



Faculty of Agriculture  
University of Novi Sad

# **POTENTIAL OF *MEYEROZYMA* *CARIBBICA* AND *TRICHODERMA VIRENS* AS A BIOSTIMULANT FOR ONION (*ALLIUM CEPA* L.) PRODUCTION**

**Jozef GAŠPAROVSKI, Dragana BUDAKOV, Tatjana DUDAŠ, Dobrila RADIĆ, Milica MESELDŽIJA,  
Snežana RAJKOV, Mila GRAHOVAC**

*E-mail: [jozef.gasparovski@polj.edu.rs](mailto:jozef.gasparovski@polj.edu.rs)*

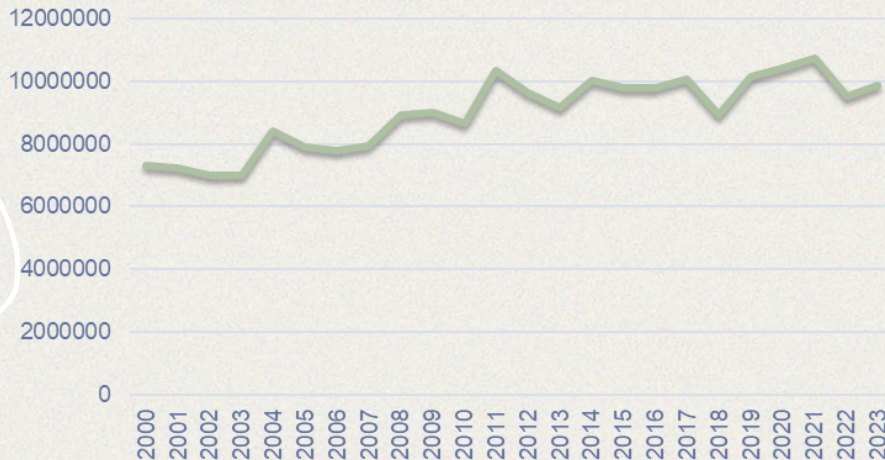


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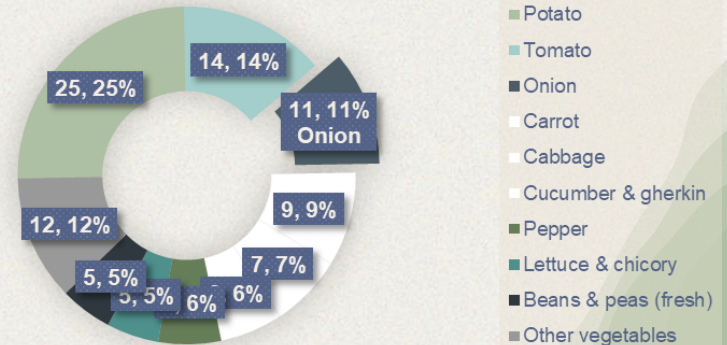
# Onion production in EU

- Onion production across the EU reached approximately 7.0 million tonnes in 2024, which represents an increase of 11% compared to 2023.
- Onions occupy approximately 8.6 % of the total fresh vegetable cultivation area in the EU (~172 000 ha).
- Account for around 11 % of the total fresh vegetable production volume.

