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The effect of added insect frass as a soil amendment in the NPK content of two pepper varieties

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Laboratory of Entomology and Agricultural Zoology

Zophobas morio

Giant mealworm

Tenebrio molitor

Yellow mealworm

Alphitobius diaperinus

Lesser mealworm

Hermetia illucens

Black soldier fly

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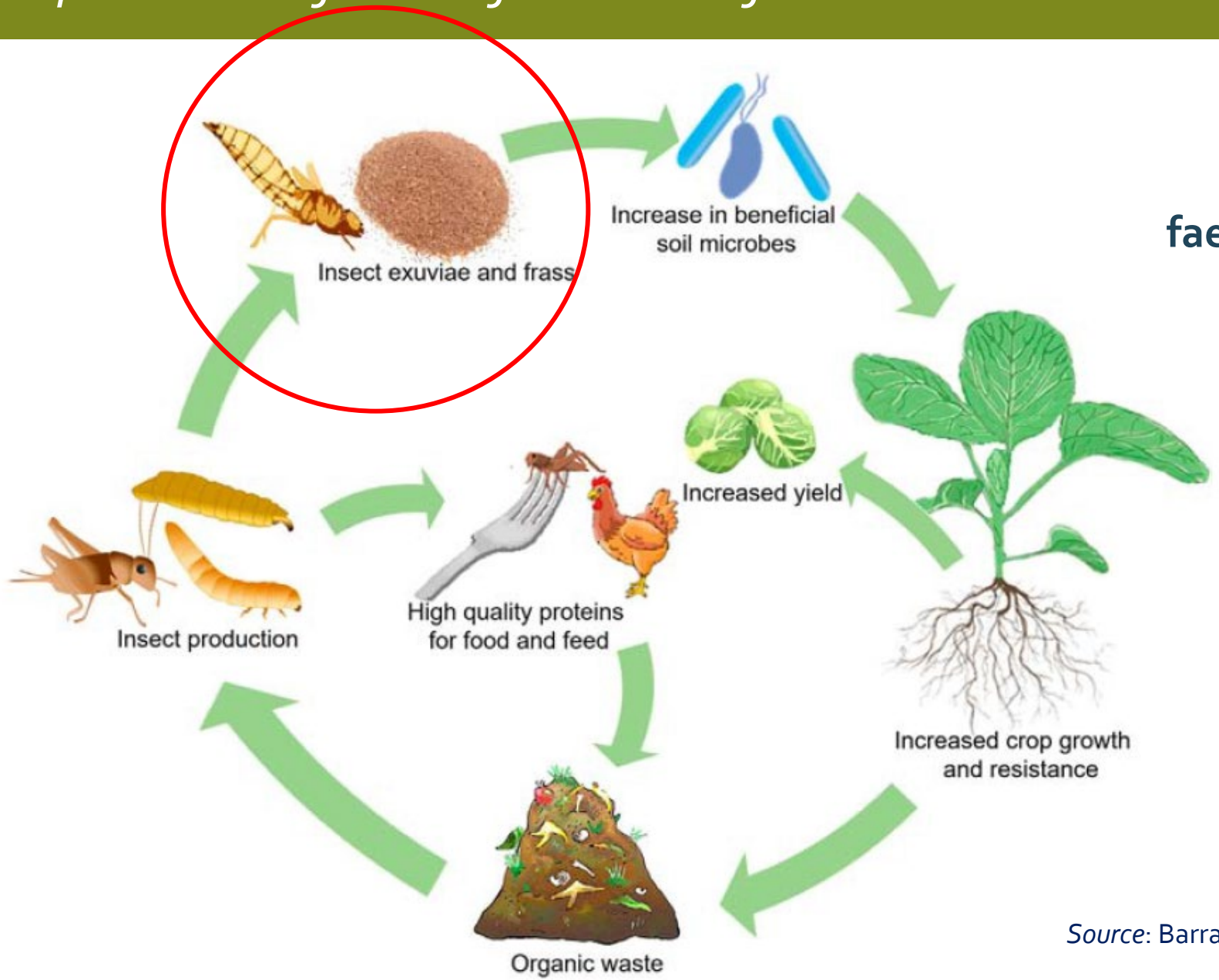
Laboratory of Soil Science

Exploitation of insect frass as biofertiliser



the leftover of the insect rearing process that consists of **larvae faeces**, **exoskeletons** and **residues of the rearing substrate**

Source: Barragán-Fonseca et al. (2022) Trends in Plant Science 27: 7

EU authorization

- November 2021: frass has been authorized in EU as fertilizer [EU Regulation 2021/1925]

FR / EN FAQ CONTACT Ynsect

YNSECT PRODUCTS PARTNERS JOBS NEWS & PRESS

BACK

EU authorities' move to set up standards for insect frass hailed as a major step forward for the European insect sector

PUBLISHED ON 27/05/2021

SHARE ON :

Paris, May 26th, 2021 – On May 25th, Member States' delegates in the EU Standing Committee on Plants, Animals, Food and Feed have backed a draft Commission Implementing Regulation, aiming at setting EU baseline standards for the valorization of insect frass as fertilizer, as part of the EU legislation on animal byproducts.

