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Powering circularity in the V4 region: waste streams for energy and fertilisers

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Statistical data for Czechia and Hungary were provided by the project partners.

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Hungary: Sebe Emese, Dobó Zsolt



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Why circular raw materials matter

1 Raw material security

Europe needs more local sources of energy and plant nutrients.

2 Waste management pressure

Large biowaste streams are generated every year, but information is fragmented.

3 Cost and environmental pressure

Virgin inputs are costly and their production can have a high environmental burden.

Biowaste becomes a regional resource only when its location, quantity, quality and current use are known.



BIOWASTELINK – V4 GRANT



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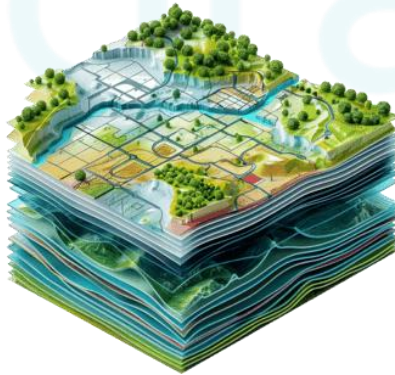
Wrocław University
of Science and Technology



MISKOLCI
EGYETEM
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Joint database



Map of waste streams in
the V4 region



Cooperation among
companies, local
authorities and research
institutions



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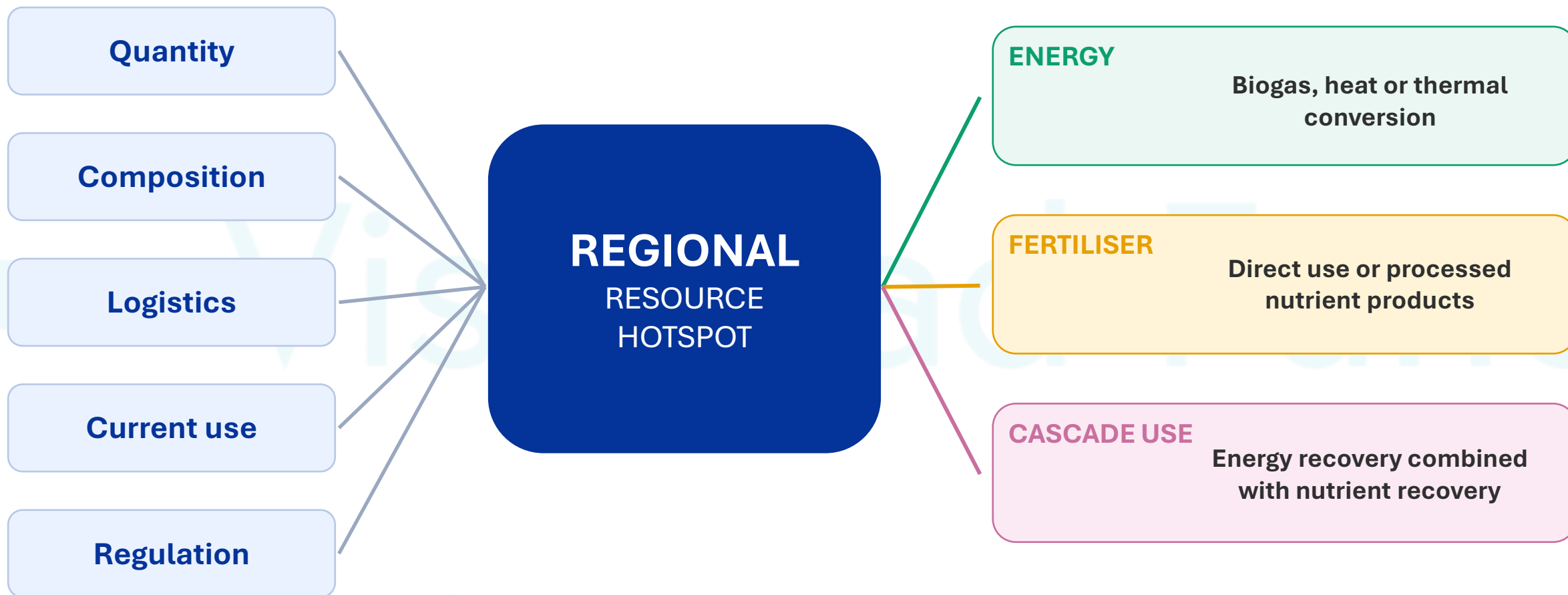
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From inventory to valorisation pathways



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Potentially promising waste streams



