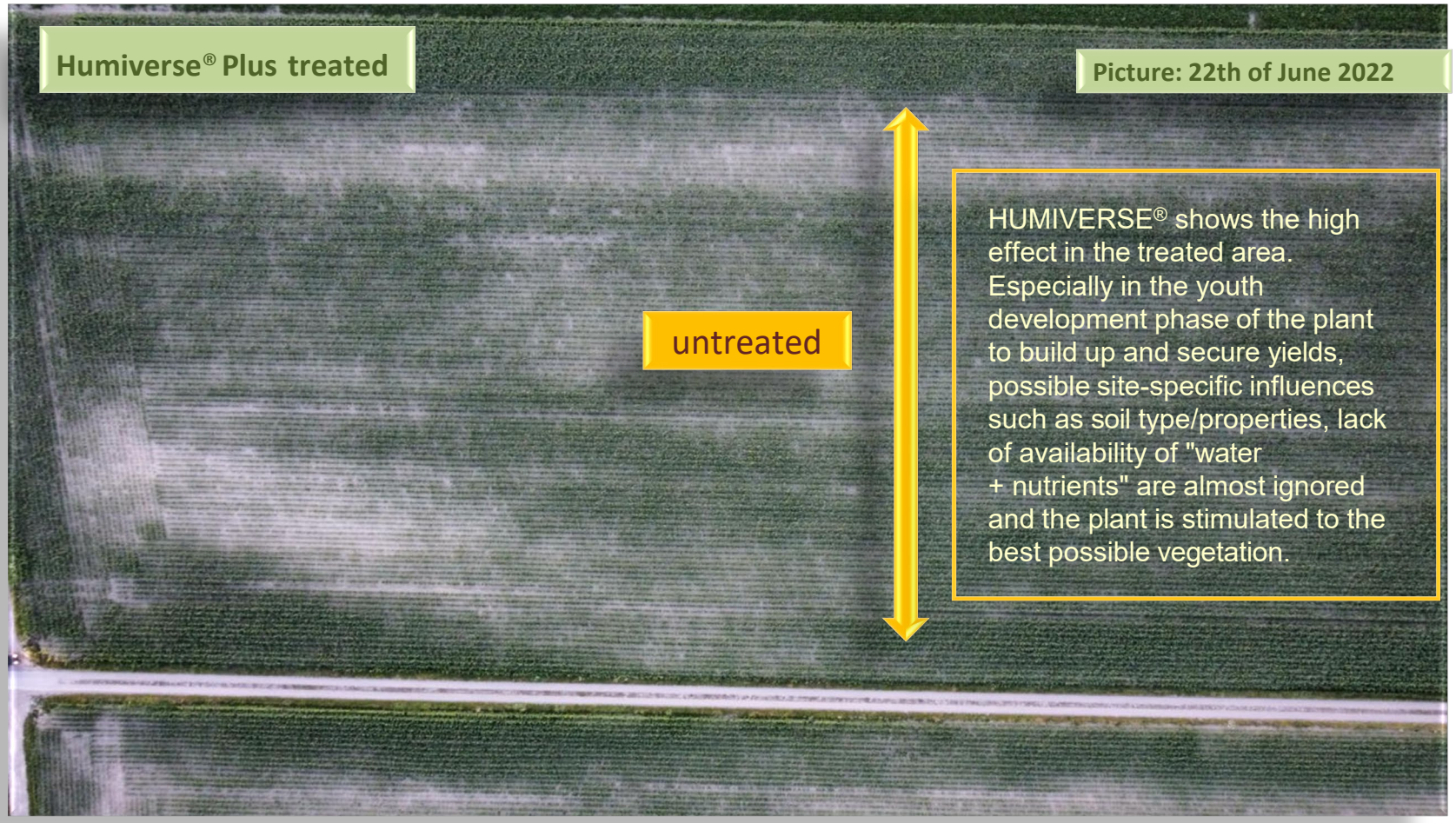
Use of Humiverse® Plus „Leaf Application“

Practical example 2 - Conventional market fruit farm in Lower Austria

Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 2 - Conventional market fruit farm in Lower Austria



Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 2 - Conventional market fruit farm in Lower Austria

