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PIANO NAZIONALE
DI RIPRESA E RESILIENZA



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Fortification of circular substrate for black soldier fly with zinc and/or selenium: effect on growth performances

A. Moradei, M. Ottoboni, C. Jucker, S. Savoldelli, S. Malabusini, A. Luciano, L. Pinotti

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Protein sources for feed

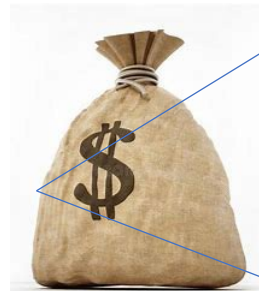
Fish meal



Soybean meal



Insect meal



Aquafeed



Pet food

Justify
**high
prices**

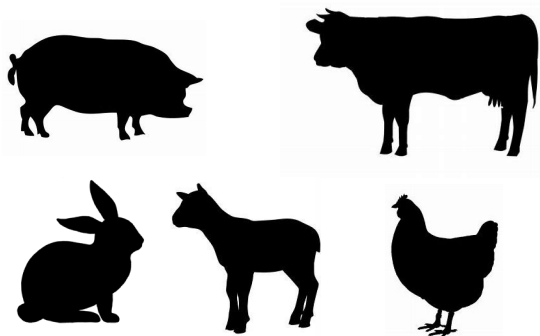
Biofortified
insects



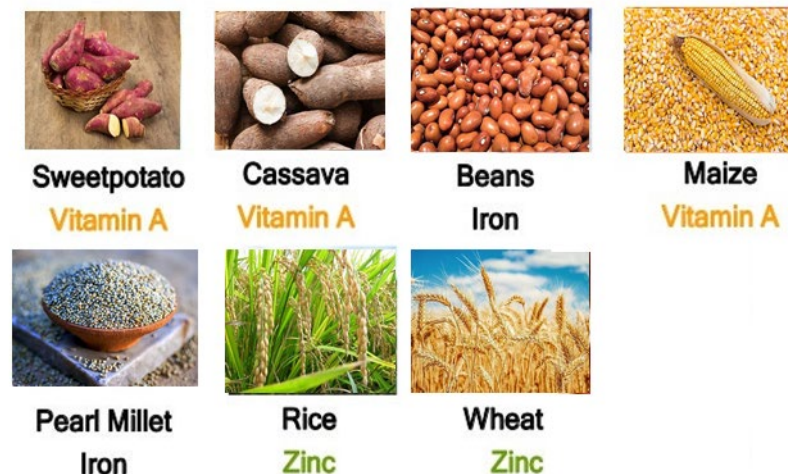
Biofortification

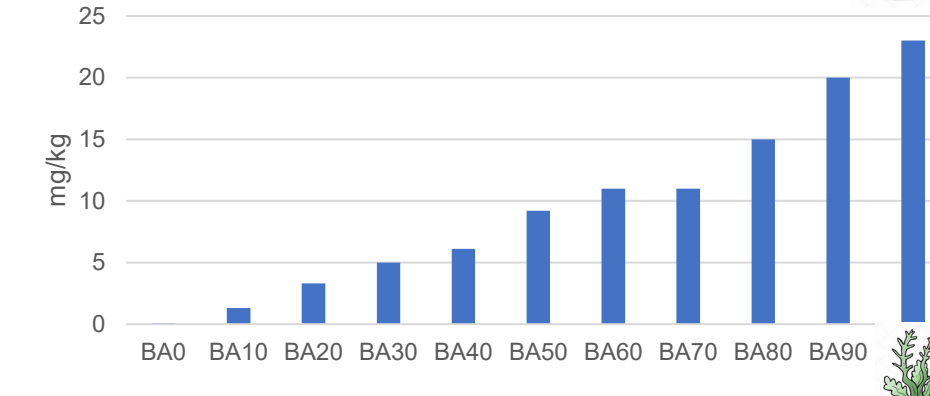
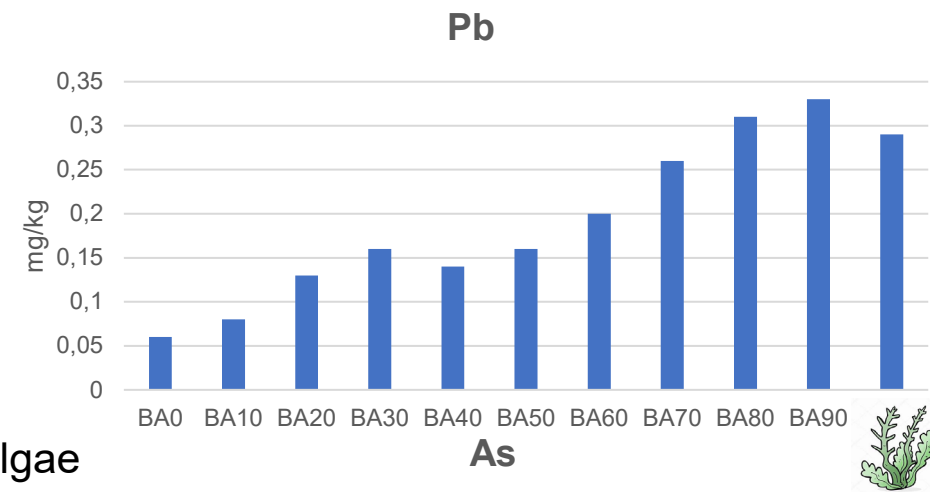
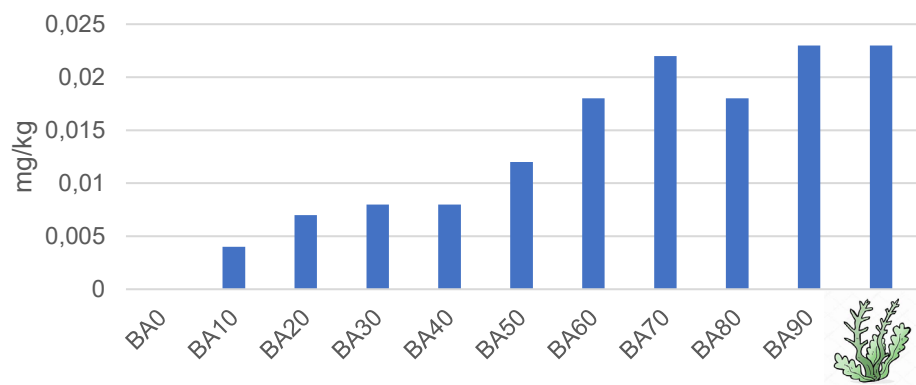
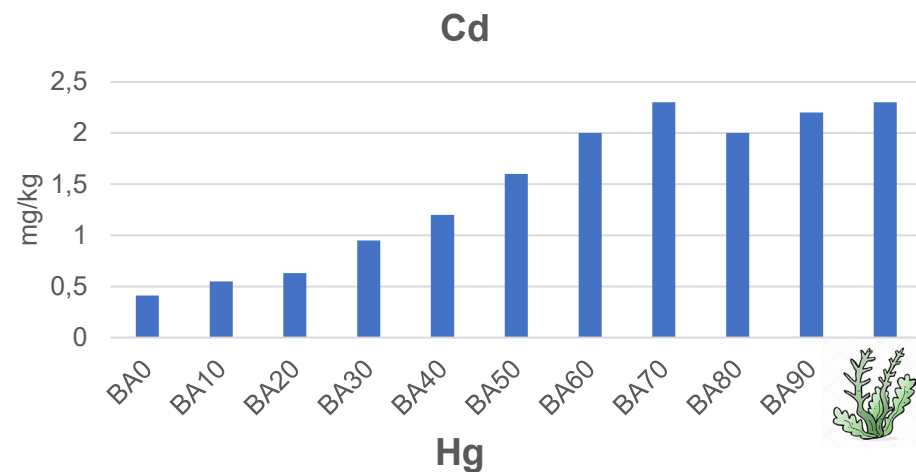