**Sewage
sludge (SS)**

**Agricultural
residues**



Digestate

**Food
processing
waste**



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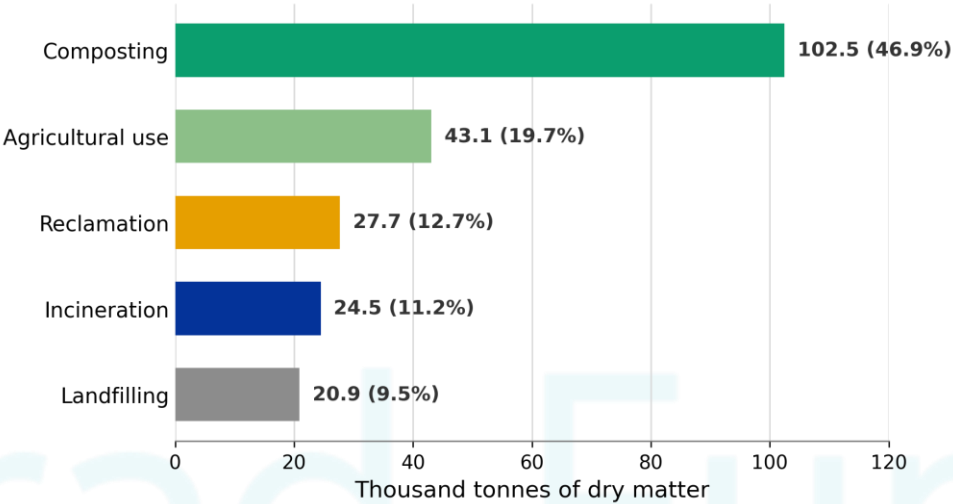
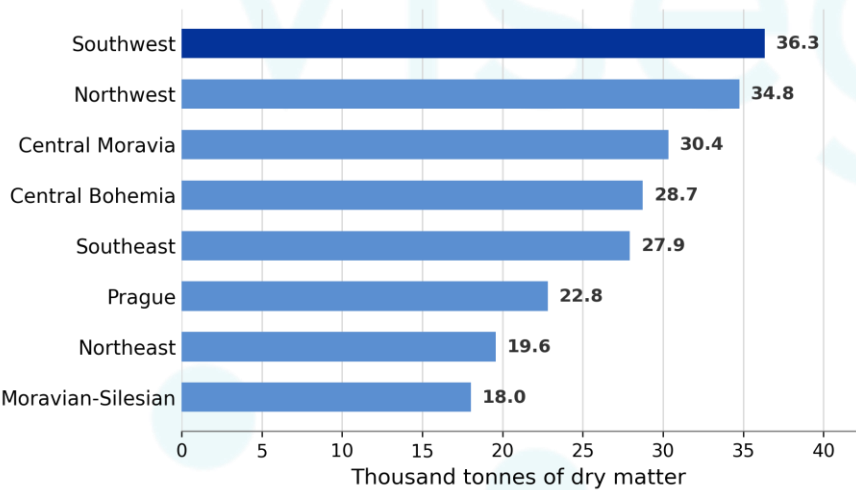
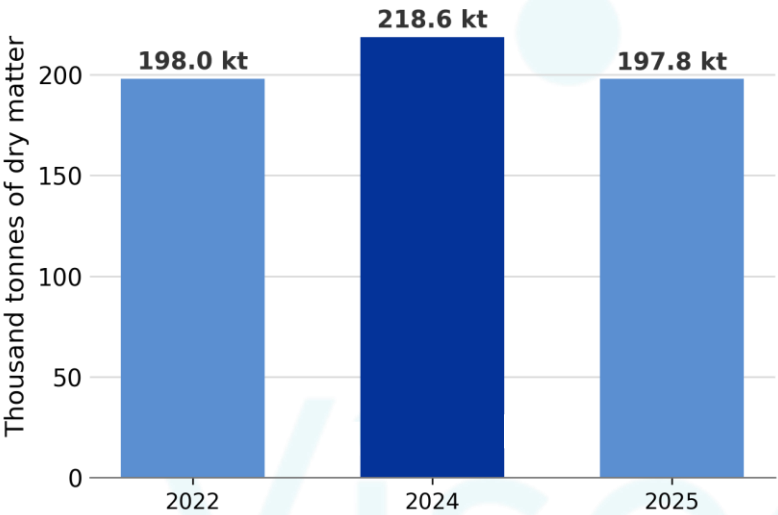
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Sewage sludge in Czechia



2024 SUMMARY

Total production: 218.6 kt DM

Composting: 46.9% - the largest route.

Largest regions: Southwest, Northwest and Central Moravia.

The 2025 total returned to a level close to that of 2022.



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Hungary – selected facility inventory

SEWAGE SLUDGE & DIGESTATE

ERV Kazincbarcika - 2.79 kt/y (R, 2022)

Szeged - 16.38 kt/y dewatered (R, 2024)

TETTYE - 190 kt/y sludge input (R)

Del-Pest - 27.3 kt dewatered (R, 2025)

Debrecen - >30,000 m³/y (R, 2021)

Biogas Miskolc - 28.7-35.9 kt/y (E)

Solti Biogaz - 15.656 kt/y digestate (R, 2021)

AGRI-FOOD RESIDUES

Sole-Mizo dairy sludge - 1.48-1.70 kt/y (E, wet)

Hungrana starch sludge - 0.84 kt DM/y (R)

Magyar Cukor lime sludge - 40 kt DM/y (E)

Equivalent product mass: about 61.5 kt/y at max. 35% moisture
These streams differ strongly in composition and legal status.