Climate-friendly soils through innovations

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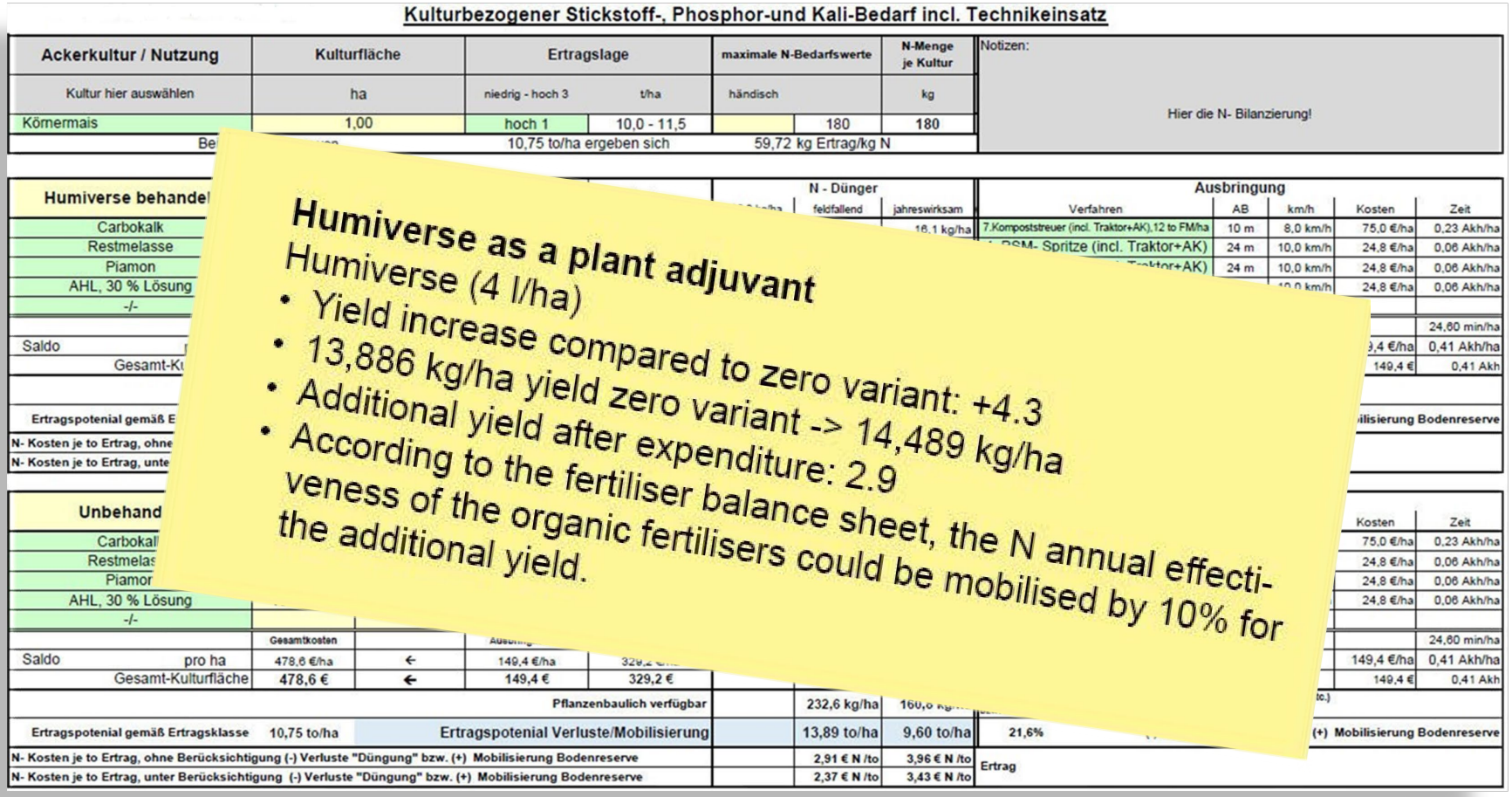

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Körnermais	1,00	hoch 1	10,0 - 11,5		180	180	
Be		10,75 to/ha ergeben sich		59,72 kg Ertrag/kg N			

Humiverse as a plant adjuvant

Humiverse (4 l/ha)

- Yield increase compared to zero variant: +4.3
- 13,886 kg/ha yield zero variant -> 14,489 kg/ha
- Additional yield after expenditure: 2.9
- According to the fertiliser balance sheet, the N annual effectiveness of the organic fertilisers could be mobilised by 10% for the additional yield.

Humiverse behandel	N - Dünger feldfallend	N - Dünger jahreswirksam	Ausbringung Verfahren	AB	km/h	Kosten	Zeit
Carbokalk		16,1 kg/ha	7.Kompoststreuer (incl. Traktor+AK),12 to FM/ha	10 m	8,0 km/h	75,0 €/ha	0,23 Akh/ha
Restmelasse			PSM- Spritze (incl. Traktor+AK)	24 m	10,0 km/h	24,8 €/ha	0,06 Akh/ha
Piamon			Traktor+AK)	24 m	10,0 km/h	24,8 €/ha	0,06 Akh/ha
AHL, 30 % Lösung					10,0 km/h	24,8 €/ha	0,06 Akh/ha
-/-							
							24,60 min/ha
Saldo						,4 €/ha	0,41 Akh/ha
Gesamt-Ku						149,4 €	0,41 Akh
Ertragspotenial gemäß E						ilisierung Bodenreserve	
N- Kosten je to Ertrag, ohne							
N- Kosten je to Ertrag, unte							

