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Transition towards a more carbon and nutrient efficient agriculture in Europe

ABC Animal Bone Char for Phosphorus recovery. Formulated Bio-Phosphate trials for two comparative plants: elder and wheat.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773682.

THE PROBLEM

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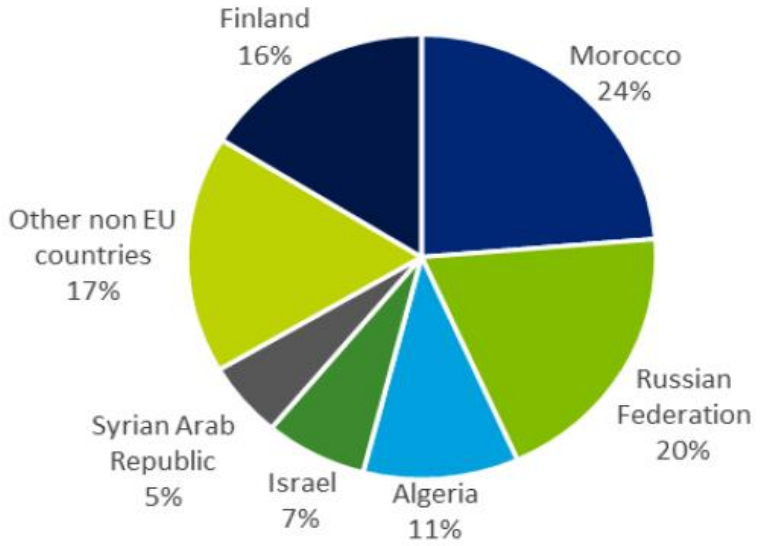
- Phosphorus is **essential to the functioning of entire agricultural food production system** and there is **no any substitute** for use of phosphorus in food chains.
- **This economical important critical raw** material is providing **over 105 Billion Euro/year added value** in the fertilisers application sector, while the EU is net-importer.
- The only operating mine extracting Phosphate rock in the EU is in Finland: the EU is over **84% reliant on imports for long term**.
- **Low >20% NUE** nutrient use efficiency (P is fix binded into soil Ca for rapid solution mineral P. Many EU soils are in P deficit).
- Fertiliser import from Russia: 3 billion EUR/year.

EU demand of phosphate rock critical raw material is on 1,9 Mt of P_2O_5 / year from which 1,6 Mt/year import



Source: EC Critical Raw Materials Factsheets (2020)

Phosphate rock contains toxic Cadmium/Uranium

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- **Contaminants in the fertilisers could pose a risk** to human, animal, to safety or to the environment.
- The application of P fertilizers is the main source of annual addition of Cd in the agricultural soils.
- **Sticker guidelines will be on the Cadmium content** (EU 2019/1009) by July 16, 2022)
- **>95% of phosphate fertilisers come from sedimentary rock with high Cd content = ≥60 mg/kg** – Subsahara - Morocco.
- **<5% of global reserves consist of low-cadmium igneous rock ≥20 mg/kg -** Finland and Russia.

EU food safety and supply security is now an urgent priority

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- **EU agriculture is now under extreme pressure.** Dependent on imported inputs, fertilisers + raw materials + energy.
- In addition to the already strong COVID-19 crisis the **geopolitical instability is leading to a significant cumulative disruption of the EU agri-food sector.**
- **The price of the P-rock has been dramatically increased by 95,73% from one year ago (in 2008 + 700%)**
- The dramatic increase in fertiliser prices is having a **major impact on the agri-food sector**.
- Food price share in the **inflation index = >16%.**

What is needed?