## Onion production in Europe since 2020



## Total production of fresh vegetables



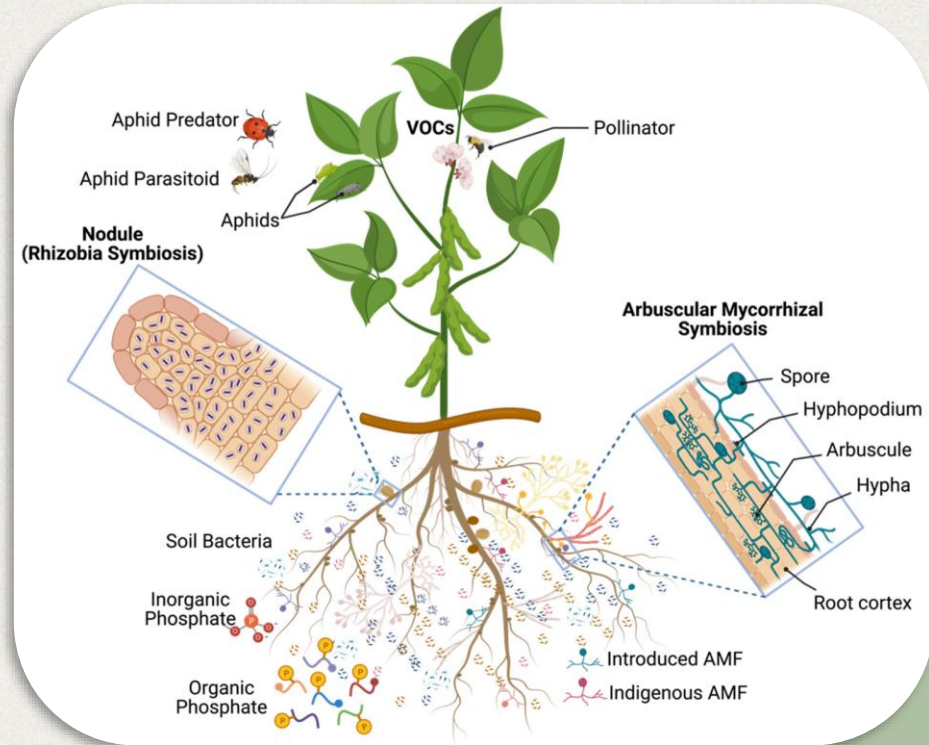
# Quality Parameters of Onion Bulbs

- **Total Dry Matter (TDM)**  
indicates bulb firmness  
impact storability and weight loss
- **Total Soluble Solids (TSS)**  
reflects sugars content and flavor  
impact taste and storage stability
- **Ash (Mineral Content)**  
represents essential minerals (Ca, K, Mg)  
contributes to tissue strength and postharvest quality



# Role of microbial stimulants and biopesticides in modern agriculture

- Enhance nutrient uptake and stimulate root growth.
- Improve plant vigor and increase tolerance to biotic and abiotic stress.
- Suppress pathogens through competition, antibiosis or parasitism.
- Strengthen overall plant health and reduce disease pressure.

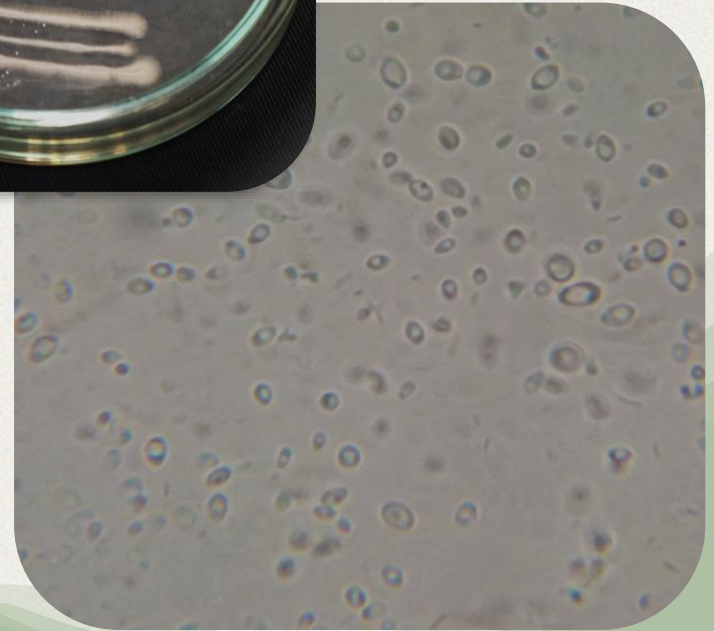


# Aim of the study

The aim of this study was to evaluate the effect of the yeast *Meyerozyma caribbica* (strain BBJ) and the fungi *Trichoderma virens* (strain DAR7) on the quality parameters and potential storage quality of onion bulbs.