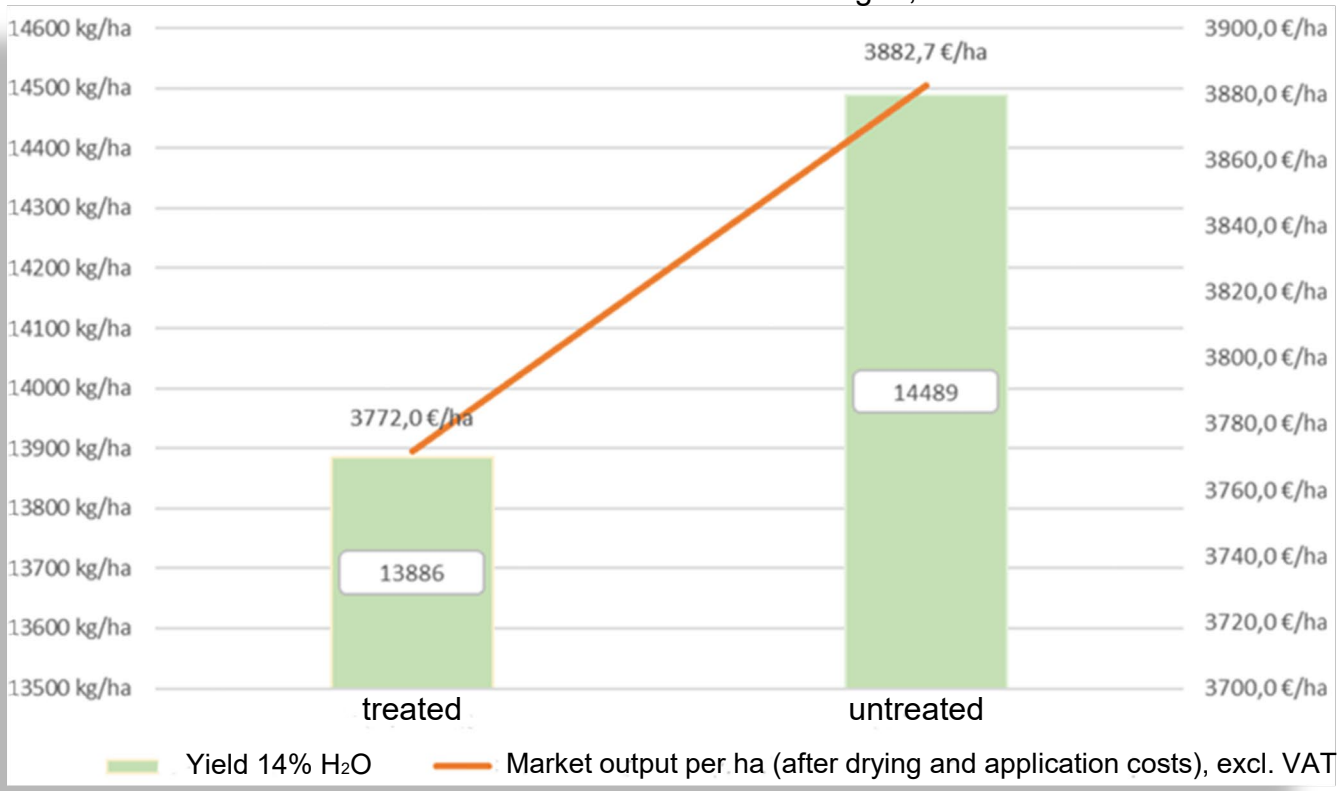
Unbehand							Kosten	Zeit
Carbokal							75,0 €/ha	0,23 Akh/ha
Restmelas							24,8 €/ha	0,06 Akh/ha
Piamor							24,8 €/ha	0,06 Akh/ha
AHL, 30 % Lösung							24,8 €/ha	0,06 Akh/ha
-/-								
	Gesamtkosten							24,60 min/ha
Saldo pro ha	478,6 €/ha	←	149,4 €/ha	329,2 €			149,4 €/ha	0,41 Akh/ha
Gesamt-Kulturfläche	478,6 €	←	149,4 €	329,2 €			149,4 €	0,41 Akh
				Pflanzenbaulich verfügbar		232,6 kg/ha	160,6 kg	
Ertragspotenial gemäß Ertragsklasse	10,75 to/ha		Ertragspotenial Verluste/Mobilisierung			13,89 to/ha	9,60 to/ha	21,6%
N- Kosten je to Ertrag, ohne Berücksichtigung (-) Verluste "Düngung" bzw. (+) Mobilisierung Bodenreserve						2,91 € N /to	3,96 € N /to	
N- Kosten je to Ertrag, unter Berücksichtigung (-) Verluste "Düngung" bzw. (+) Mobilisierung Bodenreserve						2,37 € N /to	3,43 € N /to	