BIOMASS ASH

Ajka Power Plant - 12-18 kt/y ash (E)

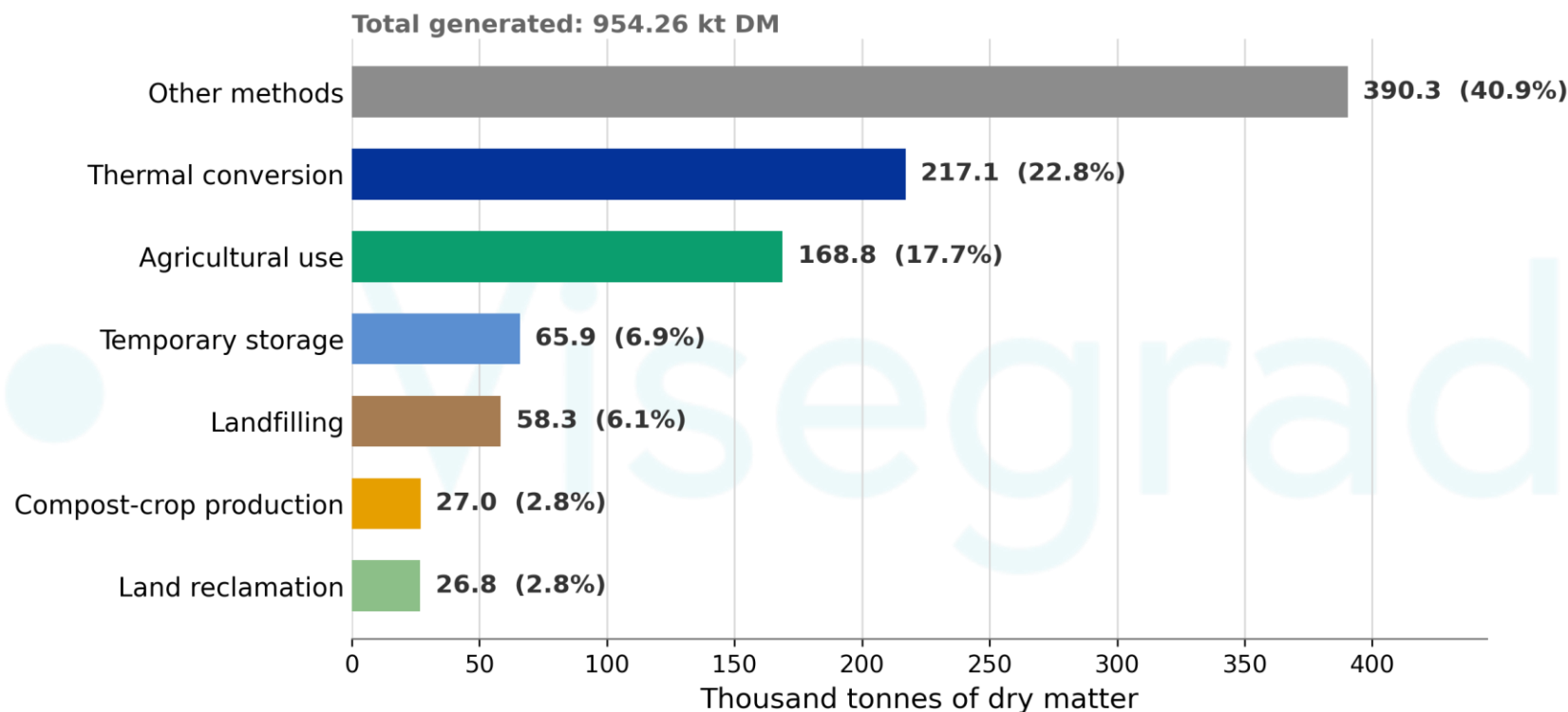
MIHO Miskolc - 45-135 t/y ash (E)
Ash values depend on assumed fuel ash content.

Facility verification is required before ranking.

R = reported E = estimated



Sewage sludge in Poland



954.26 kt DM

Largest routes

- **Other methods: 40.9%**
- Thermal conversion: 22.8%
- Agriculture: 17.7%
- Landfilling: 6.1%

The broad “other methods” category needs further disaggregation.



