Nutrient Management and Nutrient Recovery Thematic Network

Demonstration of innovative biofertilisers use in Italy

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Demonstration trials

The fertilization trials were carried out first in greenhouse and subsequently in open field.

Pot trial on tomato

Evaluation of the use at different dosages of different products from N and P recovery chains.

Comparison (from left to right): **Unfertilized control, Mineral control, Calcium Sodium Phosphate**, **Formulation 1 – Compost + BioPhosphate**

Fertilization protocol – pot trial on tomato

Treatments	Product
1	Unfertilized control
2	Mineral control
3	Calcium Sodium Phosphate (ID:397)
4	Formulation 1 – Compost + BioPhosphate (ID:192)
5	Formulation 2 – Compost + BioPhosphate (ID:192)
6	Formulation 3 – Compost + BioPhosphate (ID:192)
7	Struvite 1 (ID:250)
8	Struvite 2 (ID:208)
9	Compost (ID:210)
10	Manure (commercial control)

•NUTRIMAN product •Control

Dosages (kg/ha)	N	P2O5	K2O
Low	85	40	100
Medium	170	80	100
High	340	160	100

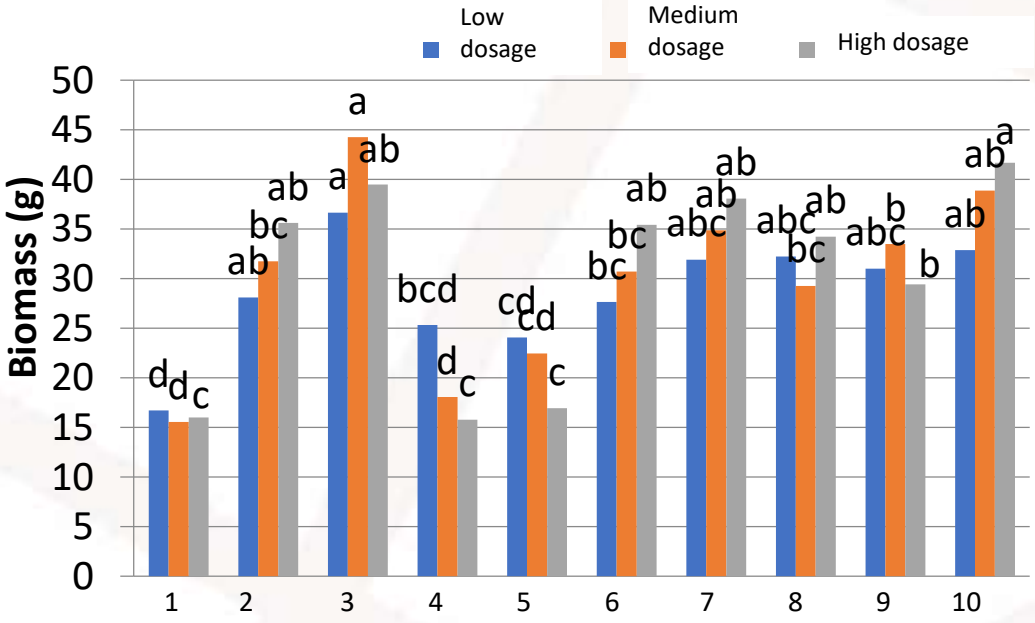
NPK concentrations corrected with:

- urea,
- Triple superphosphate,
- K sulfate.

Trial duration (6 weeks):

- **Seeding**: 24/04/2019 (I-II)
- **Transplanting** 25/05/2019 (I)-29/05/2019 (II)
- **Harvest**: 12/07/2019 (I)-16/07/2019 (II)

Effect of different treatments at different dosages on tomato above-ground biomass (g)



Conclusions:

• Plants fertilized with **Calcium Sodium Phosphate, Formulation 3 – Compost + BioPhosphate, Struvite 1, 2** and **compost** reached a **significantly higher** above-ground biomass than **unfertilized control** at all dosages, and they provided **the same** biomass of the **mineral control** and the **commercial control.**

•NUTRIMAN product | •Control

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Pot trial on lettuce

Evaluation of the use at different dosages of different products from N and P recovery chains.

External view of the pot trial on lettuce.