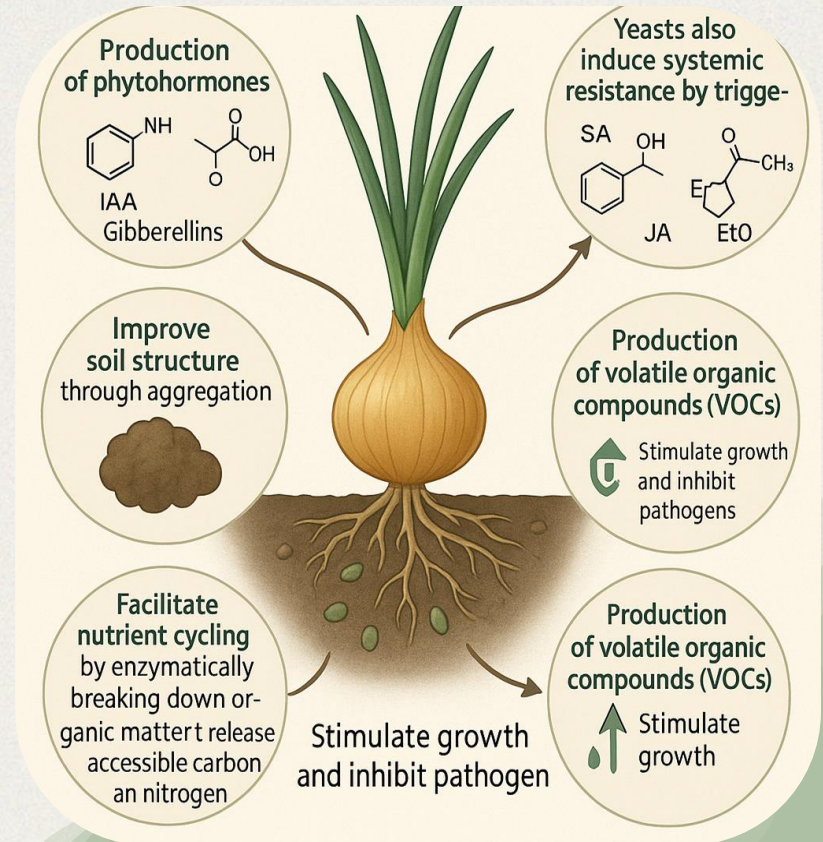
# *Meyerozyma caribbica*

- This yeast naturally occurs on plant surfaces (phyllosphere) and soil.
- Forms smooth, creamy, white to pale colonies on nutrient medium.
- Forms **hat-shaped spores** in liquid nutrient medium, characterized by a flat top and a raised rim around the edge.
- Strong antagonistic activity, including the reduction of mycotoxin accumulation.



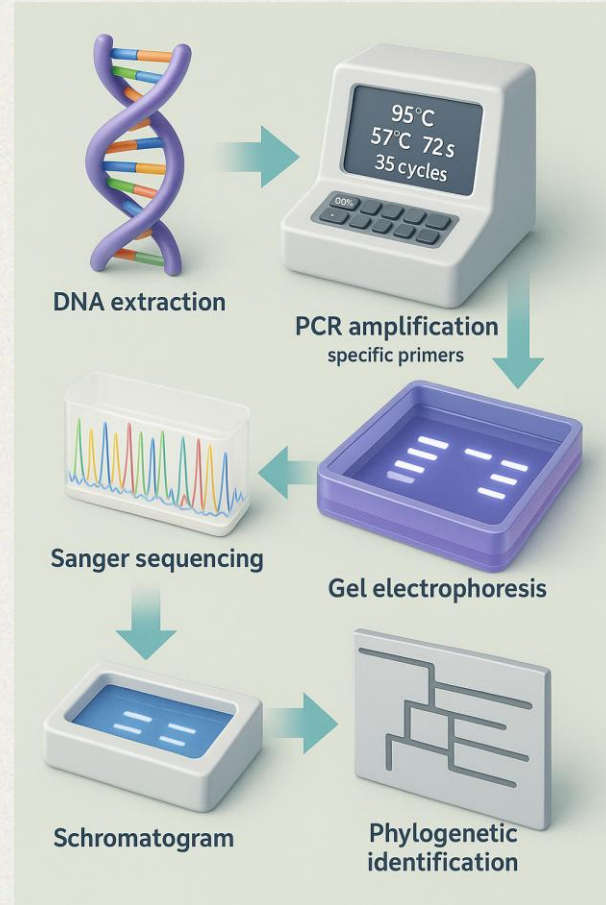
# Mechanisms of action of *Meyerozyma caribbica*