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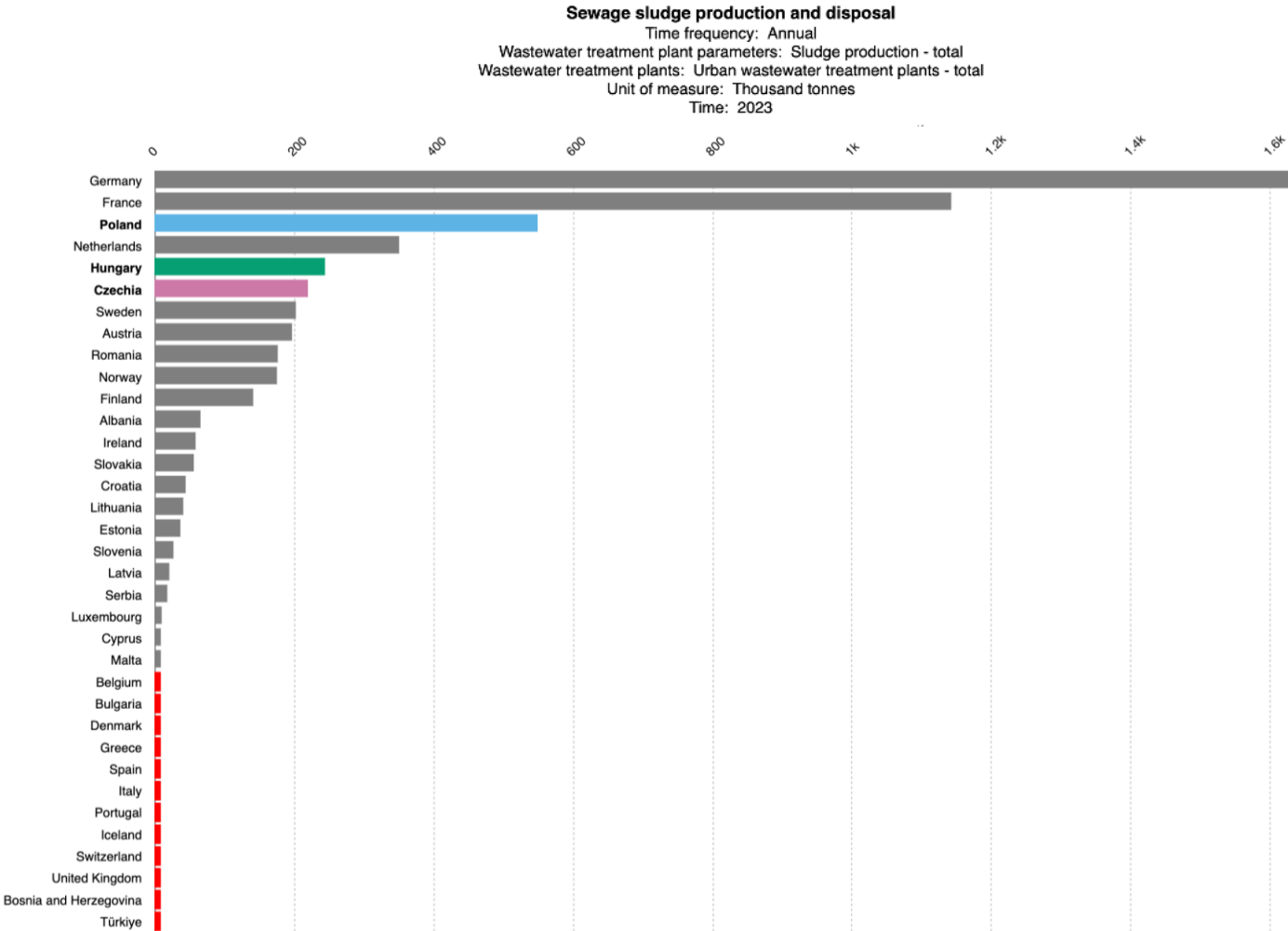
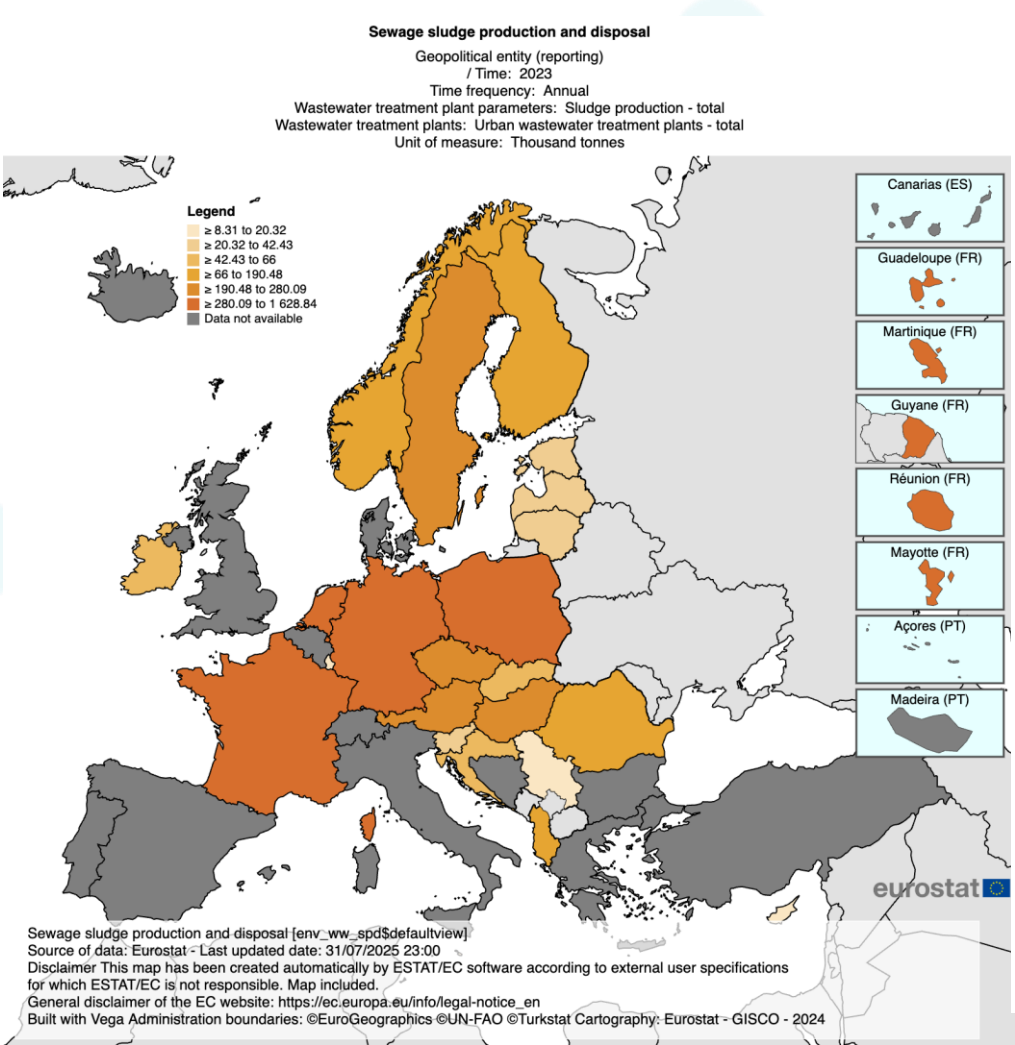