Similar to compost or other types of animal manure, frass contains relevant nutrients and micronutrients, as well as chitin, which could stimulate the growth of beneficial bacteria in soil. These properties make frass a valuable solution for farmers active in crop production

Heat treatment

1 h at 70°C

Exploitation of insect frass as biofertiliser

Journal of Economic Entomology, XX(XX), 2024, 1–8
https://doi.org/10.1093/jee/toad234
Research

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Beneficial Uses of Insects

Insect frass composition and potential use as an organic fertilizer in circular economies

Helen C.S. Amorim[1,2,*], Amanda J. Ashworth[1], Komala Arsi[1], M. Guadalupe Rojas[3], Juan A. Morales-Ramos[3], Annie Donoghue[1], Kelsy Robinson[4]

frontiers in Sustainable Food Systems

ORIGINAL RESEARCH
published: 28 July 2021
doi: 10.3389/fsufs.2021.714596

Check for updates

Assessment of the Short-Term Fertilizer Potential of Mealworm Frass Using a Pot Experiment

David Houben[1], Guillaume Daoulas[2] and Anne-Maïmiti Dulaurent[1]*

frontiers in Plant Science

ORIGINAL RESEARCH
published: 23 September 2020
doi: 10.3389/fpls.2020.574592

Check for updates

insects

MDPI

Article

Glasshouse Evaluation of the Black Soldier Fly Waste Product HexaFrass™ as an Organic Fertilizer

Sara Borkent * and Simon Hodge

agronomy

Communication

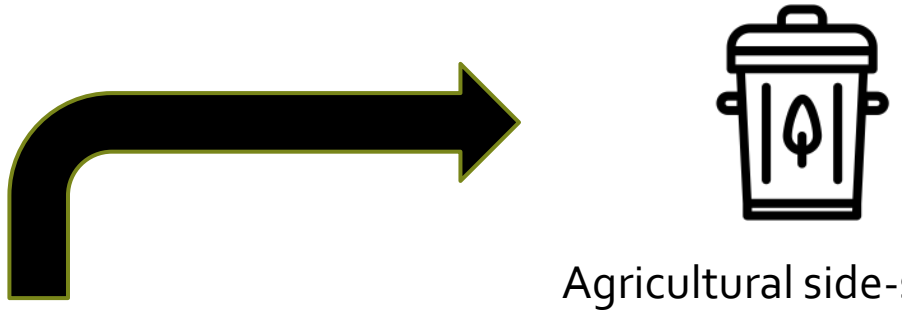
Suitability of Black Soldier Fly Frass as Soil Amendment and Implication for Organic Waste Hygienization

Thomas Klammsteiner [1,*], Veysel Turan [2], Marina Fernández-Delgado Juárez [1], Simon Oberegger [1] and Heribert Insam [1]

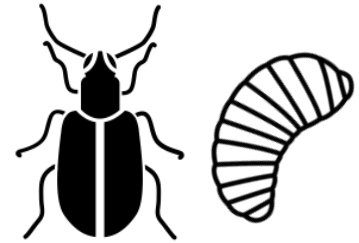
OPEN ACCESS

Exploring Black Soldier Fly Frass as Novel Fertilizer for Improved Growth, Yield, and Nitrogen Use Efficiency of Maize Under Field Conditions

Dennis Beesigamukama[1,2,3], Benson Mochoge[2], Nicholas K. Korir[2], Komi K. M. Fiaboe[1,4], Dorothy Nakimbugwe[5], Fathiya M. Khamis[1], Sevgan Subramanian[1], Thomas Dubois[1], Martha W. Musyoka[1], Sunday Ekesi[1], Segenet Kelemu[1] and Chrysantus M. Tanga[1*]*

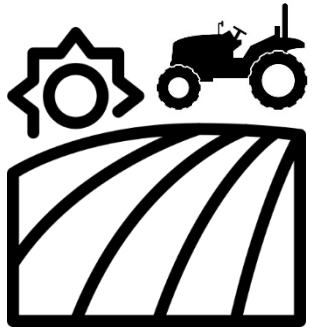


Agricultural side-streams



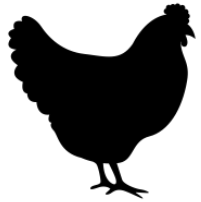
Insect rearing

insect frass



Crop production

Insect-based diets



Local poultry breeds

chicken manure

Trial objective

***Tenebrio molitor* frass (FR)**: N=5%, P=2%, K=1,7%

Objective: to study the effect of *T. molitor* frass and chicken manure in the development and composition of two local pepper varieties

ahovitiki

g/ha;

o 15-20

pot experiment

Plant species

two local varieties of pepper

Bachovitiki

Soil types

- medium-to-heavy textured soil
- sandy, light-textured soil

Florinis

240 pots of 10-L capacity (6 treatments × 2 soils × 2 pepper cultivars × 10 replicates)

Treatments

- **NC**: Negative control (no additions to the soils)
- **PC**: Positive control (addition of 2 g per pot of a fertilizer with title 12-12-17)
- Low frass: **FR0.5%**: 40 g frass per pot
- High frass: **FR1%**: 80 g FR per pot
- Low chicken manure: **CM2.5%**: 200 g CM per pot
- High chicken manure: **CM5%**: 400 g CM per pot

trial performed: April – August 2023

*A) During the growth period (*Day 10, 30, 60, 90)

i) physiological parameters

a) gas exchange rates
b) PSII photochemical efficiency
c) leaf reflectance indices
d) concentration of photosynthetic pigments

ii) product quantity

a) Number of peppers per plant
b) Fresh pepper weight per plant
c) morphometric characteristics

iii) product quality parameters

a) chroma
b) flesh firmness
c) Bioactive compounds concentration (pigments, flavonoids and phenolics)

B) Final harvest

i) plant growth parameters
ii) nutrients in soils

C) NPK in plant leaves

- **N with Kjeldahl**

(digestion with H_2SO_4, steam distillation of ammonia, titration with dilute acid at normality 0.01 N)

- **PK with dry ashing**

(ashing at 500 °C, extraction with 20% HCl);

  - **P colorimetrically**

    (with ammonium molybdenate/ascorbic acid at 882 nm in spectrophotometer)