Trial on lettuce in nursery

- Evaluation of the use of different products from N and P recovery chains

- Evaluation of the suppressiveness of the fertilizers distributed on tray at seeding vs *Fusarium oxysporum*

External view of the trays.

External view of the demo tray trial on lettuce.

Fertilization protocol for trial on lettuce in nursery

Treatment	Product
1	Unfertilized control
2	Mineral control
3	Calcium Sodium Phosphate (ID:397)
4	Formulation 1 – Compost + BioPhosphate (ID:192)
5	Formulation 2 – Compost + BioPhosphate (ID:192)
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7	Struvite 1 (ID:250)
8	Struvite 2 (ID:208)
9	Compost (ID:210)
10	Manure (commercial control)
11	Green compost (ID:280)
12	Dried digestate (ID:270)
13	Unfertilized control treated with fungicide
14	Untreated healthy control

	%
Dosages (v/v)	1

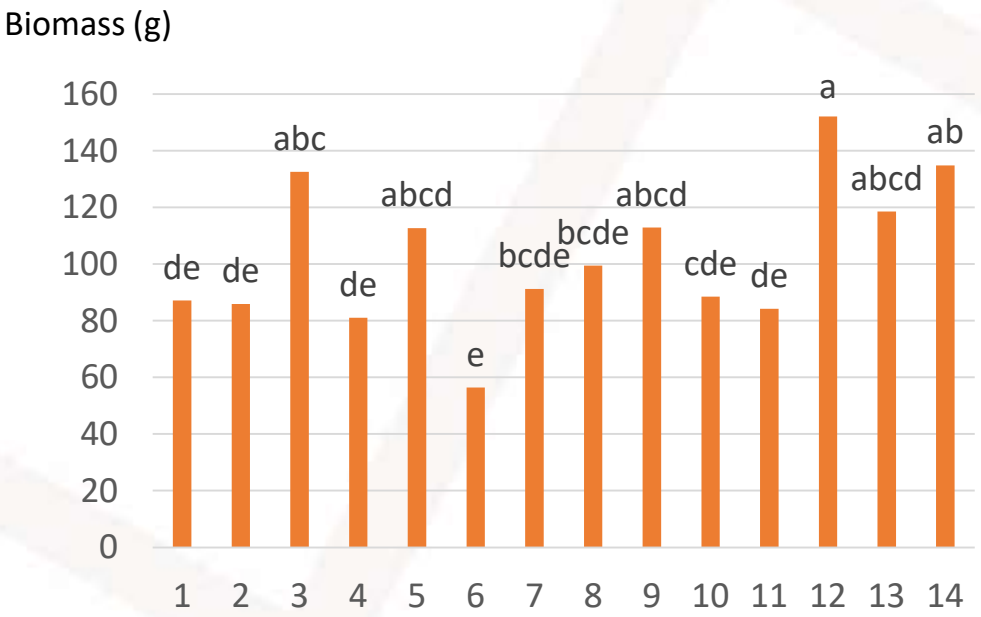
- NUTRIMAN product
- Control

N.B. The soil was inoculated with ***Fusarium oxysporum* f. sp. *lactucae***

Duration of the trial (2 months):

- **Seeding and fertilization**: 10/09/2020
- **Inoculation**: 01/10/2020
- **Transplanting**: 08/10/2020
- **Harvest**: 05/11/2020

Effect of different treatments at seeding on the production of lettuce's above-ground biomass (g)