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- **The current and dramatic crisis confirms that we need to accelerate the food system transition towards sustainability to better prepare for future crises.**
- There is urgent need for rapid and fundamental reorientation of EU agriculture and EU food systems towards sustainability , in line with the Green Deal and the reformed CAP .
- Without a transition irreversible impacts.
- **Rapid progress needs to enhance the transition towards circular, sustainable, resilient and fair agri-food systems in the EU.**
- **The adoption of best practices in TRL9 – IRL9 – CRL9 full industrial scale needed.**

Source: COM(2022) 133 final- Safeguarding food security and reinforcing the resilience of food systems

The solution

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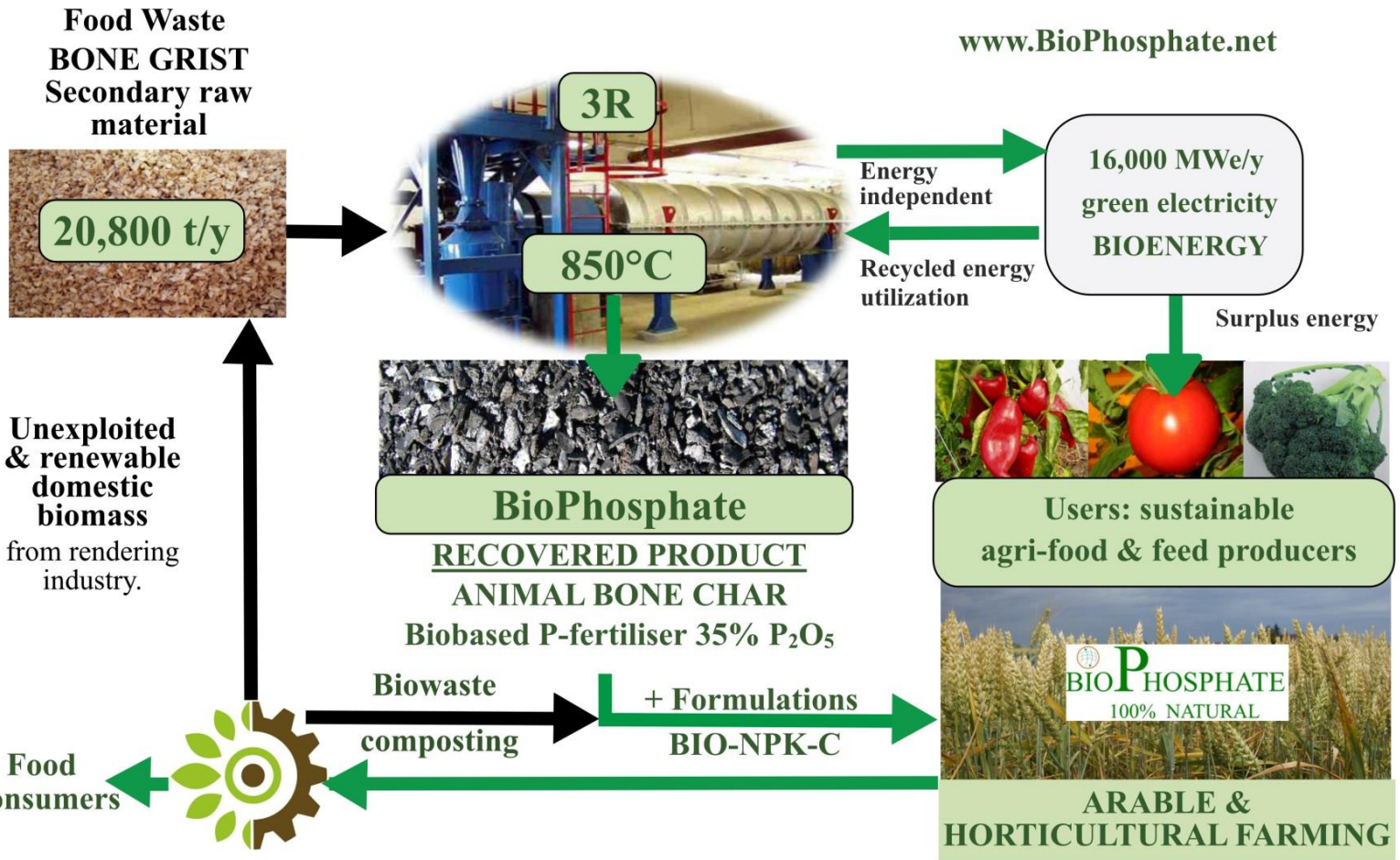
SUSTAINABLE & ZERO EMISSION "3R" BIOPHOSPHATE RECOVERY
REDUCING EU DEPENDENCY ON EXTERNAL P-ROCK CRM SOURCES



SUSTAINABLE - CIRCULAR - RESILIENT & FAIR AGRI-FOOD & FEED SYSTEM

Replace the imported CRM based + Cd/U contaminated phosphate chemical fertilisers that have low NUE Nutrient Use Efficiency.