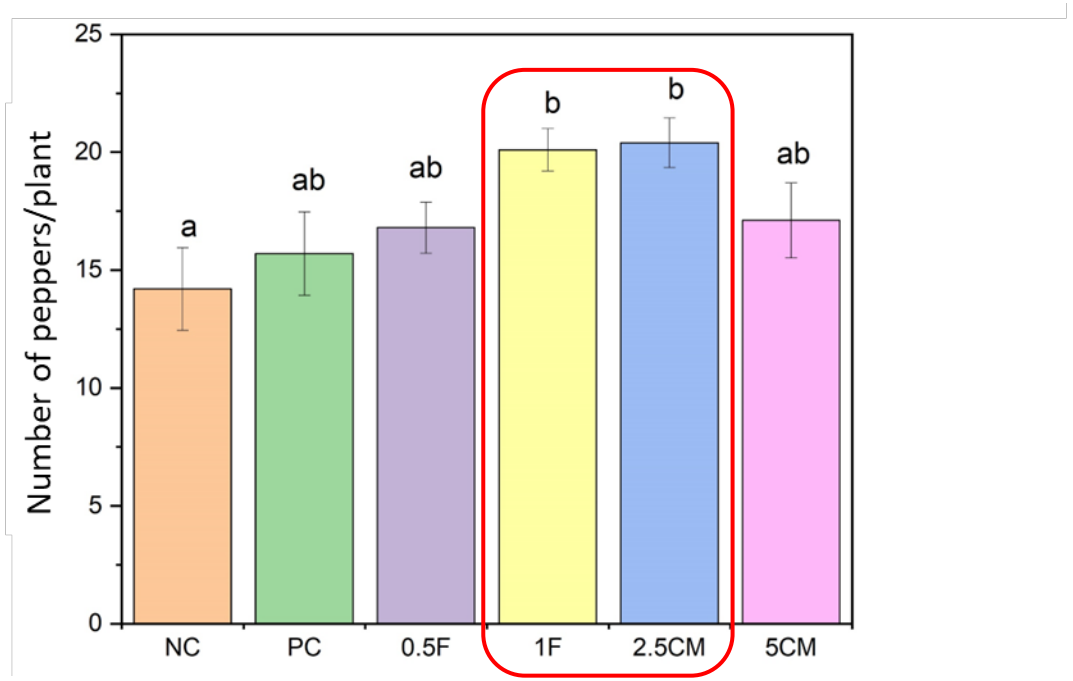
  - **K in flame photometer**

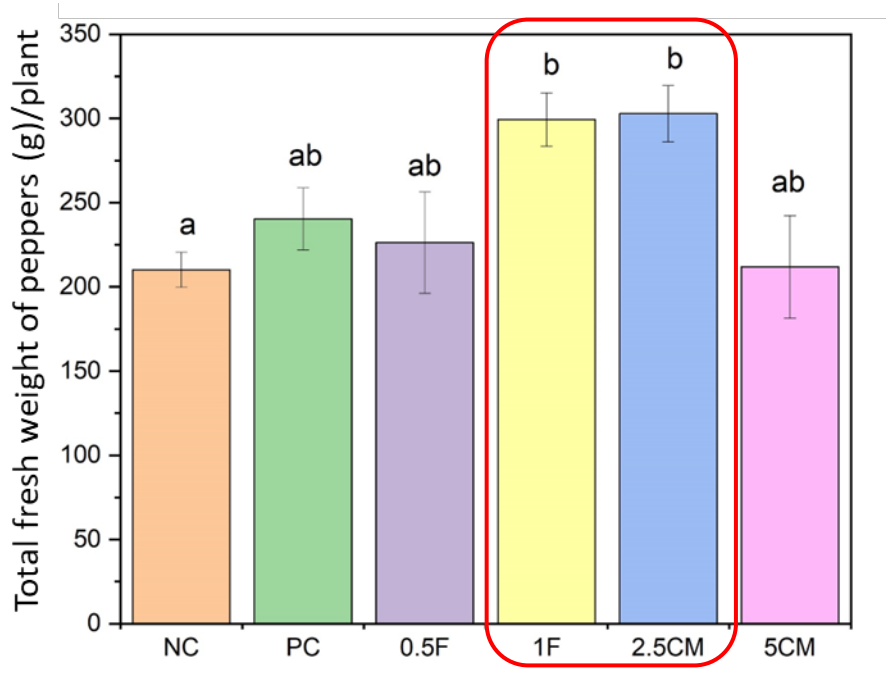

April 2023


Professor Gasco visiting
the pepper frass trial in
UTH in **June 2023**

var. Bachovitiki

medium-to-heavy textured soil

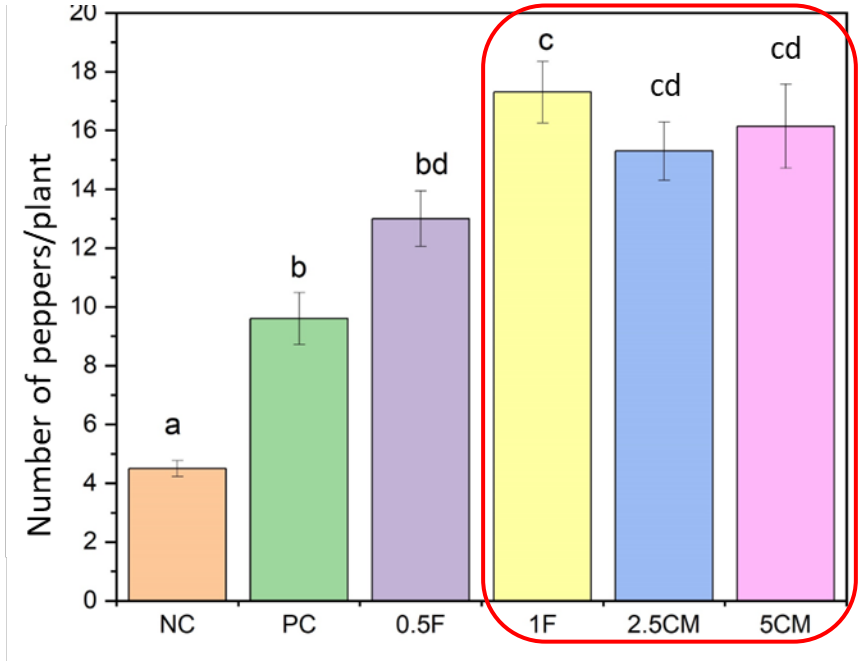


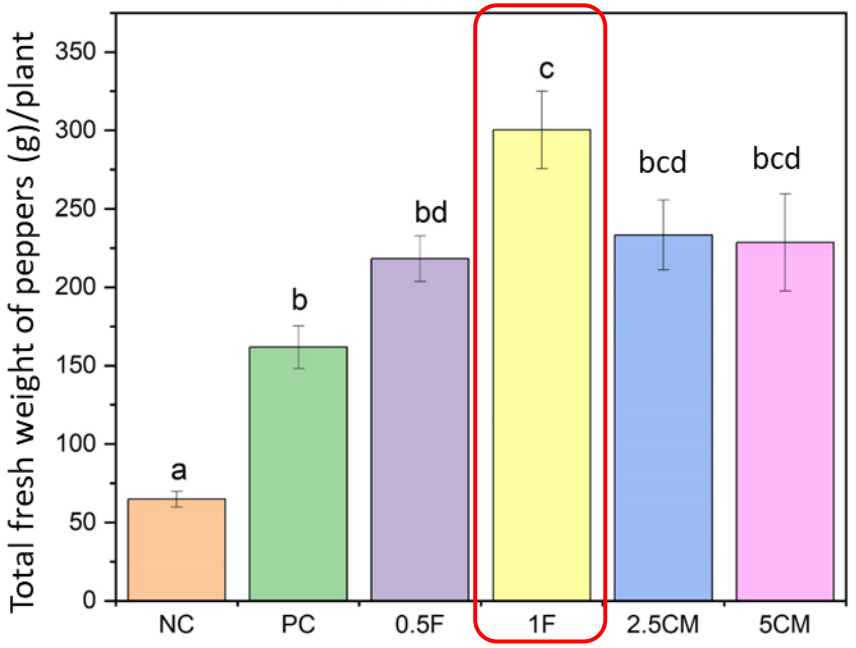


- ✓ **FR1%** and **CM2.5%** resulted in **higher number of peppers per plant**, showing, however, statistically significant differences only with NC
- ✓ The same pattern was also evident in **total yield** per plant