Climate-friendly soils through innovations

Use of Humiverse® Plus „Leaf Application“

Practical example 2 - Conventional market fruit farm in Lower Austria

Humiverse® Plus Maize trial 2022 – Marianne Pegler, Ernte 30.10.222

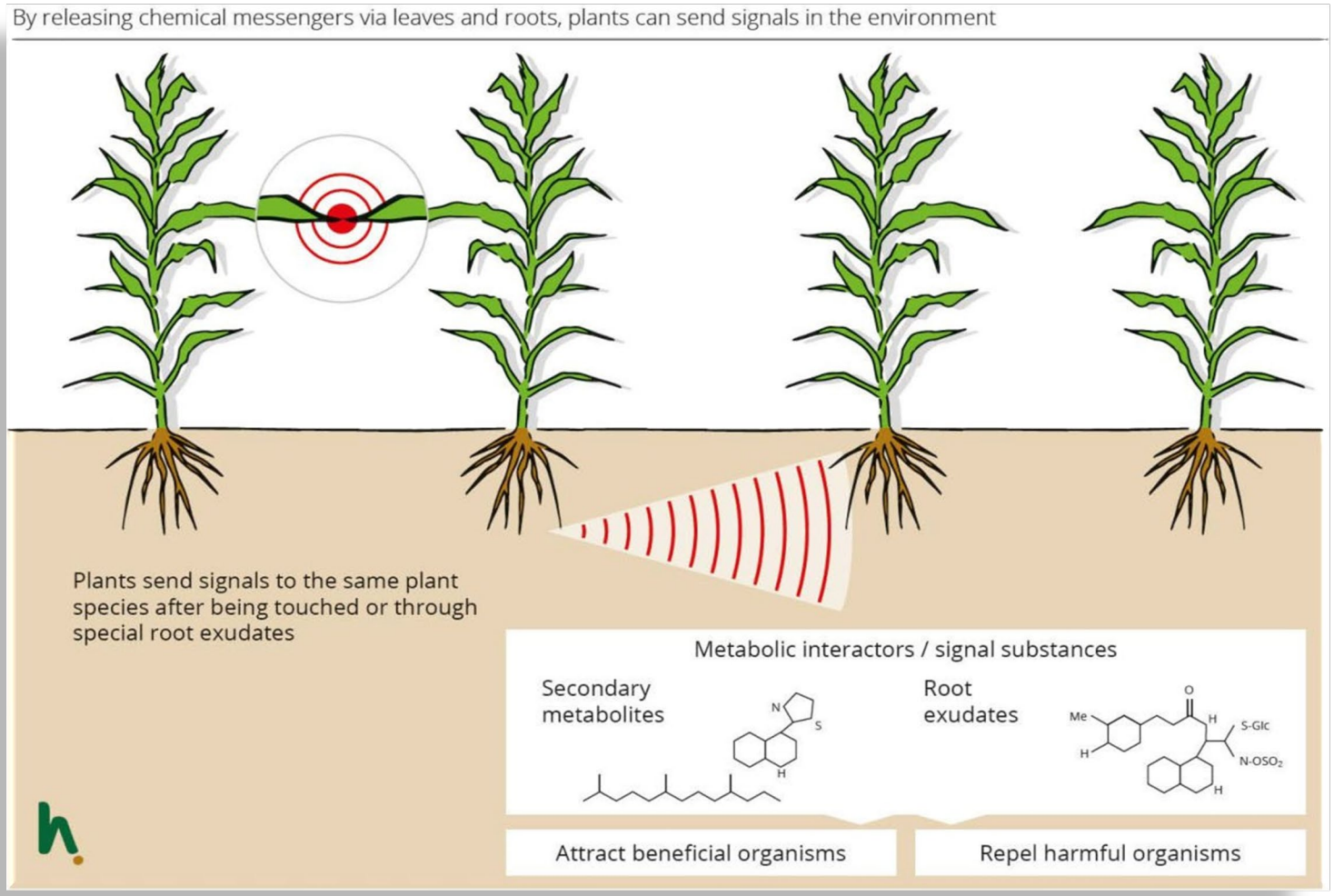


Humiverse® treateted **-> Additional Yield 4 %** **-> 110,70 €/ha additional revenue**

Application costs: 28,20 €/ha **Humiverse® Plus** + 24,80 €/ha Field sprayer/Tractor/Manpower = 53,00 €/ha excl. VAT
Market price Ethanol Wet maize 217,50 €/t excl. VAT (Calendar week 43/2022) at 30% H_2O, Weight correction factor 1,325

Humic substances

Networked flora



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More Yield the Natural Way

Farming Practice

Practical farms "Nutrient coating - Coating“

Franz Grötschl
A - 7321 Lackendorf

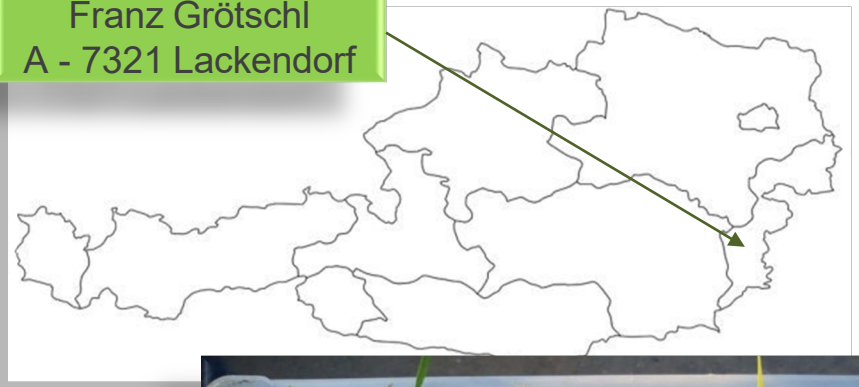


Photo delivered from farmer on 14th of November 2022

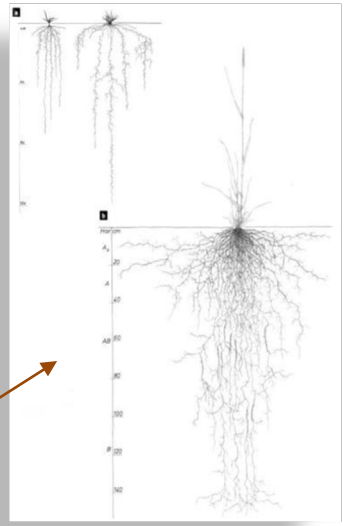
uncoated

coated

Farming Practice

What influence do available nutrients from deeper soil layers have on yield?

Arable crop/utilisation	Yield situation	Fertilisation as required According to the guideline for proper fertilisation as amended		
Wheat > 14% RP	High 1 5,5 – 6,75 to/ha	N kg/ha (ohne Verluste)	P_2O_5 kg/ha	K_2O kg/ha
	Ø 6,13 to/ha	170 kg/ha	65 kg/ha	90 kg/ha
kg Yield / Fertiliser		36,06 kg Yield/kg N	94,31 kg Yield/kg P2O5	68,11 kg Yield/kg K2O
g/m²	613 g/m²	17 g/m²	6,5 g/m²	9,5 g/m²
Comparative weight (example €-coins /m²)				



Soft wheat (winter wheat), *Triticum aestivum*
a) Left: H-T-S = 7-74-27 cm; 70 days after sowing on 02.12.1956, right: H-T-S = 7-120-54 cm, after winter dormancy on 22.03.1957, both near Grafenstein, Ktn., AT, 418 m above sea level. Field on mullgley soil.
b) H-T-S = 93-153-128 cm, near St. Donat, Carinthia, AT, 482 m above sea level. Field on brown soil, June 2003.
c) (Kutschera 1966, Fig. 9, Kutschera et al. 2009, Fig. 49