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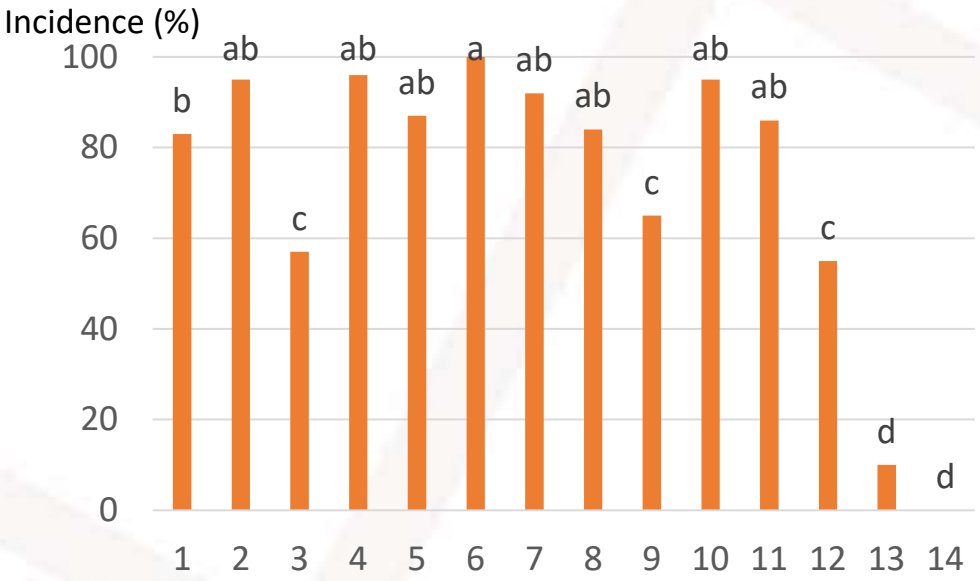
7	Struvite 1 (ID:250)
8	Struvite 2 (ID:208)
9	Compost (ID:210)
10	Manure (commercial control)
11	Green compost (ID:280)
12	Dried digestate (ID:270)
13	Unfertilized control treated with fungicide
14	Untreated healthy control

Conclusions:

- Plants treated with **dried digestate** and **calcium sodium phosphate** reached **the same** above-ground biomass as the **Untreated healty control** and higher than **mineral control**.

- NUTRIMAN product
- Control

Effect of different treatments at seeding on the incidence of fusarium wilt



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8	Struvite 2 (ID:208)
9	Compost (ID:210)
10	Manure (commercial control)
11	Green compost (ID:280)
12	Dried digestate (ID:270)
13	Unfertilized control treated with fungicide
14	Untreated healthy control

Conclusions:

- **Calcium Sodium Phosphate, Compost, Dried digestate reduced** disease incidence compared to the **Untreated control** and the **Mineral control.**

- NUTRIMAN product
- Control

Demo events organized by UNITO on vegetable crops in greenhouse

Details of the event 1	
Title of event:	Agroinnova Open Day 2019
Date:	5st June 2019
Location:	Grugliasco (TO)

Details of the event 2	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains
Date:	4th September 2020
Location:	Webinar online (WebEx)

Demo events organized by UNITO on vegetable crops in greenhouse

Details of the event 3	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero. ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains.
Date:	3rd October 2020
Location:	Webinar online (WebEx)

Details of the event 4	
Title of event:	ITA: L'utilizzo di nuovi fertilizzanti di recupero da fanghi di depurazione, digestati e letami in orticoltura. ENG: The use of new fertilizers recovered from sewage sludge, digestates and manure in horticulture.
Date:	5th December 2020
Location:	Webinar online (WebEx)

Audiovisual materials on demo greenhouse horticultural crops trials uploaded on YouTube Channel of NUTRIMAN:
https://www.youtube.com/watch?v=nf1XEYSKCQk&list=PL6SNYMmBjnltg2djS_mggoc5qS2I-ZAi5&index=3

Demo field trial on lettuce

Evaluation of the use of different products from N and P recovery chains.

External view of the demo field trial on lettuce

Demo field trial on cabbage

Evaluation of the use of different products from N and P recovery chains.

External view of the demo field trial on cabbage.

Fertilization protocol – Demo field trial on cabbage

Treatment	Product
1	Unfertilized control
2	Mineral control
3	Calcium Sodium Phosphate (ID:397)
4	Formulation 1 – Compost + BioPhosphate (ID:192)
5	Formulation 2 – Compost + BioPhosphate (ID:192)
6	Struvite 2 (ID:208)
7	Compost (ID:210)
8	Manure (commercial control)
9	Green compost (ID:280)
10	Dried digestate (ID:270)

- NUTRIMAN product
- Control

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

NPK concentrations corrected with:

- urea,
- Triple superphosphate,
- K sulfate.