var. Bachovitiki

sandy soil

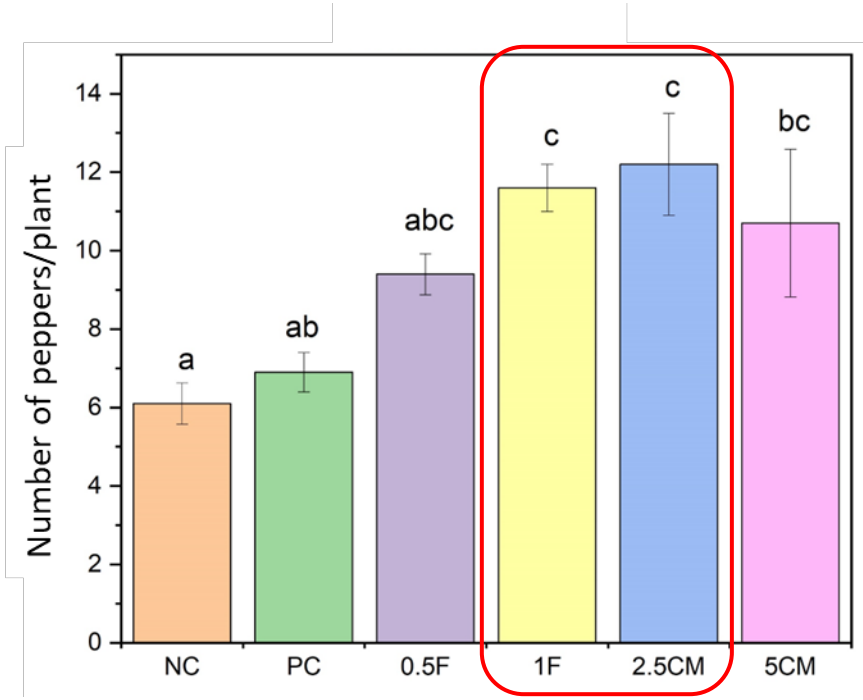


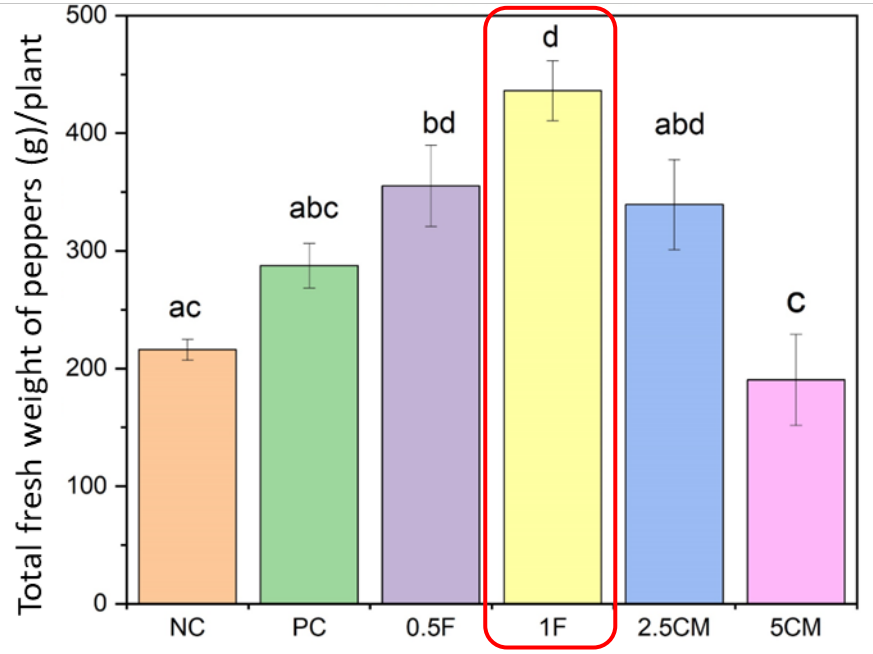


- ✓ Comparable **number of peppers per plant** for **FR1%** and **both CM rates**, outweighing all other treatments
- ✓ The **total yield** per plant was **significantly higher in FR1%** compared to FR0.5%, NC and PC
- ✓ NC and PC always lower than FR1%

var. Florinis

medium-to-heavy textured soil