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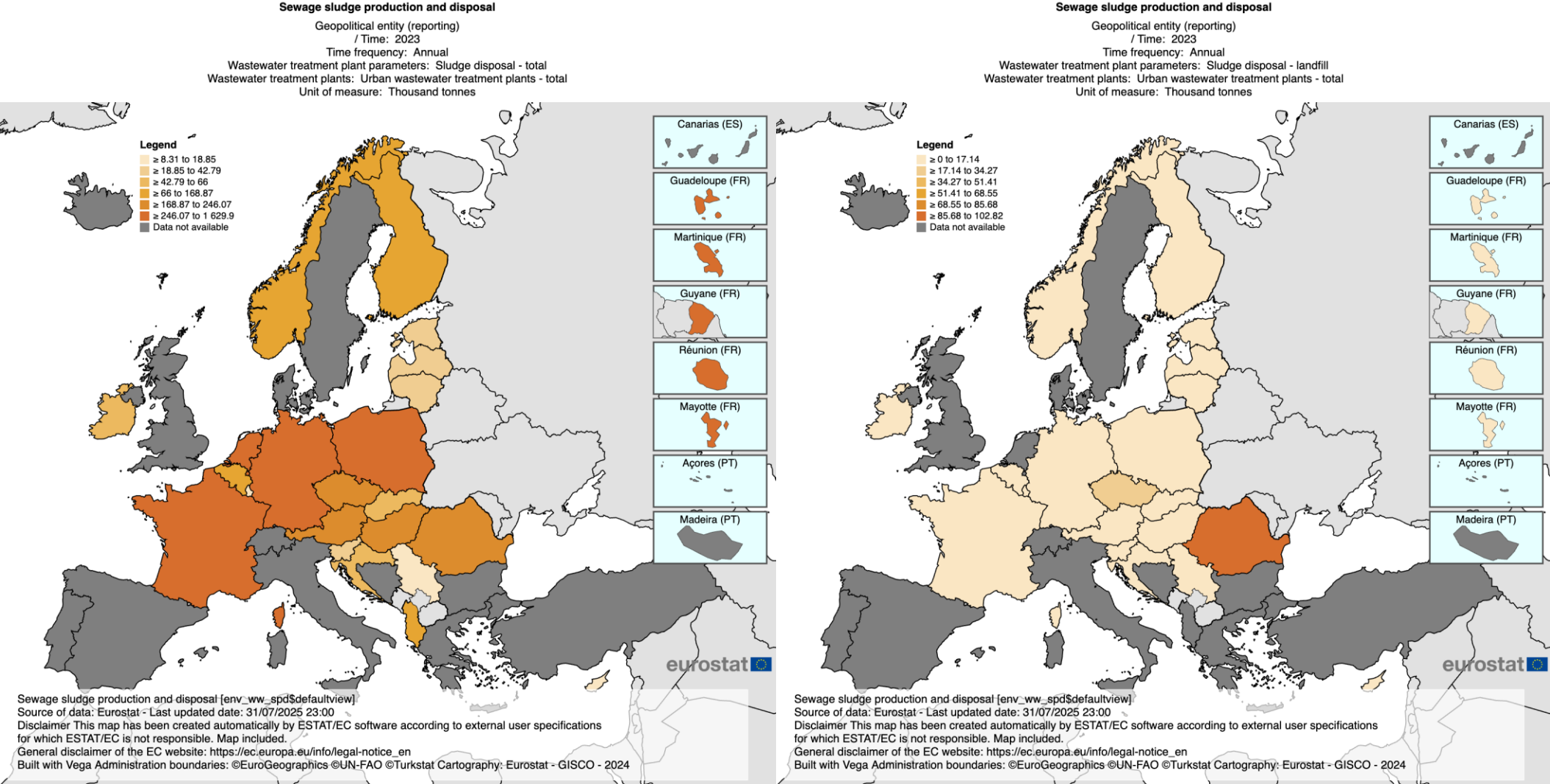