Duration of the trial (6 months):

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

Comparison – Demo field trial on cabbage

1. **Unfertilized control**

2. **Mineral control**

3. **Ca&Na Phosphate**

4. **F. 1 Compost + BioPhosphate**

5. **F. 2 Compost + BioPhosphate**

6. **Struvite 2**

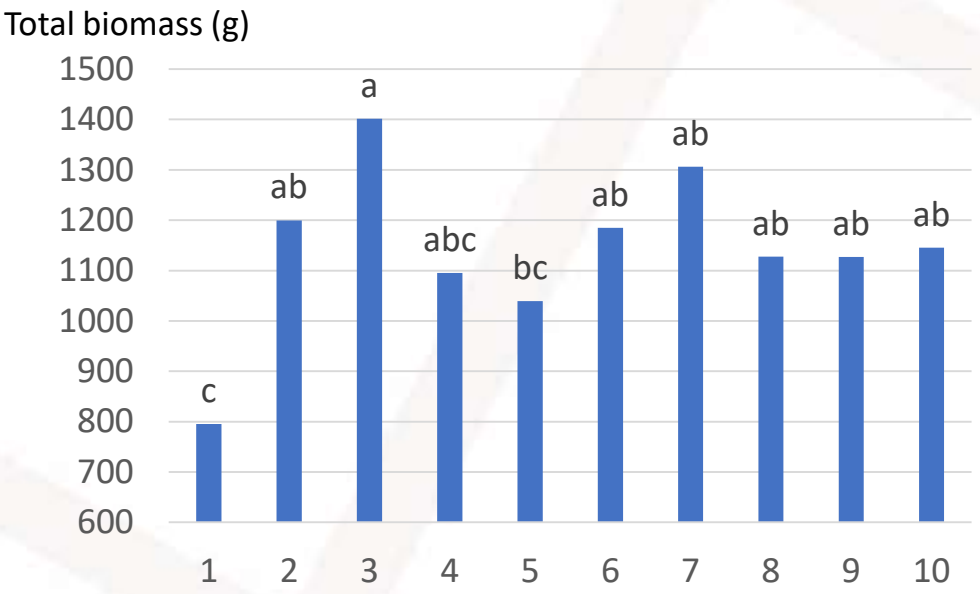
7. **Compost**

8. **Organic control**

9. **Green compost**

10. **Dried digestate**

Effects of different fertilizers on the above-ground total biomass (g) production of cabbage



• NUTRIMAN product • Control

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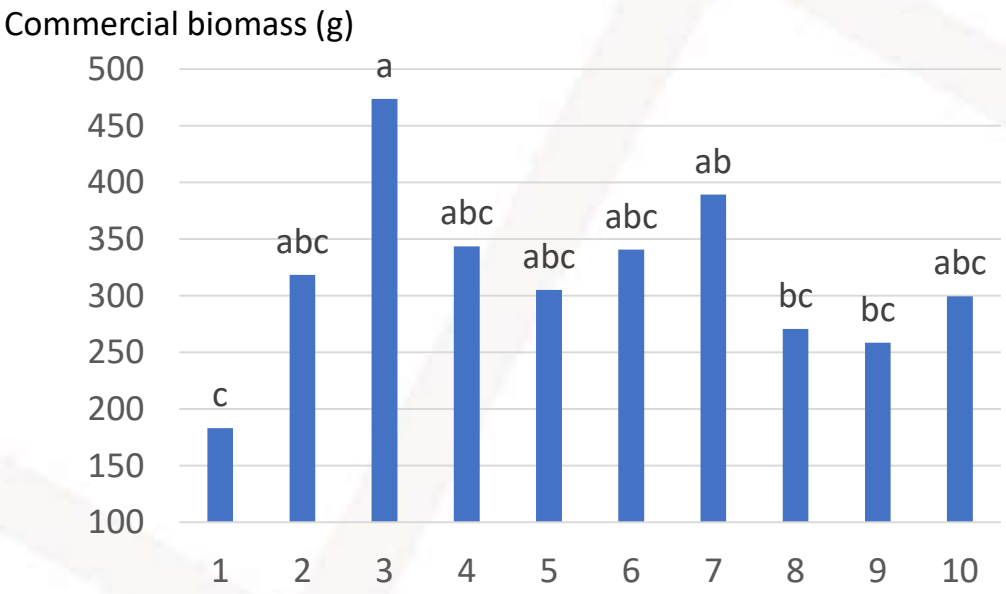
6	Struvite 2 (ID:208)
7	Compost (ID:210)
8	Manure (commercial control)
9	Green compost (ID:280)
10	Dried digestate (ID:270)

Conclusions:

• **All the treatments** improved the above-ground total biomass compared to the **Untreated control** and similarly to the **Mineral control**.