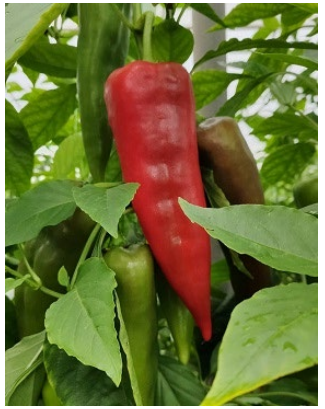


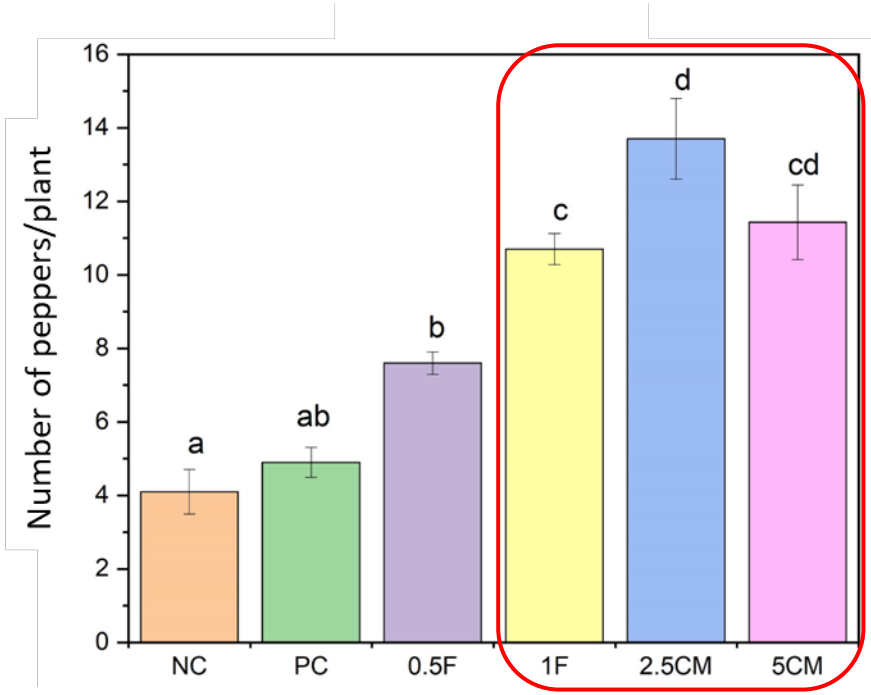


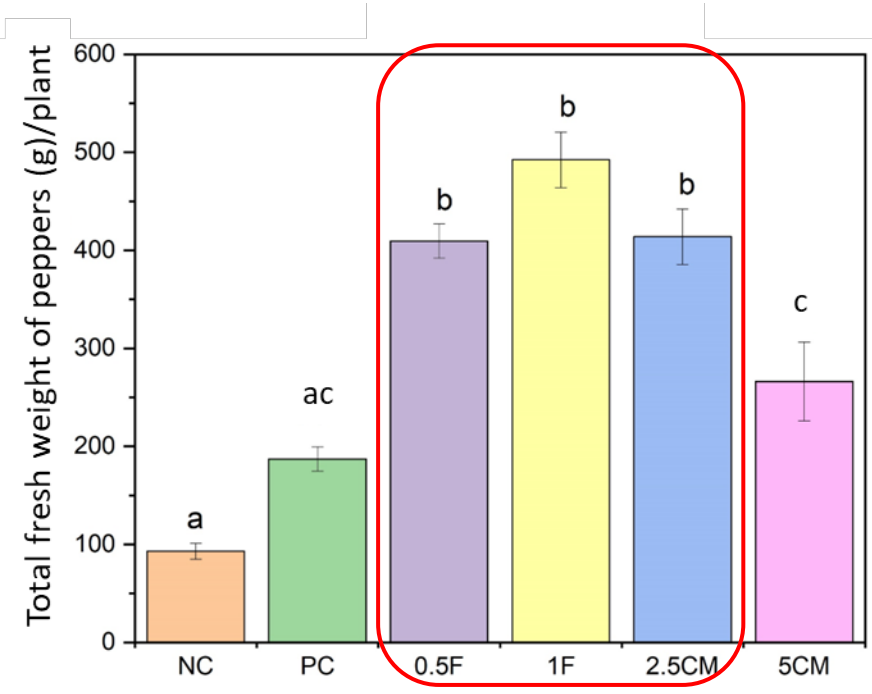
- ✓ **CM2.5%** and **FR1%** outperformed all other treatments in the **number of peppers**, with FR0.5% and CM5% closely following
- ✓ **FR1%** resulted in the **highest total yield** per plant, while **CM5%** caused a **significant reduction**
- ✓ NC and PC always lower than FR1%