Farming Practice

Practical farms "Foliar application“ on Rape

Florian Hundsberger
A – 4493 Wolfern

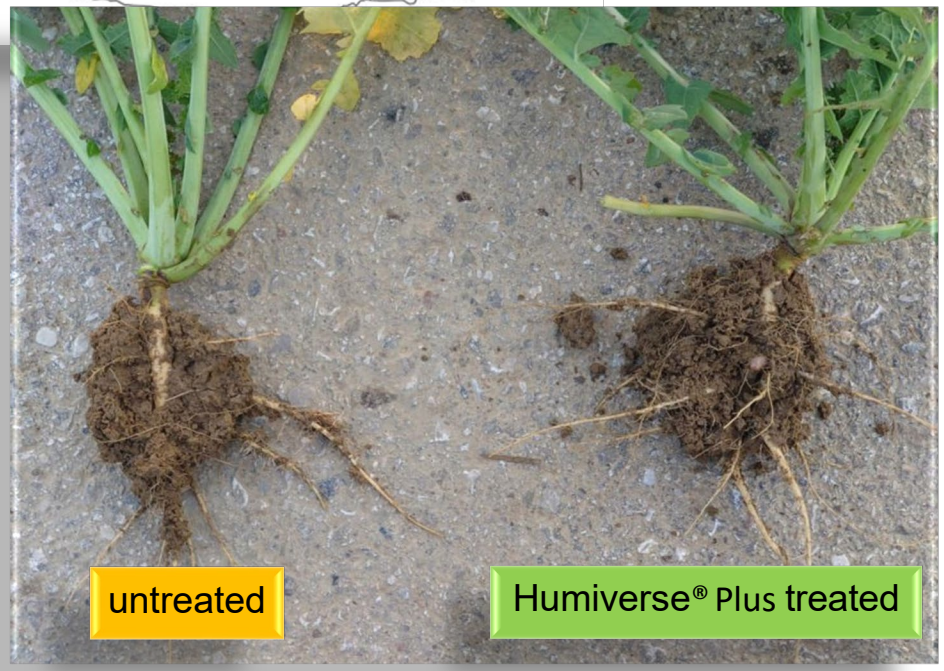


Photo: F. Hundsberger on 07.11.2022

Farming Practice

Practice farms "Seed- Nutrient coating" - Winter cereals

Thomas Roch
A – 3711 Gross Meiseldorf

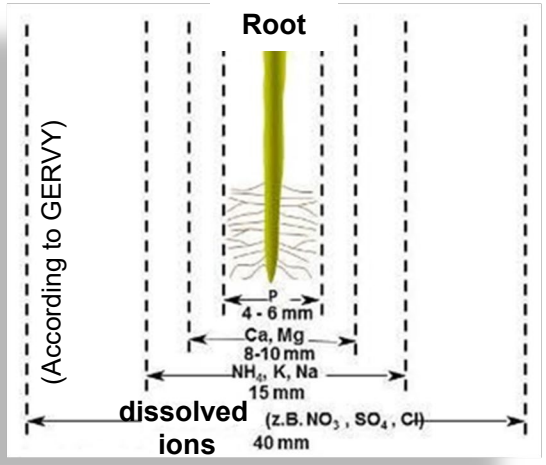
Photo: Th. Roch on 15.02.2023

Farming Practice

Application: Seed - nutrient coating

- **Seed nutrient coating**
  - 0,4 – 0,5 % solution -> 400 - 500 ml/ 100 kg seed
  - dilute with water if necessary
- **Planting potatos**
  - 5 l/ha or 0,5 ml/m²
  - Recommended water application rate: 250 l/ha or 25 ml/m² (2,0% Mixture)

Areas around the plant root from which the various nutrients are extracted



Placed fertilization is particularly suitable for nutrients that are not very mobile in the soil (e.g. phosphate, magnesium or ammonium nitrogen).

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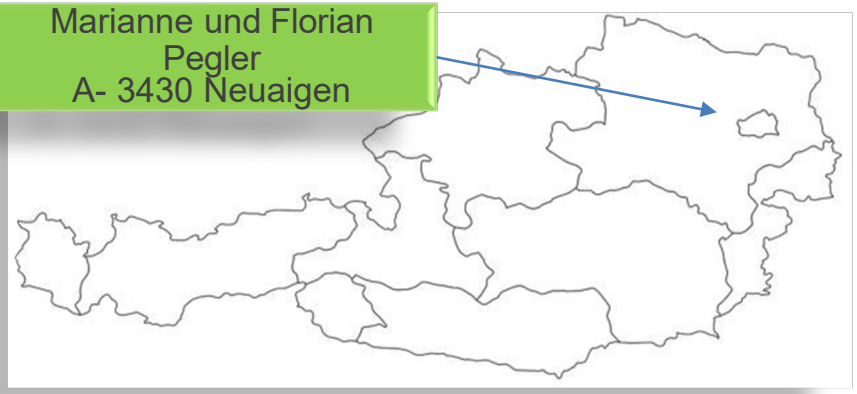
Farming Practice

Example: "leaf application“

Marianne und Florian Pegler
A- 3430 Neuaigen



Pictures of the farmers from 07.01. respectively 12.02.2023

- **Enzymatic effect on the formation of important plant hormones**
- **Improvement of nutrient absorption (activity / root extracts)**
- **Increased resistance to abiotic stress, e.g. frost, drought, heat, UV radiation, saline soils, nutrient deficiencies and pH value deviations**
- **Support of root growth (rhizosphere, gravitropism**
- **General growth stimulation (seed germination, flowering and fruit development)**