Effects of different fertilizers on the above-ground commercial biomass (g) production of cabbage



• NUTRIMAN product • Control

Treatment	Product
1	Unfertilized control
2	Mineral control
3	Calcium Sodium Phosphate (ID:397)
4	Formulation 1 – Compost + BioPhosphate (ID:192)
5	Formulation 2 – Compost + BioPhosphate (ID:192)
6	Struvite 2 (ID:208)
7	Compost (ID:210)
8	Manure (commercial control)
9	Green compost (ID:280)
10	Dried digestate (ID:270)

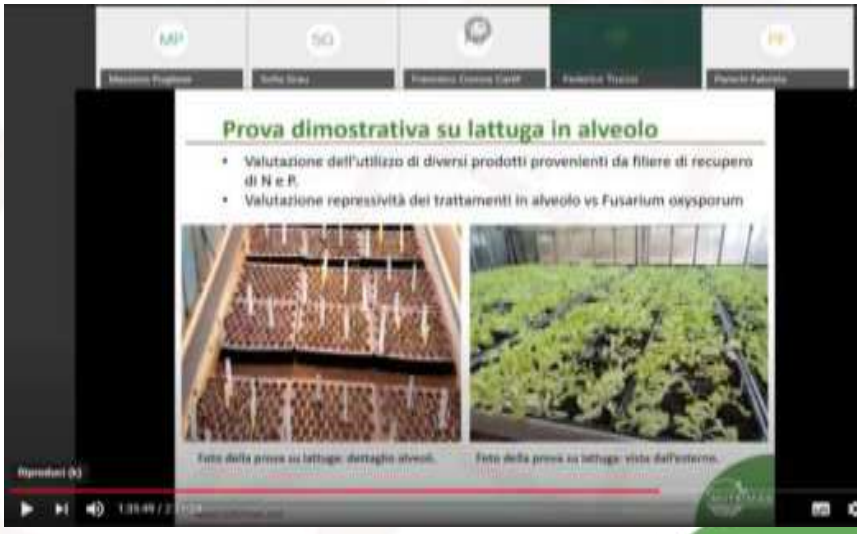
Conclusioni:

• **Calcium Sodium Phosphate** and **Compost** provided a commercial biomass significantly higher than the **Untreated control** and similar to the **Mineral control**.

Demo events organized by UNITO on field vegetable crops

Details of the event 1	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero. ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains.
Date:	3rd October 2020
Location:	Webinar online (WebEx)

Details of the event 2	
Title of event:	ITA: L'utilizzo di nuovi fertilizzanti di recupero da fanghi di depurazione, digestati e letami in orticoltura. ENG: The use of new fertilizers recovered from sewage sludge, digestates and manure in horticulture.
Date:	5th December 2020
Location:	Webinar online (WebEx)



Demo events organized by UNITO on field vegetable crops

Details of the event 3	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains
Date:	4th September 2020
Location:	Webinar online (WebEx)

Details of the event 4	
Title of event:	ITA: "La piattaforma per gli agricoltori del progetto europeo NUTRIMAN: un utile strumento per conoscere fertilizzanti prodotti da filiere di recupero". ENG: "The NUTRIMAN Farmer Platform: a useful tool to learn about recovered biofertilizers".
Date:	31st January 2020
Location:	Verona (VR)

Audiovisual materials on demo field horticultural crops trials uploaded on YouTube Channel of NUTRIMAN

- https://www.youtube.com/watch?v=5JnE4b9Hdlo&list=PL6SNYMmBjnltg2djS_mggoc5qS2I-ZAi5&index=4