var. Florinis

sandy soil





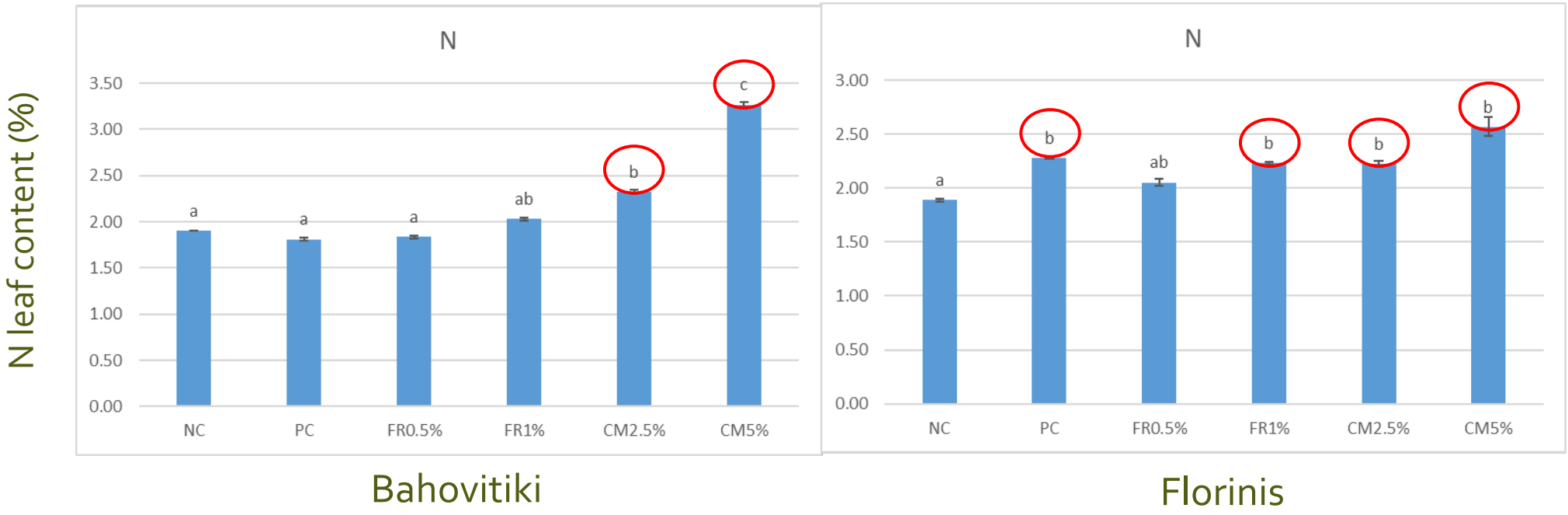


- ✓ **CM2.5%** outperformed all other treatments in the **number of peppers**, with the CM5% and FR1% following
- ✓ The **total yield** per plant was significantly higher in **FR1%** and **FR0.5%**, as well as **CM2.5%**
- ✓ NC and PC always lower than FR1% and CM2.5% CM

Conclusions

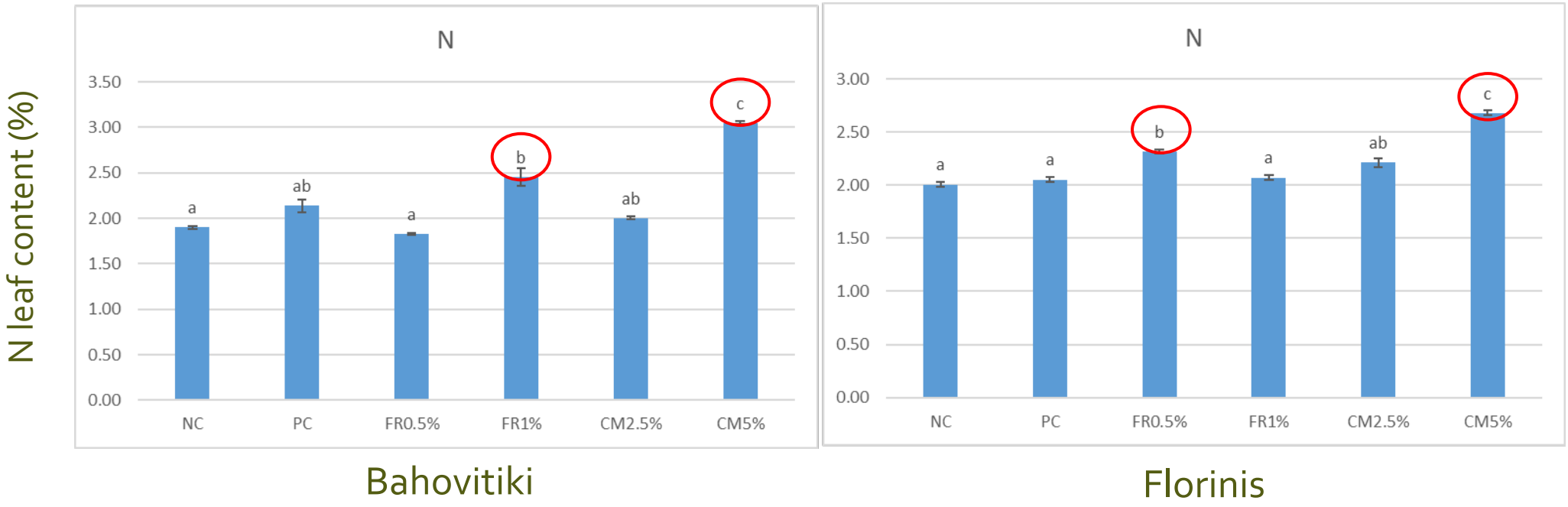
- **Pepper production** (pepper number and total weight) **in the sandy soil was reduced** by 75% compared to the medium-textured soil in NC in Bachovitiki and almost by 50% in Florinis
- Of similar direction but less pronounced were the differences observed in **PC**. Therefore, the supplementation of chemical fertilizers **failed to support plant performance in the sandy soil**
- The **amendment of frass and chicken manure greatly improved the fertility of the sandy soil**, resulting in similar crop productivity to that of the medium-textured soil
- **FR1%** seems to be the **most appropriate choice** for increasing the productivity of both pepper varieties in both soils, with **CM2.5% following**

