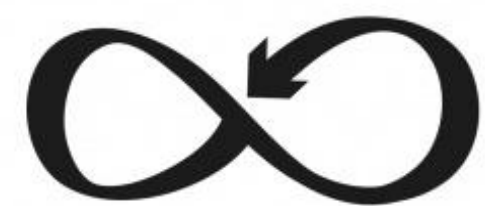




BIOREFINE CLUSTER EUROPE



NUTRIMAN: practical observations and experience on phosphorus recovery from animal bones



Massimo Pugliese

Brussels, 27th October, 2020

<https://nutriman.net/subscribe>



Nutrient Management and Nutrient Recovery Thematic Network (NUTRIMAN)

Program: H2020, RUR 15 CSA, Thematic networks for the dissemination of ready-to-use knowledge.

Coordinator: Edward Someus, 3R-BioPhosphate Ltd

Start: 1^o October 2018 **Duration:** 36 months

Long term project maintenance: + 10 years <2031.

18 partner coming from 8 UE countries:

- 9 research institutions, - 3 PMI - 4 CCIA
- 1 farmers' association 1 no-profit organization

8 languages operated web info

<https://nutriman.net/farmer-platform>

<https://nutriman.net/subscribe>



Objectives of the NUTRIMAN project

- Demo trials about circular economy through the use of recovered fertilizers under the new European regulation on fertilizers.
- Objective: by 2022, the year of implementation and harmonization of the new EU legislation on Fertilizers



agricultural professionals will already know, will have tried and will be applying products from recovery chains.

Summarizing, sharing and presenting the best existing solutions "ready for use" and "almost on the market" to farmers.

Bottom-up approach = farmers' point of view.

Farmer Platform for successfully completed post RTD results only =>TRL7.

<https://nutriman.net/farmer-platform>

Objectives of the NUTRIMAN project



Above TRL7 status technologies and products for the recovery of N / P "ready for the market"



NUTRIMAN PLATFORM FOR FARMERS
Tips and recommendations



NUTRIMAN PLATFORM FOR FARMERS
Practical knowledge

<https://nutriman.net/farmer-platform>



Present situation for mineral phosphates

- Extracted mineral **phosphate rocks are toxic contaminated**
- Dangers: **Cadmium + Uranium**
- Rapid solution fertilizers: **low nutrient use efficiency**
- Energy intensive production, **high environmental/climate impacts**



dx.doi.org/10.1021/es4002357 | Environ. Sci. Technol. 2013, 47, 2433–2434

Viewpoint

pubs.acs.org/est

Fertilizer-Derived Uranium and its Threat to Human Health

Ewald Schnug^{†,*} and Bernd G. Lottermoser[‡]

[†] Fakultät für Lebenswissenschaften der Technischen Universität Braunschweig, Pockelsstraße 14, D-38106 Braunschweig, Germany

[‡] Environment and Sustainability Institute, University of Exeter, Cornwall Campus, Penryn, Cornwall, TR10 9EZ, U.K.

In Germany from 1951 to 2011 about 14,000 tons of **uranium (1 kg / ha)** were spread over the land.

Over 2 million people receive "drinkable" water containing over 10 µg / L of Uranium (in the US according to the EPA, animals should not consume water with more than 30 µg / L of Uranium).

P = critical raw material + high supply risk + non-renewable resource + non replaceable

P price increase in 2008 = +700% in one year * P price increase >2022= + XXX%



**ORIGINAL SOLUTION = BioPhosphate key strategic
PRODUCT + TECHNOLOGY**



BIO P HOSPHATE
100% NATURAL

Converting Trash into € Cash



Low value input:

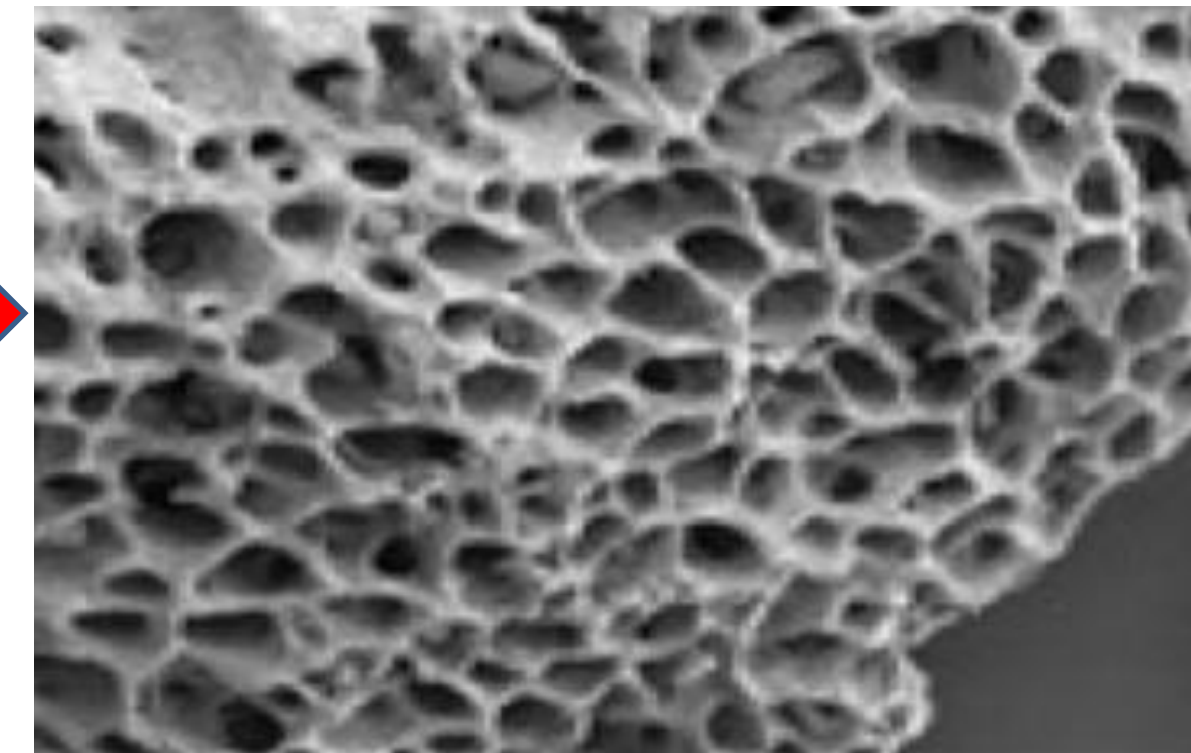
Unexploited biomass
Food grade bone
materials



Unique processing:

Massive competitive benefits
Maximum high efficient

https://nutriman.net/farmer-platform/product/id_192
https://nutriman.net/farmer-platform/technology/id_193



High added value:

BioPhosphate
Green energy
Adsorbents



ORIGINAL & KEY ENABLING SOLUTION = BioPhosphate
key strategic PRODUCT + TECHNOLOGY



3R “Recycle-Recover-Reuse” evolution



<2010: 3R pilot concept
(500 t/y)

Progressive Evolution

 **BIO**P_HOSPHATE
100% NATURAL



>2010-2020: 3R field demo
(1,200 t/y)

2021 - 2022: 3R large scale

industrial replication model

12,500 t/y output (35% P₂O₅ content)

Plus BIO-NPK-C formulations

Rapid market replications in global dimension.

Replicate

Scale up



➤ >2022-2025

➤ + 10 new 3R projects

➤ Global expansion

+ surplus green electricity

ORIGINAL SOLUTION = BioPhosphate key strategic PRODUCT + TECHNOLOGY

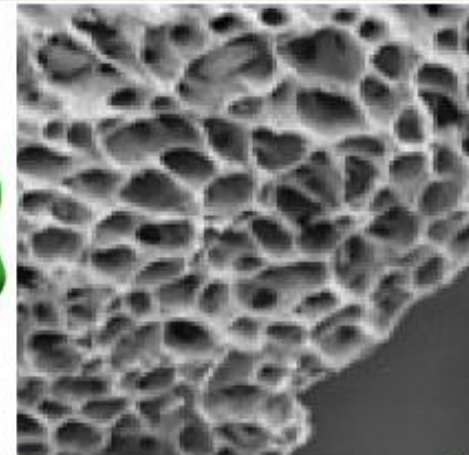


 **BIO**P_HOSPHATE
100% NATURAL

- Controlled release VS rapid release mineral phosphate (eutrophication or nonsoluble binded with Ca calcium content of the soil).
- Incorporated into the soil microbiological structure and the P is slower but safer released over the years.
- Promoting to reduce soil pollution and enhance restoration of soil natural balance

“ABC” Animal Bone Char BioPhosphate - CalciumPhosphate product
High Phosphorus concentrated macroporous bio fertiliser/adsorbent