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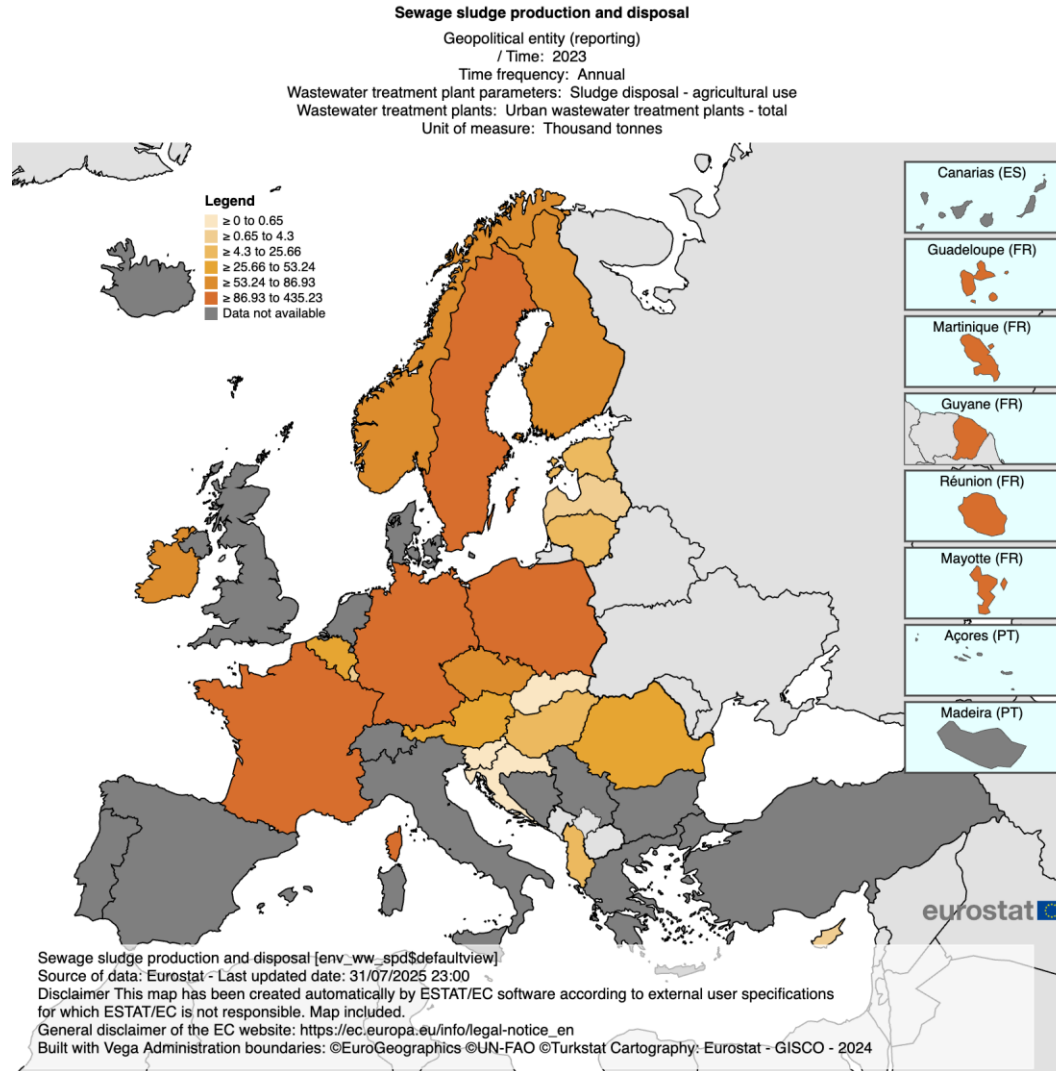
Sewage sludge production in V4 countries: EU statistics