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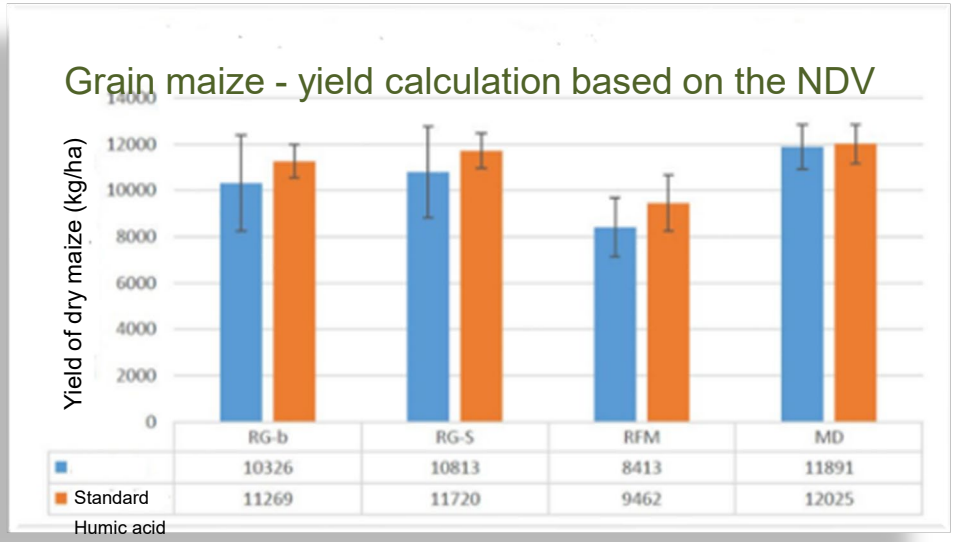
Farming Practice

Innovation Farm Wieselburg 2022

Innovation Farm
A – 3250 Wieselburg



"Humiverse® Plus as a soil additive"

0.6 % of soil volume
=> 3240 l or kg HS/ha

- RG-B->Cattle slurry wide distribution 80 kg N/ha
- RG-S->Cattle slurry drag-out, 80 kg/ha
- RFM ->Cattle solid manure, 80kg N/ha
- MD->mineral fertilisation, 170kg/ha NAC/ KAS

Farming Practice

Application: Carrots

Field study
Holger Buck, Naturland Consulting Specialist Field Vegetables (in cooperation with)
Beckmann und Brehm GmbH

Testing conditions and methods:

- Water application rate: 300 l/ha
- Humiverse® Plus application rate: 4 l/ha
- Soil type: IS
- Variety: Novara F1
  (115 growing days, Bejo)
- Sowing: 8th of Mai 2023
  1,6 Mio grain/ha (160 grain/m²)
- Field: 27248 Wesenstedt, Germany organic/natural farm H. Kanzelmeier
- The treatment date: 14.6.2023, BBCH 14

Farming Practice

Application: Carrots

Field study
Holger Buck, Naturland Consulting Specialist Field Vegetables (in cooperation with)
Beckmann und Brehm GmbH

Testing results summary:

- The single application of the product Humiverse® Plus resulted in **a 28 dt/ha higher yield (gross) of organic food carrots** compared to the control.

- The single application was carried out as a foliar treatment on 14.6.2023 at BBCH 14.

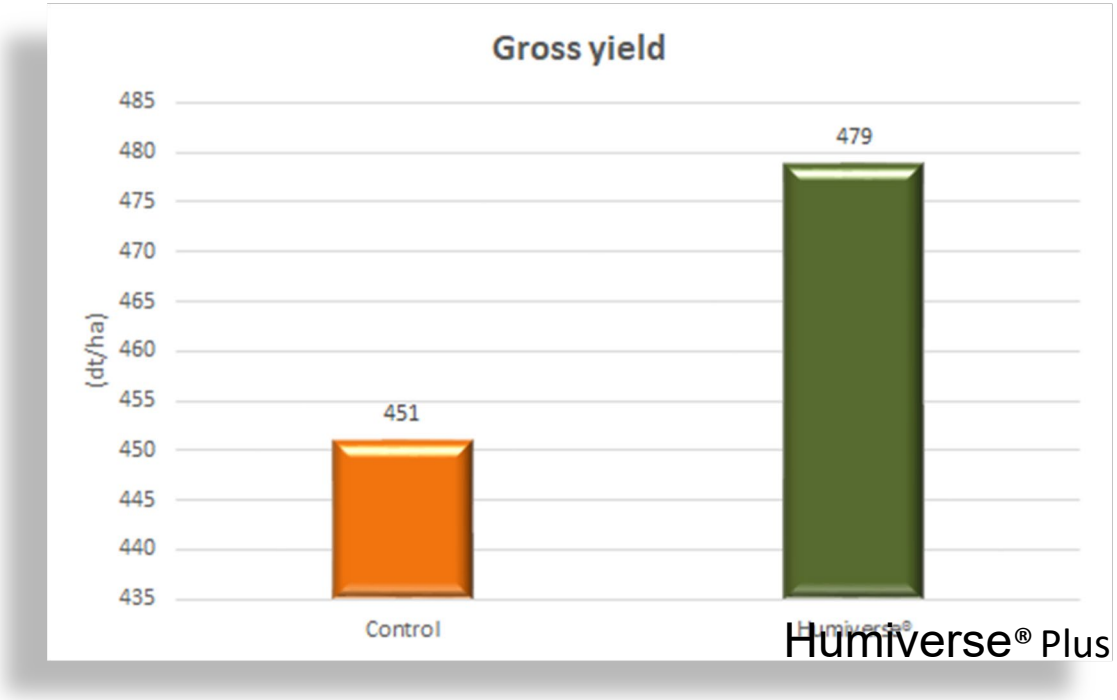
Trail plot on 31st of July 2023
Picture made by Naturland