Made of food grade animal bones at 850°C material core temperature



- ✓ 92% CalciumPhosphate
- ✓ 8% Carbon
- ✓ 30% - 35% P₂O₅
- ✓ No contamination, safe
- ✓ Controlled P release
- ✓ Macroporous structure
- ✓ P = critical raw material

ABC BioPhosphate

WATER TREATMENT

Specific environmental and industrial applications, drinking, food industrial and process water treatments.
Efficient removal of: macromolecular organics & metals

ADSORBENT



\$ Economical applications €
www.3Ragrocarbon.com

AGRI - FOOD- wide range of **BIO-NPK-C** + microbio formulations

Recommended crops: vegetables, fruits, rice, tobacco, viticulture, medicinal plants, herbs

USERS: Organic farming
Low input farming



Improving drought tolerance. Recommended dose:
0.2 t/ha - 1.5 t/ha



ORIGINAL SOLUTION = BioPhosphate key strategic PRODUCT + TECHNOLOGY



Lawful applications as of EU 1009/2019, EU 515/2019, MS permits



ABC BioPhosphate
safer - better - less costly

**Product Functional
Category applications:**

PFC1: Solid organic fertilizer
PFC2: Liming material
PFC3: Soil improver
PFC4: Growing medium
PFC6: Plant biostimulant-microbial/non microbial
PFC7: Fertilizing product blend
Applied for soil & soilless media cases



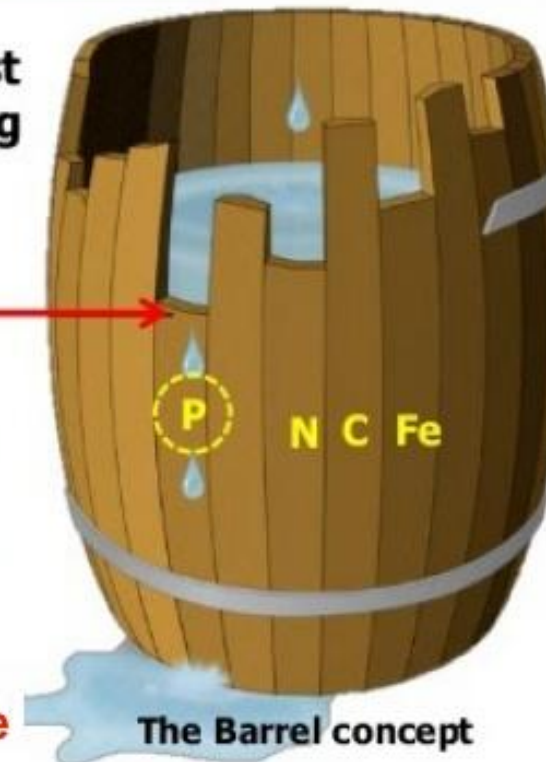
Leibig's Law of Minimum

❖ "The nutrient present in the least relative amount is the limiting nutrient"

**Limiting nutrient
Phosphorus**

❖ "even if all but one of the essential elements be present, the absence of that one constituent renders the crop barren"

**Chemical mineral phosphate use
efficiency not more than 20%**



Lawful applications meet
✓ EU1009/2019 + all others
✓ EU 515/2019
✓ EU - MS Authority permits
✓ Producer Responsibility

www.3Ragrocarbon.com

BIO_PHOSPHATE
100% NATURAL



BioPhosphate: NUTRIMAN demo trials in Italy



 **BIO**P_{HOSPHATE}
100% NATURAL



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 818470.

BioPhosphate: NUTRIMAN demo trials in Italy



Demo field trial on corn

Treatments	Products
1	Not fertilized
2	Only mineral fertilization
3	Formulation 1 – COMPOST + BIOPHOSPHATE (ID:192)
4	Formulation 2 – COMPOST + BIOPHOSPHATE (ID:192)
5	Farmers' fertilization plan*

*Mineral fertilization plan started with the distribution of farm cattle manure (53t/ha), for a total contribution of: 290 kg / ha of N, 66 kg / ha of P₂O₅, 119 kg / ha of K₂O.

	N	P ₂ O ₅	K ₂ O
Dosages (kg/ha)	180	60	60

Correction of N/P/K content with:

- urea,
- Triple superphosphate,
- K sulfate.