Demo field trial on corn

1. Subdivision of pre-plowing plots to distribute fertilizers

2. Push fertilizer spreader

3. Fertilizers distributed in pre-plowing

4. Post-sowing replenishment

Fertilization protocol - Demo field trial on corn

Treatment	Product
1	Unfertilized control
2	Mineral control
3	Formulation 1 – Compost + BioPhosphate (ID:192)
4	Formulation 2 – Compost + BioPhosphate (ID:192)
5	Struvite 1 (ID:250)
6	Struvite 2 (ID:208)
7	Compost (ID:210)
8	Manure (commercial control)
9	Farmers' fertilization plan*

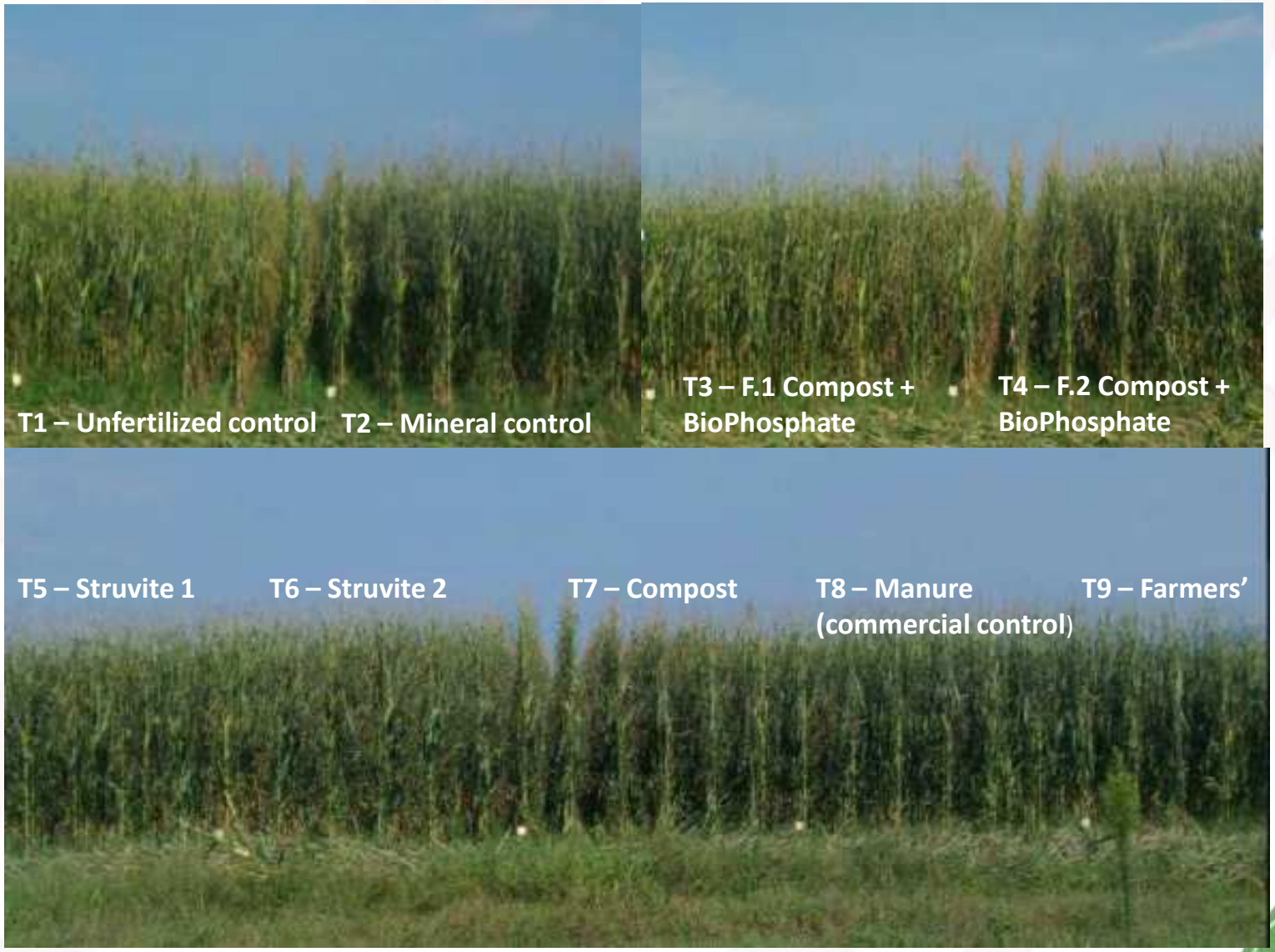
* Mineral fertilization plan by distribution of farm cattle manure (53t/ha), for a total contribution of: 290 kg/ha of N, 66 kg/ha of P2O5, 119 kg/ha of K2O.