BioPhosphate secondary source of phosphorus = economically high nutrient density >35% P2O5 and high NUE.

- ✓ **High nutrient density = economical/efficient low dose.**
- ✓ **Low nutrient density = costly high dose + assoc. risks.**

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List of treatment

Nr	Name of the treatment	Fertilizer (P)	Fertiliser Dose (kg/ha)
1	standard control	Reference mineral fertiliser: NPK 10-20-10 + 5% CaO + 4% MgO+7% S	400
2	untreated control	Unfertilized treatment	0
3	recovered fertiliser product	Formulated ABC-BioPhosphate	200
4	recovered fertiliser product	Formulated ABC-BioPhosphate	400

Type of design

Location: Val, Hungary

Crop: Winter Wheat, Triticum aestivum

Seed number: 550/m^2

Number of replicates: 3

Total demo size area: 5.4 ha

Block area per treatments: 4500 m^2,

block wide: 50m, block lenght: 90m

Number of treatments: 4

Fertilisation level: 200 kg/ha and 400 kg/ha Bio-NPK-C formulated Bio-Phosphate

Arrangement of treatment: Random block.

Results:

Fresh weight of yield in kg ha -1 (2021)

	1	2	3	4
	Control standard	Control untreated	ABC 200 kg/ha	ABC 400 kg/ha
Fresh weight of yield (kg ha-1)	4570	4210	5110	5220
% change	100%	91%	117%	127%

- Visually there is no difference between ABC treated versus CS control standard.
- **ABC gave higher yield and that is the key technical and economic benefit objective.**
- At 5.4 ha test area 200 kg/ha and 400 kg/ha BioPhosphate applied at random block order, compared to standard control (practice as usual) and control blank. Yield increase up to 27% achieved and cost/benefit demonstrated.

List of treatment

Nr	Name of the treatment	Fertilizer (P)	Fertiliser Dose (kg/ha)
1	standard control	Practice as usual, reference organic fertiliser: Farmpower poultry manure. N 2.5%, P_2O_5 4%, K_2O 3.5%, Ca 6.5 %, Mg 1%)	8000 kg/ha
2	untreated control	Unfertilized treatment	0
3	recovered fertiliser product	Formulated ABC-BioPhosphate	200 kg/ha
4	recovered fertiliser product	Formulated ABC-BioPhosphate	400 kg/ha

Type of design

Location: Val, Hungary

Crop: Elderberry, Sambucus nigra L, Variety: Haschberg (Planting date: 2010)

Plant density: 6500 plants/ha

Number of replicates: 3

Total demo size area: 6 ha

Block area per treatments: 5000 m^2,

block wide: 50m, block lenght: 100m

Number of treatments: 4

Fertilisation level: 200 kg/ha and 400 kg/ha Bio-NPK-C formulated Bio-Phosphate

Arrangement of treatment: Random block.

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Results:

Fresh weight of yield in kg ha -1 (2021)

	1	2	3	4
	Control standard	Control untreated	ABC 200 kg/ha	ABC 400 kg/ha
Fresh weight of yield (kg ha-1)	6790	5510	7145	7427
% change	100%	81%	105%	112%

Analysis of nutrient content of plant leaf (2021):

Parameter	Measurement unit	1	2	3	4
N	m/m %	3.13	291	3.37	3.86
P	m/m %	0.24	0.14	0.31	0.52
K	m/m %	0.51	0.48	0.72	0.81
Ca	m/m %	1.73	2.11	2.32	2.64
Mg	m/m %	2.31	2.54	2.78	2.99

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Nurturing the Circular Economy

The Stone Age did not end because of World run out of stones.
The Chemical Fertiliser Age will not end because we run out of chemical fertilisers.

Thank you

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