Duration of the trial (6 months):

- Seeding:** 13/03/2019
- Harvesting:** 13/09/2019

• NUTRIMAN products

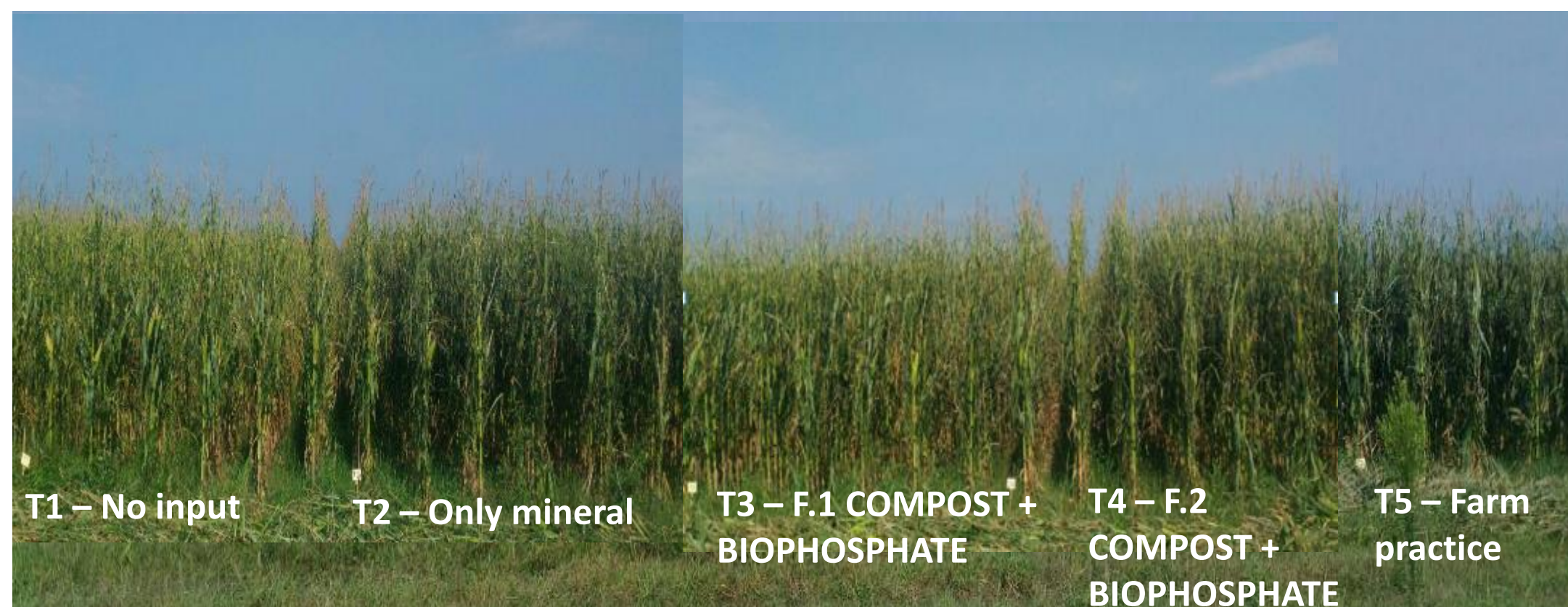
•Other



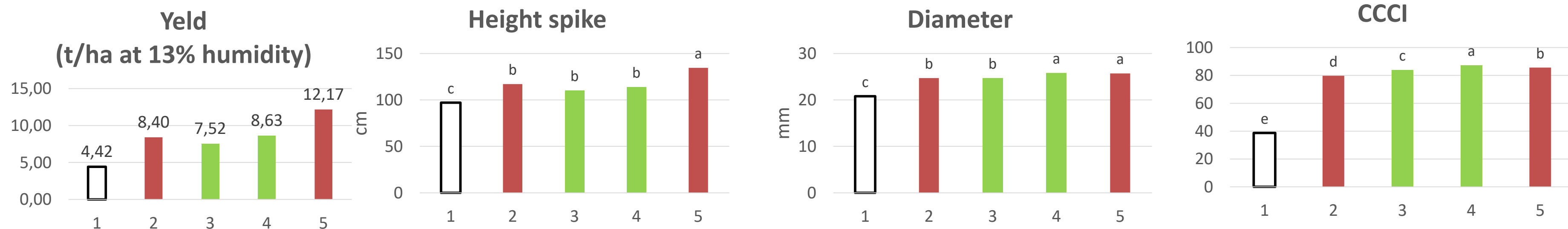
BioPhosphate: NUTRIMAN demo trials in Italy