Farming Practice

Application: Carrots

Field study
Holger Buck, Naturland Consulting Specialist Field Vegetables (in cooperation with)
Beckmann und Brehm GmbH

Testing result on yield



Farming Practice

Application: Viticulture

Field study under the scientific supervision of
Dr. Eduard G. Taufratzhofer, Weinbau und Biotechnologie, Gumpoldskirchen, Austria
(In cooperation with)
Agrana AG, Vienna, Austria

Testing conditions and methods:

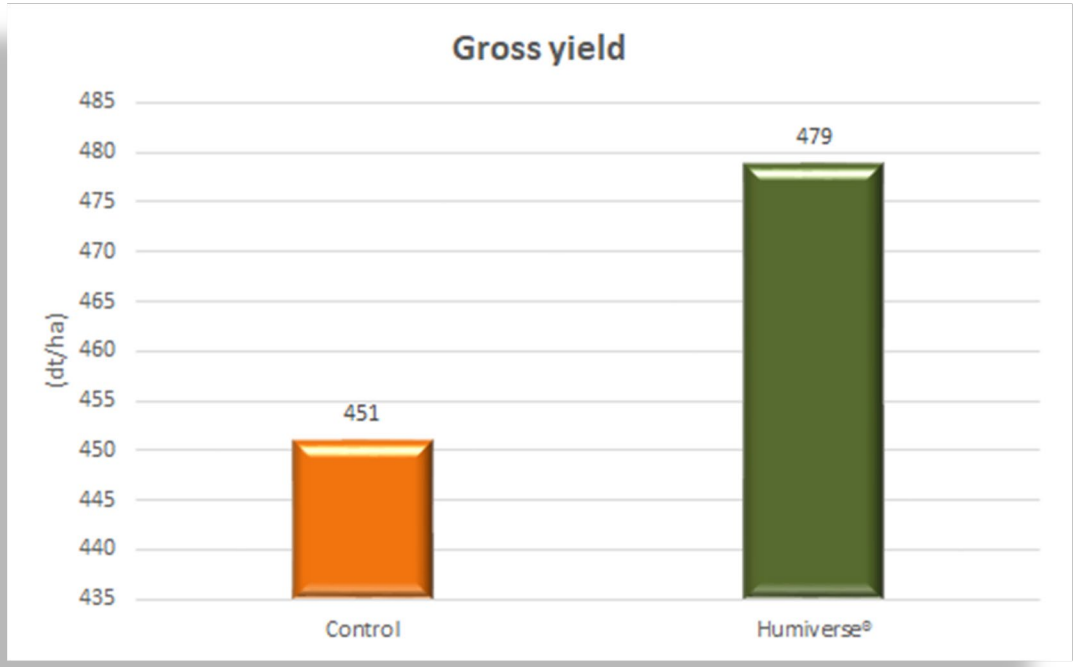
- 3-year-field study
- Resultperiod: 1st year (2023)
- Use of Humiverse® Plus in liquid form
- Grape yield: each individual plot recorded in its entirety
- Sugar gradation as a Klosterneuburg cider scale
- Visual evaluation of the grapes
- Leaf analyses: (N, P, K, Fe, Mn)
- Application according to the application notices (slide number 46)

Farming Practice

Application: Viticulture

Field study under the scientific supervision of
Dr. Eduard G. Taufratzhofer, Weinbau und Biotechnologie, Gumpoldskirchen, Austria
(In cooperation with)
Agrana AG, Vienna, Austria

Testing results in 2023 (1st year)



Humiverse®
More Yield the Natural Way

Farming Practice

Application: Viticulture

Field study under the scientific supervision of
Dr. Eduard G. Taufratzhofer, Weinbau und Biotechnologie, Gumpoldskirchen, Austria
(In cooperation with)
Agrana AG, Vienna, Austria

Results in 2023 (1st year)

- **"Specific yield potential" +15%**
  (as a mixture of)
  - grape yield +18 %
  - sugar yield +15 %

  (in relation to the control).

Farming Practice

Application: Viticulture

Field study under the scientific supervision of
Dr. Eduard G. Taufratzhofer, Weinbau und Biotechnologie, Gumpoldskirchen, Austria
(In cooperation with)
Agrana AG, Vienna, Austria

Results in 2023 (1st year)

- As already shown in folder 31 – 36 the application of Humiverse® Plus principally leads to a significant improvement in root formation in the relevant field trials.
- This affects both:
  - the absorption capacity of water and nutrients, as well as
  - growth in deeper soil layers.
- The same effects have also been observed in grapevines.

Recommendations for use of Humiverse® Plus

Soil additive

Arable soils

➢ Sandy soils, humus < 2.0 %	25 – 75 l/ha resp. 2,5 – 7,5 ml/m²
➢ Sandy soils, humus > 2.0 %	25 – 50 l/ha resp. 2,5 – 5,0 ml/m²
➢ Loess soils, humus < 2.0 %	25 – 60 l/ha resp. 2,5 – 6,5 ml/m²
➢ Loess soils, humus < 2.0 %	25 – 45 l/ha resp. 2,5 – 4,5 ml/m²
➢ Clay soils, humus < 2.0 %	20 – 50 l/ha resp. 2,0 – 5,0 ml/m²
➢ Clay soils, humus > 2.0 %	20 – 45 l/ha resp. 2,0 – 4,5 ml/m²
Recommended water application rate:	500 l/ha resp. 50 ml/m²

Gardening

➢ Garden soil in the greenhouse	2,5 – 4,5 ml/m²
➢ Garden soil in the open field	2,0 – 5,0 ml/m²
Recommended water application rate:	500 ml/m²

➢ Multiple application in splitting is recommended, solution mixtures above 2.0 % can lead to technical problems in the process!