- Production of phytohormones
- Improve soil structure
- Facilitate nutrient cycling by enzymatically breaking down
- Induce systemic resistance
- Antagonize pathogens via extracellular enzymes



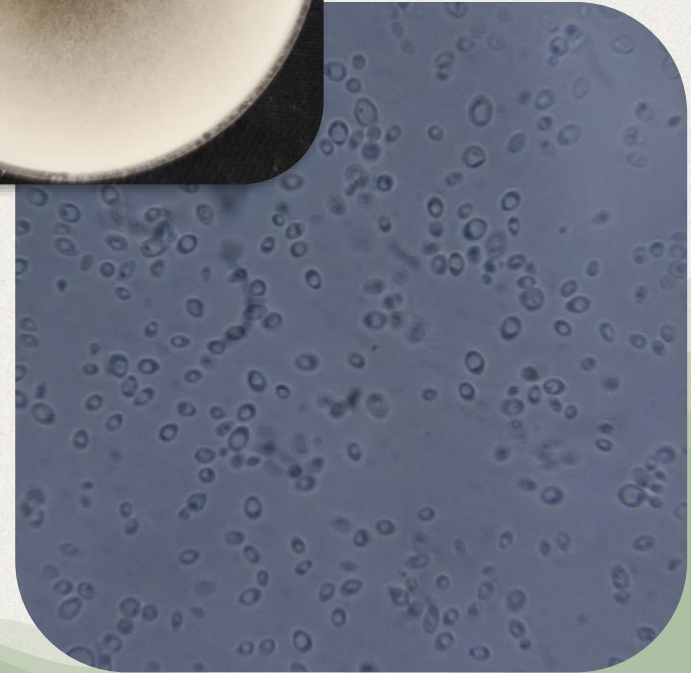
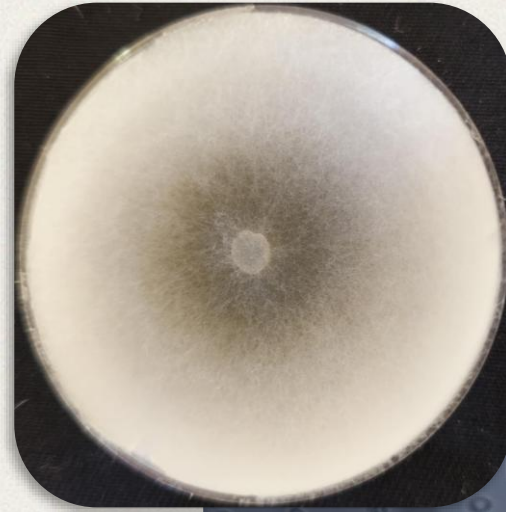
## Molecular identification of the *Meyerozyma caribbica* (strain BBJ) used in this study

- The isolate *Meyerozyma caribbica* (strain BBJ) was identified by amplification of **ITS region**, using the ITS4/ITS5 primers and **LSU region** using NL1/NL4 primers.
- The amplified PCR products were purified, sequenced and the sequences were analyzed using BLAST.
- **The BLAST analysis confirmed the identity of the isolate as *M. caribbica*.**