Demo field trial on corn



 **BIO**P_{HOSPHATE}
100% NATURAL



BioPhosphate: NUTRIMAN demo trials in Italy



BIOP_{HOSPHATE}
100% NATURAL

Demo field trial on cabbage

Treatments	Products
1	No input
2	Only mineral fertilization
3	Formulation 1 – COMPOST + BIOPHOSPHATE (ID:192)
4	Formulation 2 – COMPOST + BIOPHOSPHATE (ID:192)



• NUTRIMAN products

• Other

	N	P2O5	K2O
Dosages (kg/ha)	170	80	190

Correction of N/P/K content with:

- urea,
- Triple superphosphate,
- K sulfate.

Duration of the trial (6 months):

- **Seeding:** 03/07/2019
- **Transplanting:** 23/08/2019
- **Harvesting:** 18/01/2020



Demo field trial on cabbage



1. Untreated



2. Mineral fertilizers



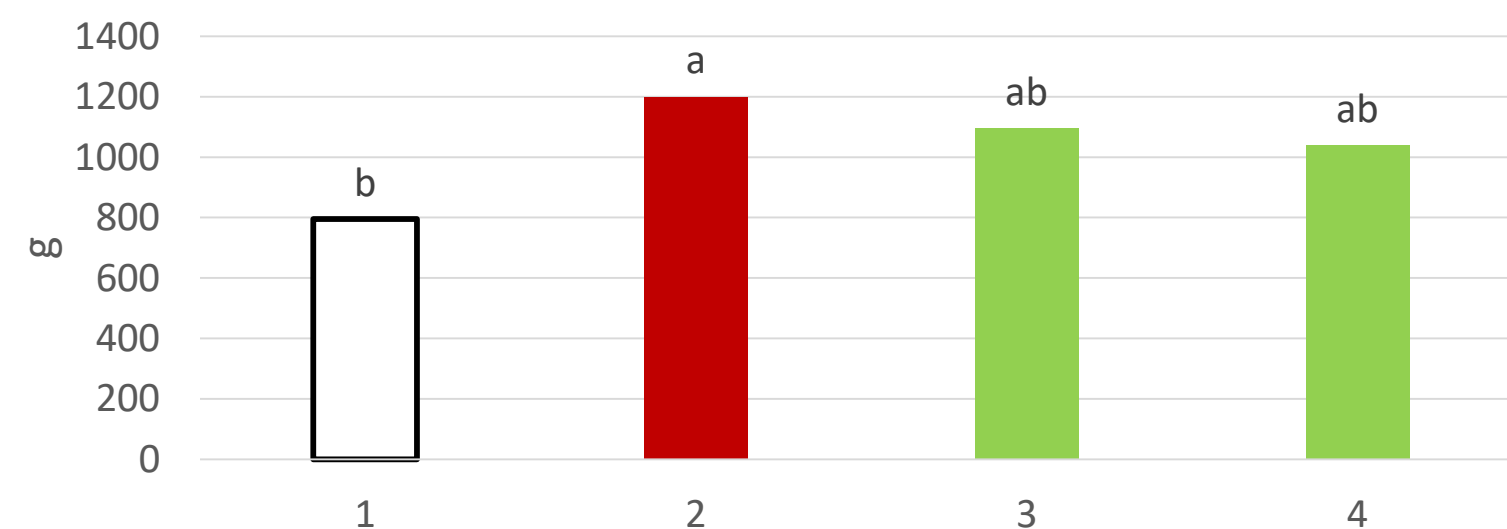
3. **F. 1 COMPOST +
BIOPHOSPHATE**



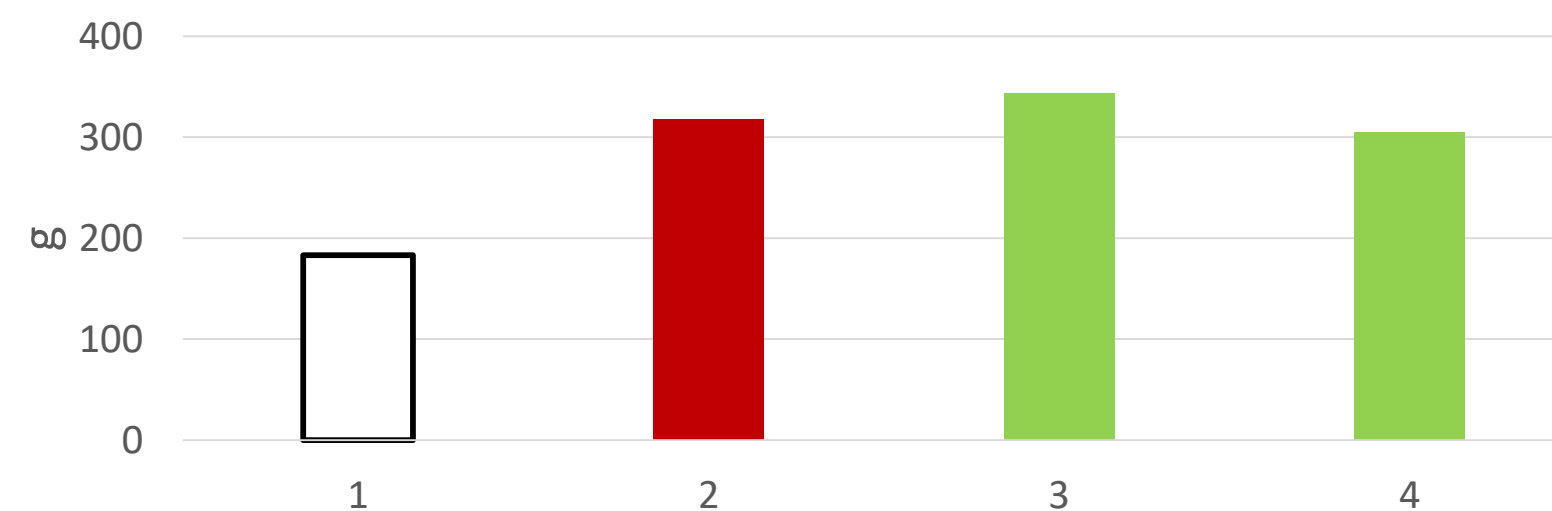
4. **F. 2 COMPOST +
BIOPHOSPHATE**