Landfilling vs. total sewage sludge disposal: EU statistics



Agricultural use of sewage sludge: EU statistics



What the map shows

- Large differences in absolute agricultural use between countries.
- The volume depends on sludge production and national management policy.
- This route can recycle nutrients, but it requires suitable quality and regulatory compliance.
- **Missing data must be distinguished from zero use.**



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A real-world example: the Landfeed project

5 use cases over Europe

LANDFEED focuses on five different types of biowastes, each at a different use case:

HORECA waste

UC1 | Spain

Animal waste

UC2 | France

Olive Oil waste

UC3 | Greece

Multi waste

UC4 | Italy

Dairy waste

UC5 | Poland



LANDFEED

„Unlocking efficient bio-based fertilisers for soil sustainability from underutilised side streams”

Grant agreement ID: 101157636

HORIZON Europe, CBE JU Innovation Actions

21 participants from the EU

Total project cost: EUR 8.00 million (EU contribution: EUR 6.53 million)



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Dairy waste production in Poland and EU



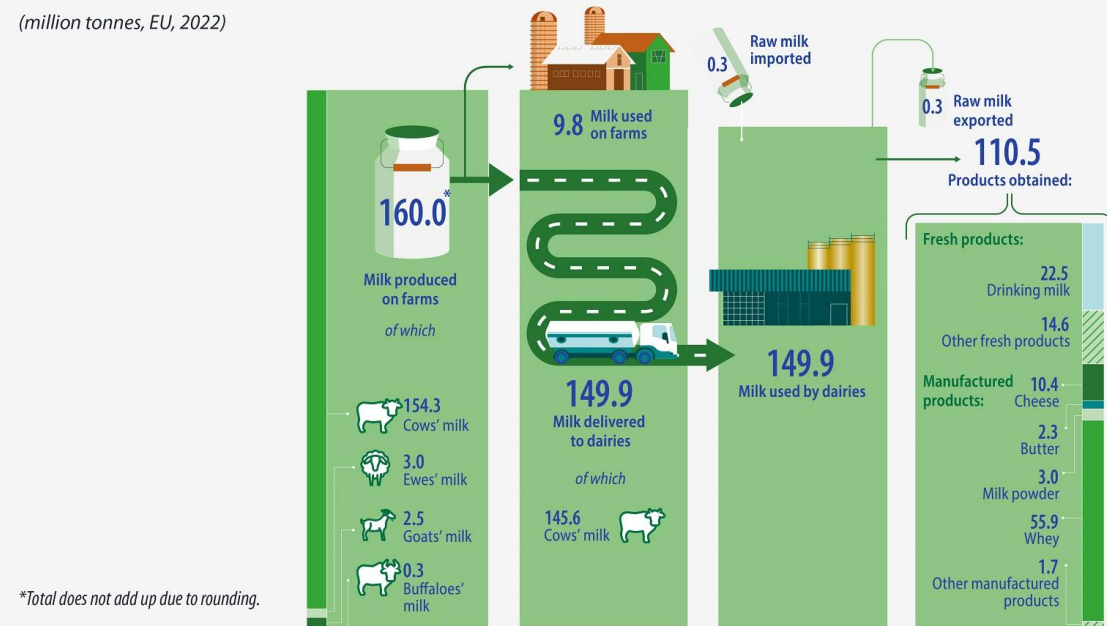
Poland produces **about 14 million tonnes** of milk annually which is almost **9%** of total production in the European Union

Poland is among the **leading milk-producing countries in the EU**. It is also among the **leading dairy exporters**.



Production and use of milk

(million tonnes, EU, 2022)