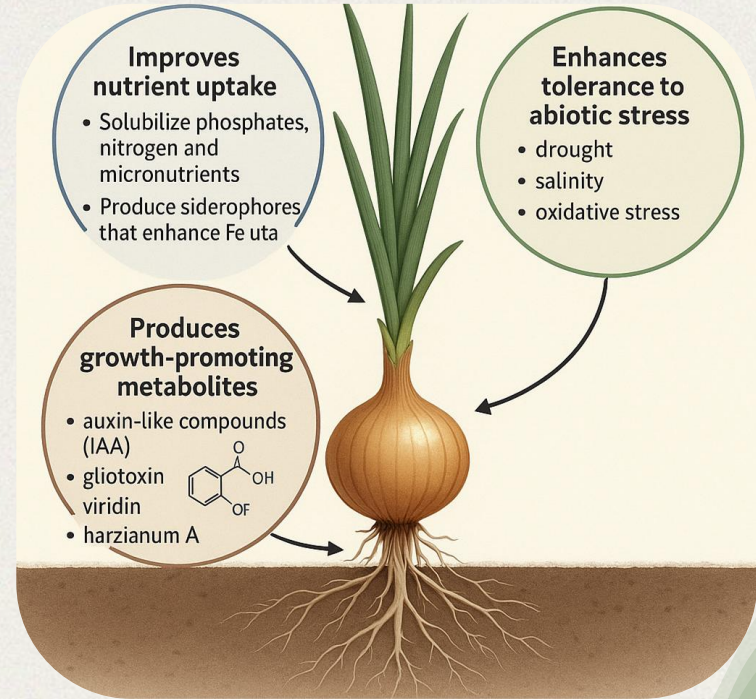
# *Trichoderma virens*

- Fast growing white mycelium filamentous fungus, widely present in agricultural soils.
- Functions as a plant growth-promoting symbiont and biocontrol agent.
- Chlamydospores are **thick-walled, spherical to sub-spherical** spores.
- Highly resistant resting propagules and persistence in biopesticide or bio-formulation products.



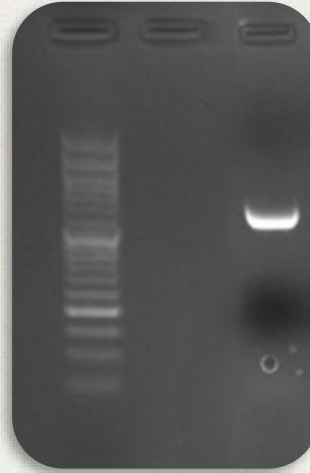
## Mechanisms of action of *T. virens*

- **Improves nutrient uptake**  
solubilize phosphates, nitrogen and micronutrients  
produce siderophores that enhance **Fe** uptake
- **Produces growth-promoting metabolites**
- **Enhances tolerance to abiotic stress**  
drought  
salinity  
oxidative stress

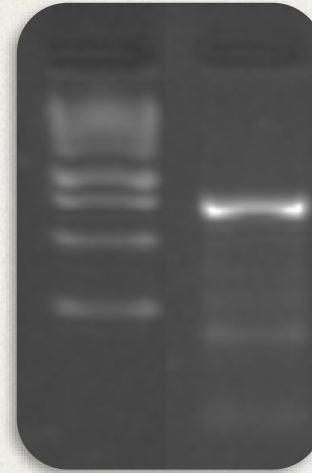


# Molecular identification of the *Trichoderma virens* (strain DAR7) used in this study

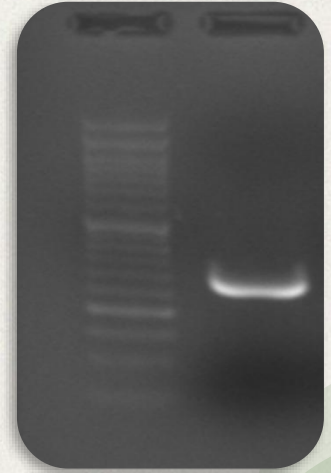
- The isolate *Trichoderma virens* (strain DAR7) identified by amplification of:
  - **ITS** using the ITS4/ITS5 primers
  - **$\beta$ -tubulin** gene using T1/T22 primers
  - **TEF-1 $\alpha$**  gene using EF1/EF2 primers
- The obtained PCR products were purified and sequenced, and the sequences were analyzed using BLAST.
- The BLAST analysis confirmed the identity of the isolate as *Trichoderma virens*.