 **BIO**P**HOSPHATE**
100% NATURAL

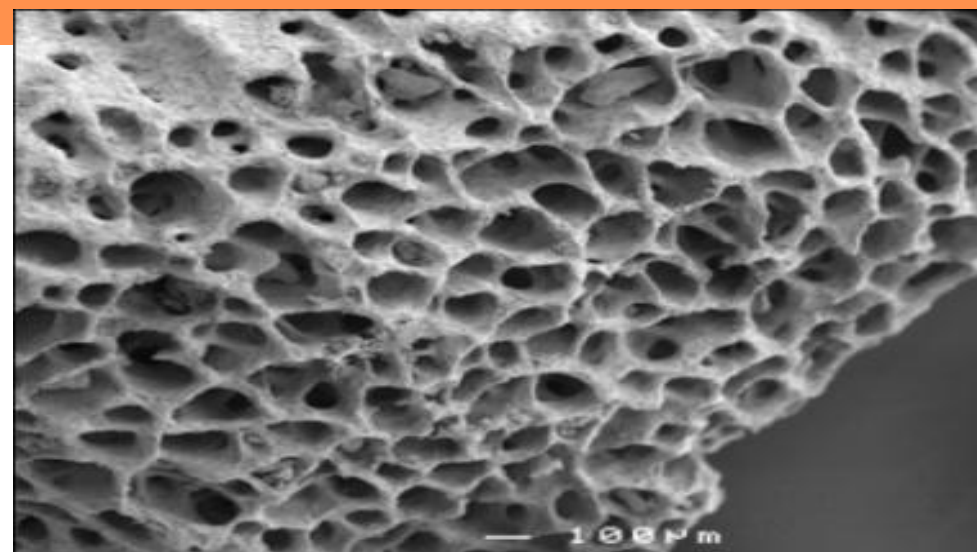
Total biomass (g) of cabbage



Commercial biomass (g) of cabbage



**ORIGINAL SOLUTION = BioPhosphate key strategic
PRODUCT + TECHNOLOGY**



BioPhosphate inside

**Proven field demonstrated
IT – IL - DE - NL - DK - SI - ES
- HU - IRL - UK**



Efficiency tests



**International tests in
different conditions,
drought tolerance test**



**High food safety
and security**

Successful in different climatic/soil conditions * soilless media = under development



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THANK YOU FOR YOUR ATTENTION



www.nutriman.net

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<https://nutriman.net/farmer-platform>

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Massimo Pugliese

Brussels, 27th October, 2020