eurostat



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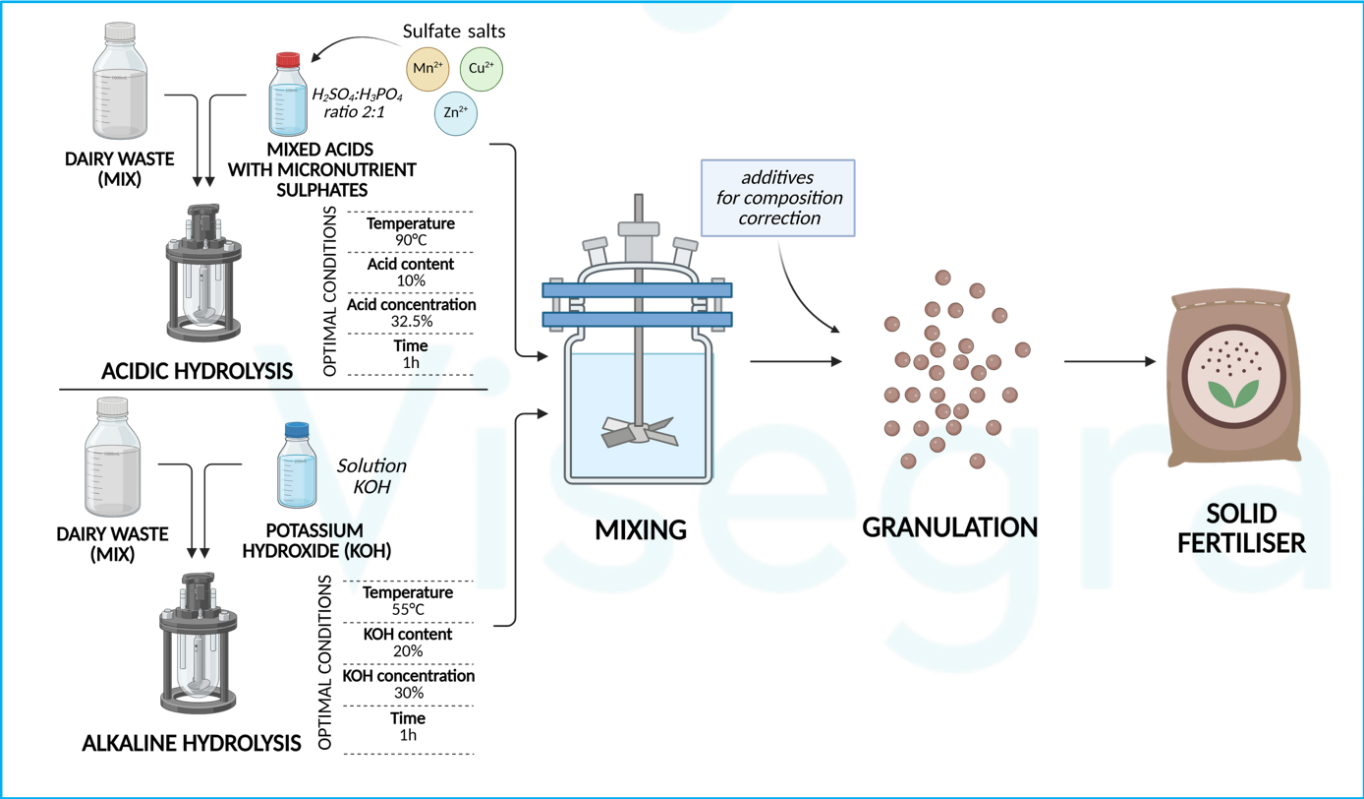
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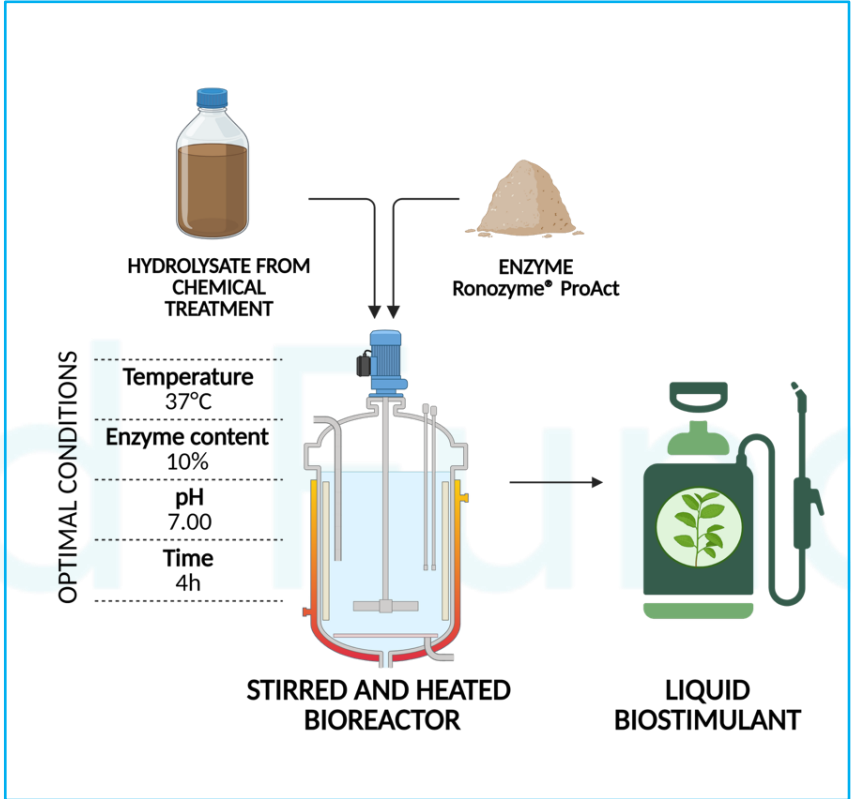
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Processing of the waste stream



Chemical treatment of dairy waste – production of solid organo-mineral fertiliser



Enzymatic hydrolysis – production of liquid biostimulant

Fertiliser and biostimulant

Product	Macronutrients											
	N _{tot.}	N _{org.}	N _{NH4}	N _{NO3-}	C	C _{org.}	P ₂ O ₅	K ₂ O	CaO	MgO	Na ₂ O	SO ₃
	%											
Fertiliser	3.32 ±0.33	0.68 ±0.07	1.59 ±0.16	1.05 ±0.11	13.2 ±1.3	10.4 ±1.0	2.11 ±0.42	3.10 ±0.62	2.65 ±0.53	0.814 ±0.163	0.146 ±0.029	2.19 ±0.44
Biostimulant	1.16 ±0.12	1.16 ±0.12	-	-	26.1 ±2.6	26.1 ±2.6	0.800 ±0.160	2.88 ±0.58	0.434 ±0.087	0.0711 ±0.0107	0.297 ±0.059	1.59 ±0.32

Product	Micronutrients			
	Cu	Fe	Mn	Zn
	mg/kg			
Fertiliser	688±103	23973±4795	805±121	1088±218
Biostimulant	1.53±0.23	16.7±2.5	1.86±0.28	10.5±1.6

Product	Presence/number of <i>Escherichia coli</i> or <i>Enterococcaceae</i>	Presence of <i>Salmonella</i> spp. in 25 g
	CFU/g	Presence/Absence
Fertiliser	<100	Absence
Biostimulant	<100	Absence



Fertiliser



Microbiological
safety



Biostimulant



No toxic
elements



Bioavailable
nutrients



Rich in
nutrients



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Thank you very much!

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