Internal transcribed spacer (**ITS**)



**$\beta$ -tubulin**



Translation elongation factor 1-alpha (**TEF-1 $\alpha$** )

# Inoculum preparation

- Prepared from **48 h culture** of *M. caribbica* and **7-day culture** of *T. virens* from PDA medium
- Cultivated in broth at 28 °C, 150 rpm, for 72 h.
- Suspension adjusted to  **$1 \times 10^7$  spores mL<sup>-1</sup>** using a hemocytometer.



# Experiment design

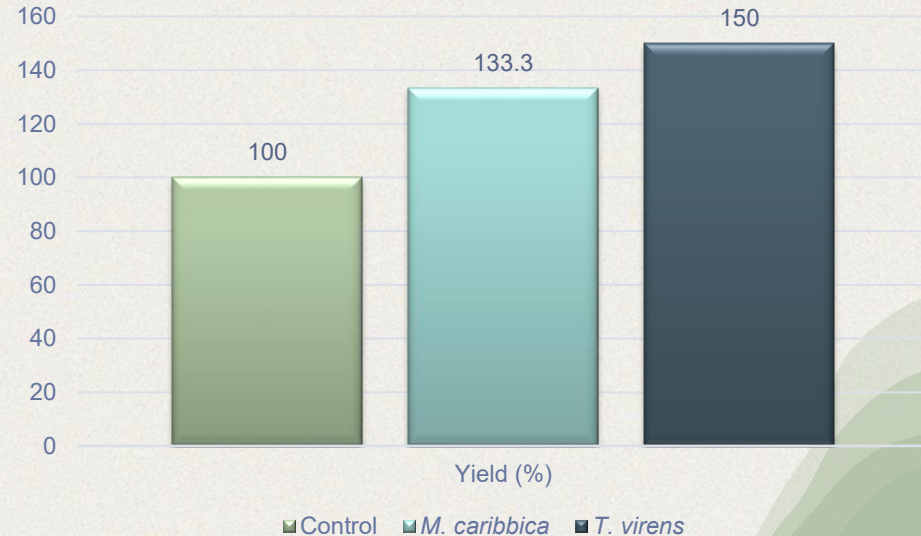
- **Experimental variants:**  
Three treatments were included:
  - plants treated with *Meyerozyma caribbica*
  - plants treated with *Trichoderma virens*
  - Untreated control plants
- **Before planting:** bulbs were **immersed in the suspension** for initial colonization, using prepared inoculum
- **During vegetation:** three foliar treatments were applied at monthly intervals, using prepared inoculum
- **Number of plants:** each variant consisted of 3 repetitions × 200 plants, totaling in 600 onion plants per variant
- **Onion cultivar:** Stuttgarter Riesen
- **Location:** agricultural field in Serbia
- **Evaluation:** yield, total dry matter, soluble solids, mineral residue, were evaluated.



# Results

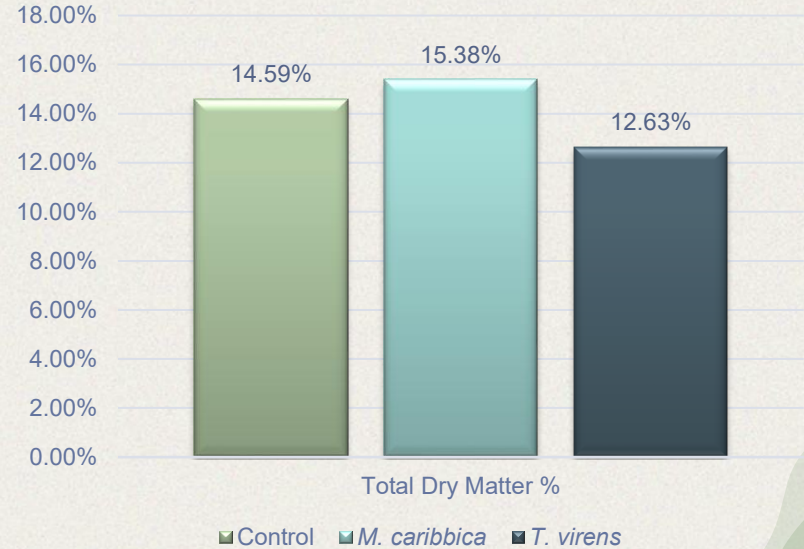
## Effect of treatments on yield (%)

- ***M. caribbica*** treatment **increased** onion yield **by 33.3%** – promoted higher bulb weight and overall productivity compared to the untreated control
- ***T. virens*** treatment **increased** onion yield by **50%** indicates highly effective root stimulation, nutrient uptake enhancement, and stress tolerance
- Both biostimulants significantly outperformed the untreated control, demonstrating their potential as effective biological inputs for sustainable onion production.