NPK concentrations corrected with:
- urea,
- Triple superphosphate,
- K sulfate.

Duration of the trial (6 months):
- **Seeding**: 13/03/2019
- **Harvest**: 13/09/2019

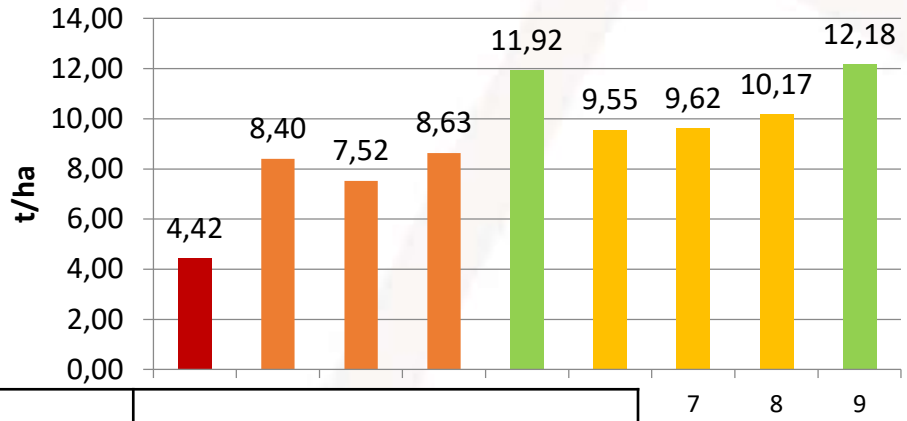
•NUTRIMAN product •Control

Visual comparison – Demo field trial on corn

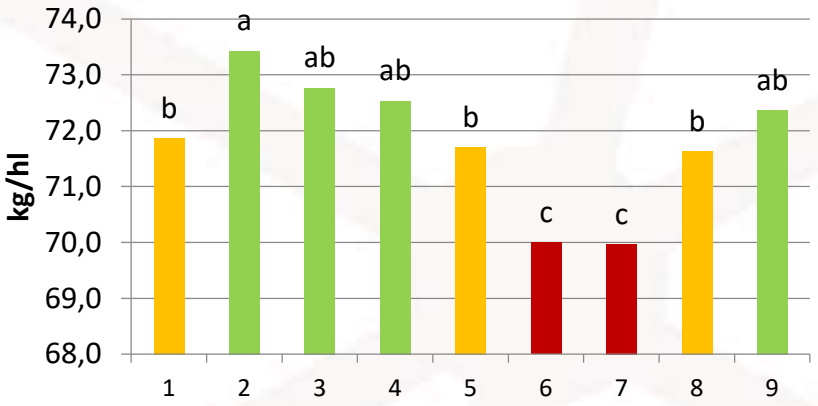


Yield and grain quality

Yield t/ha (13% humidity)



Medium hectolitre test wheight (kg/hl)



Treatment	Product
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2	Mineral control
3	Formulation 1 – Compost + BioPhosphate (ID:192)
4	Formulation 2 – Compost + BioPhosphate (ID:192)
5	Struvite 1 (ID:250)
6	Struvite 2 (ID:208)
7	Compost(ID:210)
8	Manure (commercial control)
9	Farmers' fertilization plan

Conclusions:

•**Yield**: **Farmers' fertilization plan and Struvite 1** generated the **highest** yields; **all treatments** provided yields **higher** than the **Unfertilized control** and similar to the **mineral control**.

•**Quality**: **BioPhosphate** and **Farmers' fertilization plan** provided a **higher** medium hectolitre test wheight rather than the **Unfertilized control**.