sandy soil



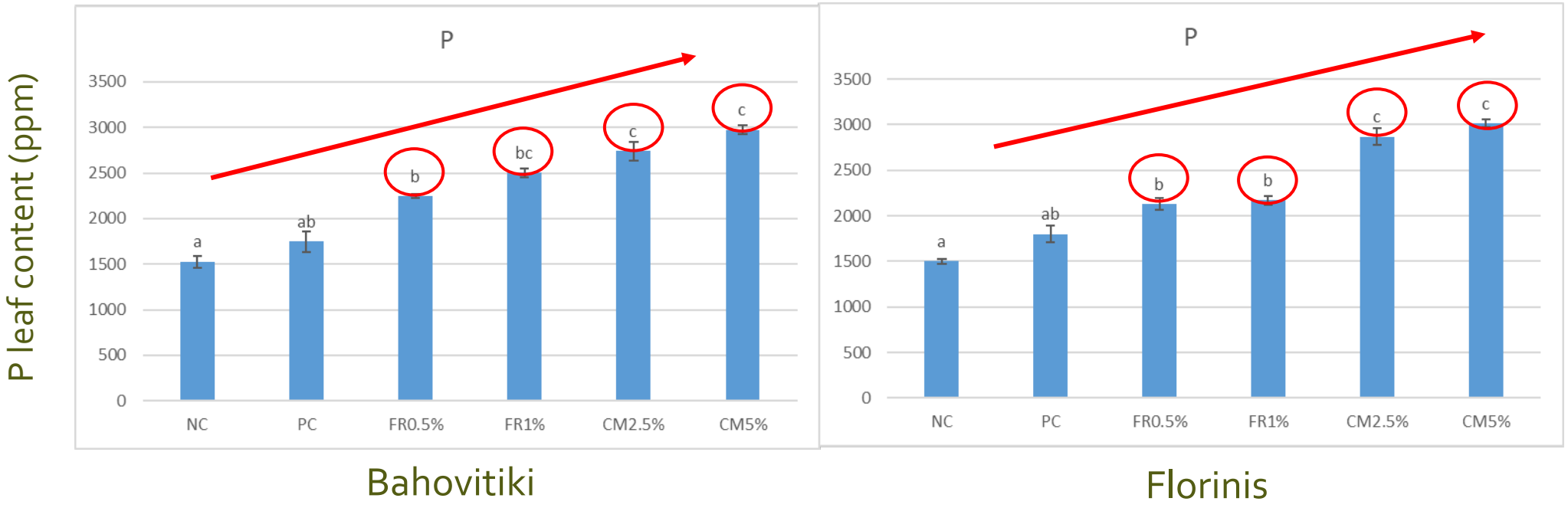
- ✓ Control: N ca. 2% in both varieties
- ✓ Significant increase of leaf N content at high frass rate (FR1%) in Florinis, but not in Bahovitiki
- ✓ CM5%: $N_{Bahovitiki}$=3.3%; $N_{Florinis}$=2.6% (both significantly higher than NC)

medium-to-heavy textured soil



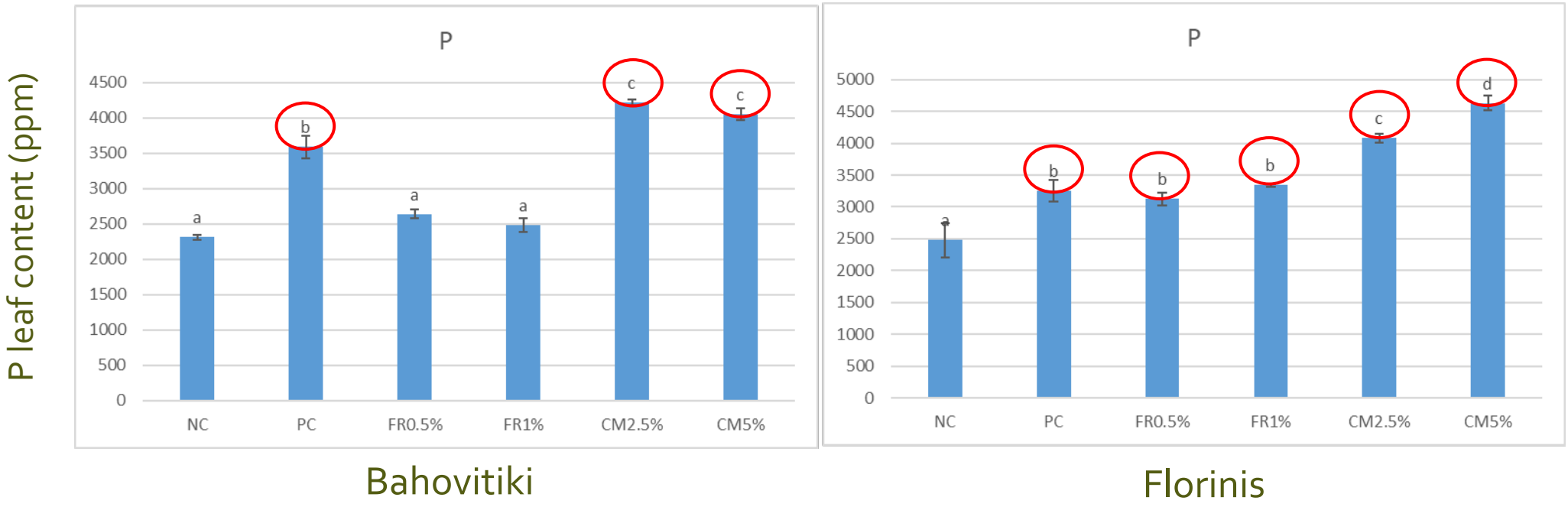
- ✓ Control: N ca. 2% in both varieties
- ✓ Similar results with the sandy soil except: between frass treatments, only FR0.5% significantly increased N content in Florinis compared to NC