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Recommendations for use of Humiverse® Plus

Biostimulant

Plant adjuvant

- **All crops** (from 2 leaf stage)
  Recommended water application rate:
  4 l/ha or 0,4 ml/m²
  300 l/ha or 30 ml/m²
  1,33% mixture

- **Grasses** (willows, turf)
  Recommended water application amount:
  3 l/ha or 0,3 ml/m²
  300l/ha or 30 ml/m²
  1,00%mixture

- **Vines, fruit trees, soft fruit**
  Recommended water application rate:
  50 ml/plant
  10 l/plant
  0,55% mixture

- Multiple application is possible, negative effects in case of overdosage are not known, if necessary check miscibility with chemical plant protection products beforehand or reduce application rate.

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Recommendations for use of Humiverse® Plus

Soil adjuvant and/or Soil cultivation/remediation

- **Landscaping**

  New planting / re-cultivation areas ´ 75 l/ha or 7,5 ml/m²

  Recommended water application rate: 7,500 l/ha or 750 ml/m²

  (1,00 % mixture)

- **Soil decontamination**

  (compaction, higher levels of metabolites and/or divalent heavy metals, etc.) 150 l/ha or 15.0 ml/m²

  Recommended water application rate: 9,000 l/ha or 900 ml/m²

  (1,67 % mixture)

- Multiple application in the splitting is recommended.

- Solution mixture above 2.0 % can lead to technical problems in the process!

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Recommendations for use of Humiverse® Plus

Soil adjuvant and/or Soil cultivation/remediation

- **Special crops** (vines, fruit, etc.) **Cultivation area / young plantation**

  - Normal soil values — 50 l/ha or 5,0 ml/m²
    Recommended water application rate: — 500l/ha or 500 ml/m² (1,00% mixture)

  - higher soil values of metabolites or 2-valent heavy metals (e.g. Cu) — 125 l/ha or 12.5 ml/m²
    Recommended water application amount: — 7500l/ha or 750ml/m² (1,00% mixture)

- Multiple application in the splitting is recommended.

- Solution mixture above 2.0 % can lead to technical problems in the process!

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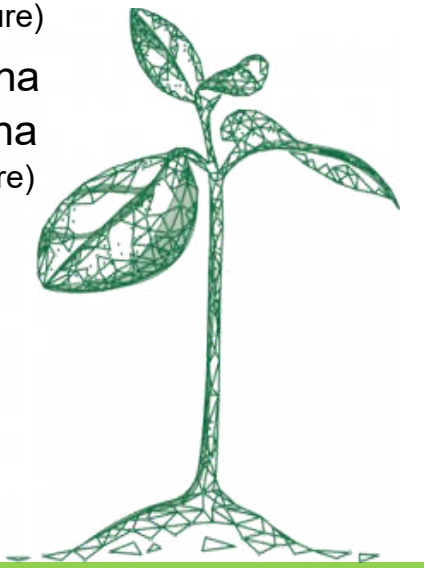
Recommendations for use of Humiverse® Plus

Hors-sol production / hydroponics / irrigation

- **Hors-sol production / hydroponics**
  - 4 -14 ml / 100 l nutrient solution (0,04-0,14 % mixture)
- **Watering, all plants**
  - Watering jug (10 l) — 100 ml/jug
    Recommended water application rate: — 10 l/jug (1,0 % mixture)
  - Sprinkler systems / hose dosing units
    - Single application, e.g. 100 m² garden — 10 l/m²
      Example: 20 mm irrigation water per application — 2.000l/100 m² (0,5 % mixture)
    - Repeated application, other crops — 10 l/ha
      Example: 25 mm irrigation water per application — 25 m³/ha (0,04 % mixture)



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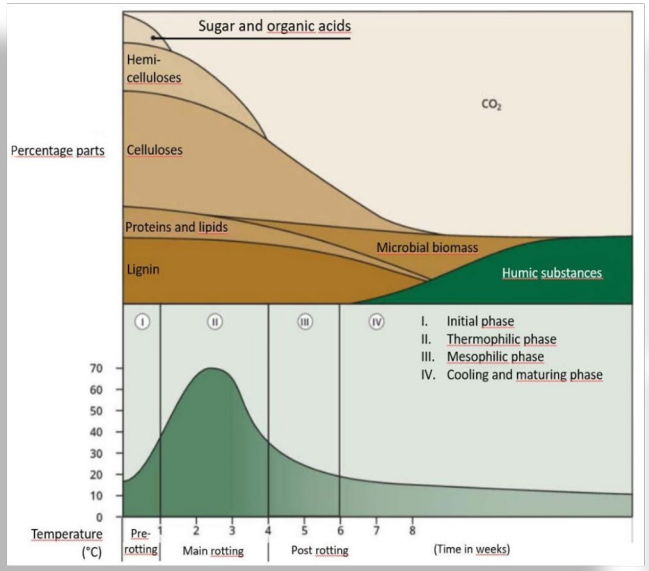
Recommendations for use of Humiverse® Plus

Use in compost, substrates, soil production, organic fertilisers

(solid manure, slurry, sewage sludge)

- **Standard**
  - per raw material (origin, specific weight, etc.) — 0,5 – 6,0 l/m³ / 0,05 – 0,60 % mixture
- **Improved plant compatibility**
  - with higher contents of metabolites or divalent heavy metals (e.g. Cu) — 3,0 – 20,0 l/m³ / 0,05 – 2,00 % mixture



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