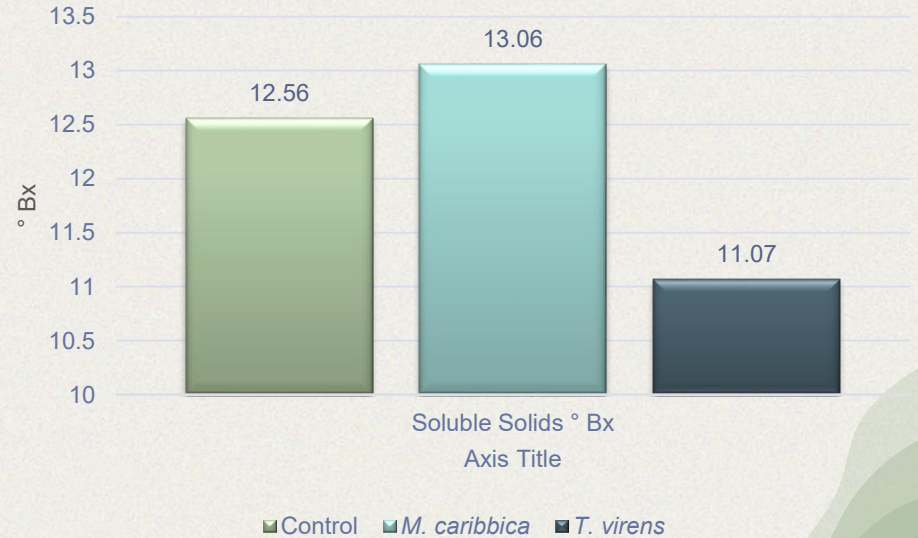
## Total dry matter

- ***M. caribbica*** treatment **increased** total dry matter by **5.4%**  
– resulted in firmer bulbs with better postharvest stability
- ***T. virens*** treatment **decreased** total dry matter by **13.4%**  
– produced softer bulbs with lower dry-matter accumulation
- Both biostimulants showed distinct physiological effects, demonstrating that microbial treatments can differently influence bulb composition and dry-matter dynamics in onion production.



## Soluble solids

- ***M. caribbica*** treatment **increased** soluble solids content by **4.0%**
  - indicates improved flavor intensity and higher sugar accumulation in bulbs
- ***T. virens*** treatment **decreased** soluble solids content by **11.9%**
  - reflects reduced sugar concentration and lower flavor intensity



## Mineral residue

- **Ash content remained stable across all variants**

-mineral composition of onion bulbs is stable and less sensitive to these biostimulant.

# Conclusion

- ***M. caribbica* (strain BBJ)** provides **moderate yield increase** and **clear improvement in quality** (higher dry matter and soluble solids).  
Suited for **onions intended for longer storage** and improved postharvest performance.
- ***T. virens* (strain DAR7)** strongly **boosts yield** but **reduces dry matter and soluble solids**.  
More suitable for **fresh-market onions** that will be **used or sold soon after harvest**.
- Each bioagent has its own target application depending on growers' priorities:  
**Quality-focused production - *M. caribbica***  
**Maximum yield-focused production - *T. virens***
- Together, these results show that microbial stimulants can be **strategically selected** to meet **different agricultural needs** and production goals.



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# Thank you for your attention!

Email: [jozef.gasparovski@polj.edu.rs](mailto:jozef.gasparovski@polj.edu.rs)

**Acknowledgements:** This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant Nos: 451-03-65/2024-03/200117, and 451-03-66/2024-03/200117).



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