sandy soil



- ✓ P content for NC was 1500 ppm (1.5‰) for both varieties
- ✓ Significant increase with FR and CM

medium-to-heavy textured soil

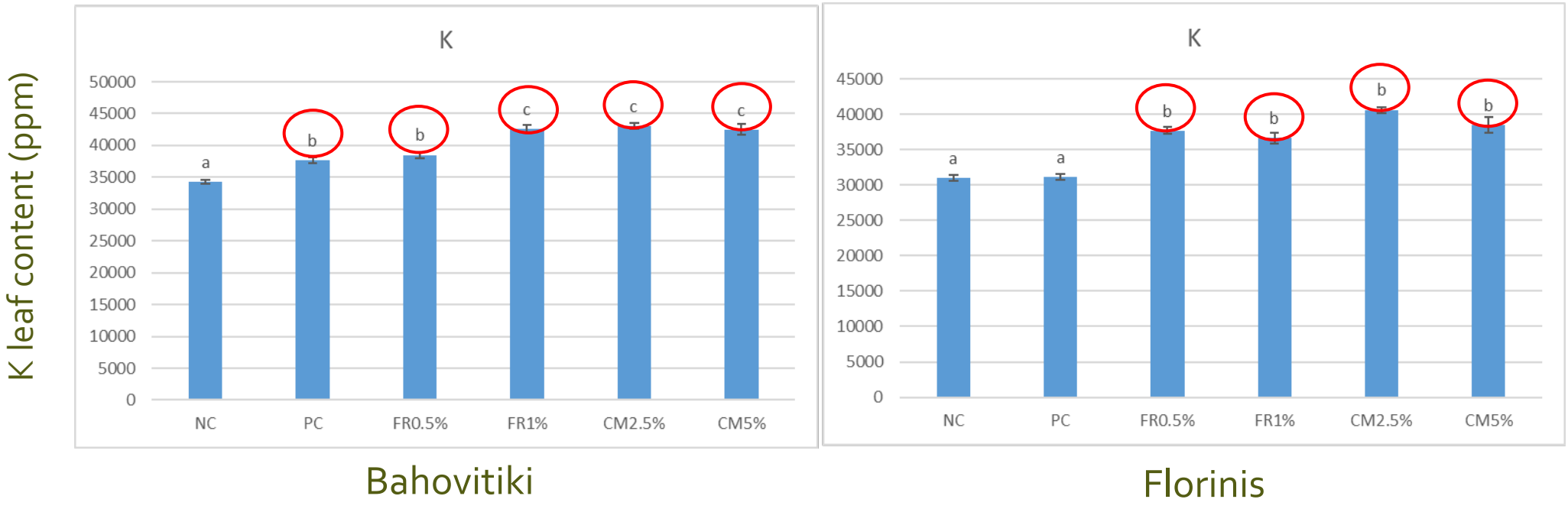


- ✓ Leaf P content for NC was 2500 ppm (2.5‰) in both varieties, higher than in the sandy soil [more fertile soil]
- ✓ Similar trends with the sandy soil

sandy soil

✓ K content in NC was already high (2.5%)

medium-to-heavy textured soil



- ✓ Higher K in NC than in the sandy soil [more fertile soil]
- ✓ **FR1%** and **both rates of CM** resulted in **significantly** higher leaf K content compared to NC and PC

Conclusions

- Both **FR** and **CM** had a **positive effect** in the nutrition of the two tested pepper varieties, Bahovitiki and Florinis, in both soils

- Leaf **N content** increased significantly in both soils and in both pepper varieties with added FR and CM

- **FR1%** was **as effective as CM2.5%** regarding pepper leaf NPK levels in most cases [except for 3 cases all concerning P]

- For FR1% pepper NPK levels were in most of the cases significantly higher than for PC

- FR seems to be superior to CM: lower application rates (1%) than for CM (2.5%) resulted in similarly enhanced plant nutritional levels

Follow-up work

Eggplant experiment: April – August 2024

pot experiment

Plant species

two local varieties of eggplants

Tsakoniki

Langada

Soil types

- medium-to-heavy textured soil
- sandy soil

Treatments, measurements and replication as per pepper experiment

Papadimitriou Nikos

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Thalassinos Georgos

UNIVERSITY OF THESSALY

Levizou Efi

Athanassiou Christos

Thanks to the whole UTH team!

UNIVERSITY OF THESSALY

For more information regarding ADVAGROMED please **scan the QR-code** [https://www.advagromed.com]:

Thank you for your attention!

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