Demo events organized by UNITO on cereals

Details of the event 1	
Title of event:	CAMPO DEMO MAIS 2019
Date:	30th August 2019
Location:	Carmagnola (TO)

Details of the event 2	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains
Date:	4th September 2020
Location:	Webinar online (WebEx)

Demo events organized by UNITO on cereals

Details of the event 3	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero. ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains.
Date:	3rd October 2020
Location:	Webinar online (WebEx)

Details of the event	
Title of event:	ITA: L'utilizzo di nuovi fertilizzanti di recupero da fanghi di depurazione in cerealicoltura. ENG: The use of new fertilizers recovered from sewage sludge in cereals.
Date:	6th November 2020
Location:	Webinar online (WebEx)

Demo events organized by UNITO on cereals

Audiovisual materials on demo field crops trials uploaded on YT Channel of NUTRIMAN

- NUTRIMAN - Demo trial on corn in Italy - April 2020 - Prova dimostrativa su mais – YouTube

- NUTRIMAN - Demo trial on corn in Italy, part 2 - June 2020 - Prova dimostrativa su mais, parte 2 – YouTube

Demo field trial in vineyard

Evaluation of the use of different products from N and P recovery chains.

External view of the demo field trial on vineyard.

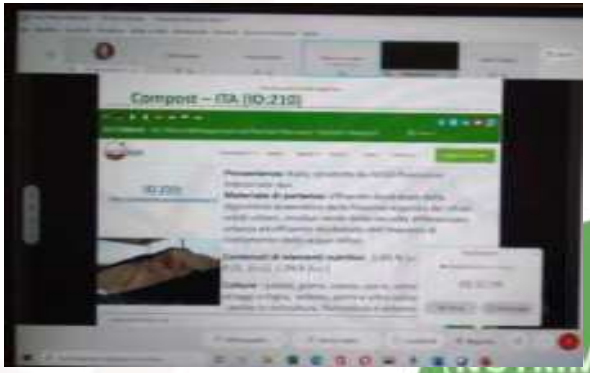
Harvesting.

Demo events organized by UNITO on grape

Details of the event 1	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains
Date:	4th September 2020
Location:	Webinar online (WebEx)

Details of the event 2	
Title of event:	ITA: Il progetto europeo NUTRIMAN e la nuova frontiera dei fertilizzanti prodotti da filiere di recupero. ENG: The European project NUTRIMAN and the new frontier of fertilizers produced from recovery chains.
Date:	3rd October 2020
Location:	Webinar online (WebEx)

Details of the event 3	
Title of event:	ITA: L'utilizzo di compost e digestati in viticoltura. ENG: The use of compost and digestates in viticulture.
Start date:	18/12/2020
End date:	18/12/2020
Location:	Webex



Demo events organized by UNITO on grape

Videos:

- https://www.youtube.com/watch?v=fsnVmbVU6IQ&list=PL6SNYMmBjnltg2djS_mggoc5qS2I-ZAi5&index=2

- https://www.youtube.com/watch?v=nAEitvbxEuc&list=PL6SNYMmBjnltg2djS_mggoc5qS2I-ZAi5&index=6

Conclusions

Fertilizers from nutrient recovery chains such as those used in the demonstration trials showed effects similar to mineral fertilizers.

Products demonstrated during the NUTRIMAN project in Italy	ID
Calcium-Sodium-Phosphate from sewage sludge ash conversion with the "AshDec®" process	397
High nutrient dense Bio-Phosphate products recovered from food grade animal bone grist with over 30% P_2O_5 content by "3R zero emission pyrolysis" process	192
Struvite from digestate and manure by "REVAWASTE" process	250
Struvite from wastewater by "PHORWater" process	208
Compost from green waste and digested mixed-waste by "ACEA Pinerolese" process	210
Green compost from green waste by "IMOG" process	280
High NP pelletized digestate from animal manure and organic waste digestate by "Arbio and NPirriK-project" process	270

14 demo trials were organized by UNITO on: lettuce, tomato, cabbage, corn, soft wheat, grape.

1000 farmers/professionals reached directly attending demo trials events and workshops carried out in Italy within the NUTRIMAN project.

Thank you for the attention!

AGRINNOVA

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NUTRIMAN

Nutrient Management and Nutrient Recovery Thematic Network

www.nutriman.net

@NUTRIMANnetwork

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