Biofortification is the process of enhancing the profile and availability of essential micronutrients (minerals and vitamins) in staple food crops for the human population by applying cutting-edge biotechnological tools, agronomic practices, and breeding techniques (Choudhary et al., 2022).

Feeding livestock Se-rich
diets may provide
Se-enriched meat.



Is it possible to do the
same with insects?





Significant bioaccumulation
of Cd, Pb, Hg and As was
observed in BSF larvae.

Possible use of bioaccumulation
capacity to **enrich insects** in
selected **micronutrients**.





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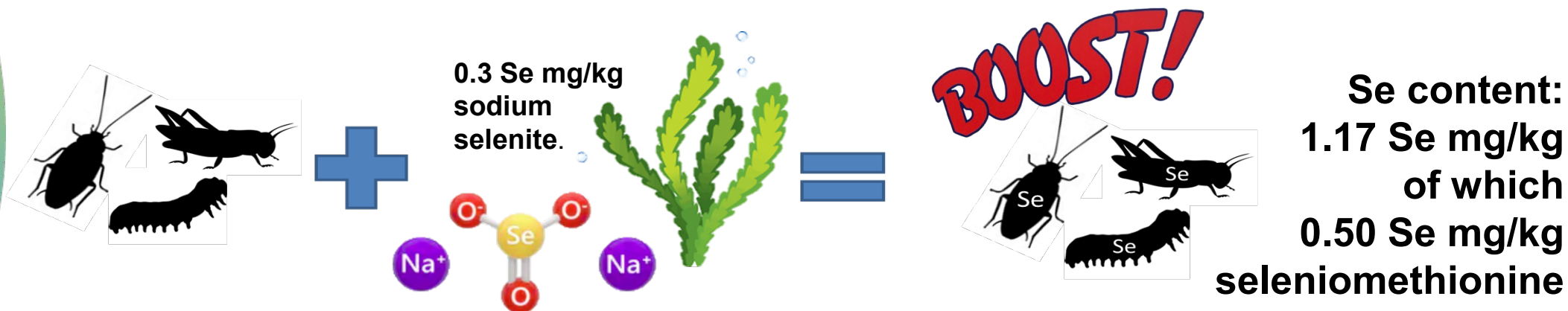
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Biofortification of selenium in black soldier fly (*Hermetia illucens*) prepupae reared on seaweed or selenium enriched substrates

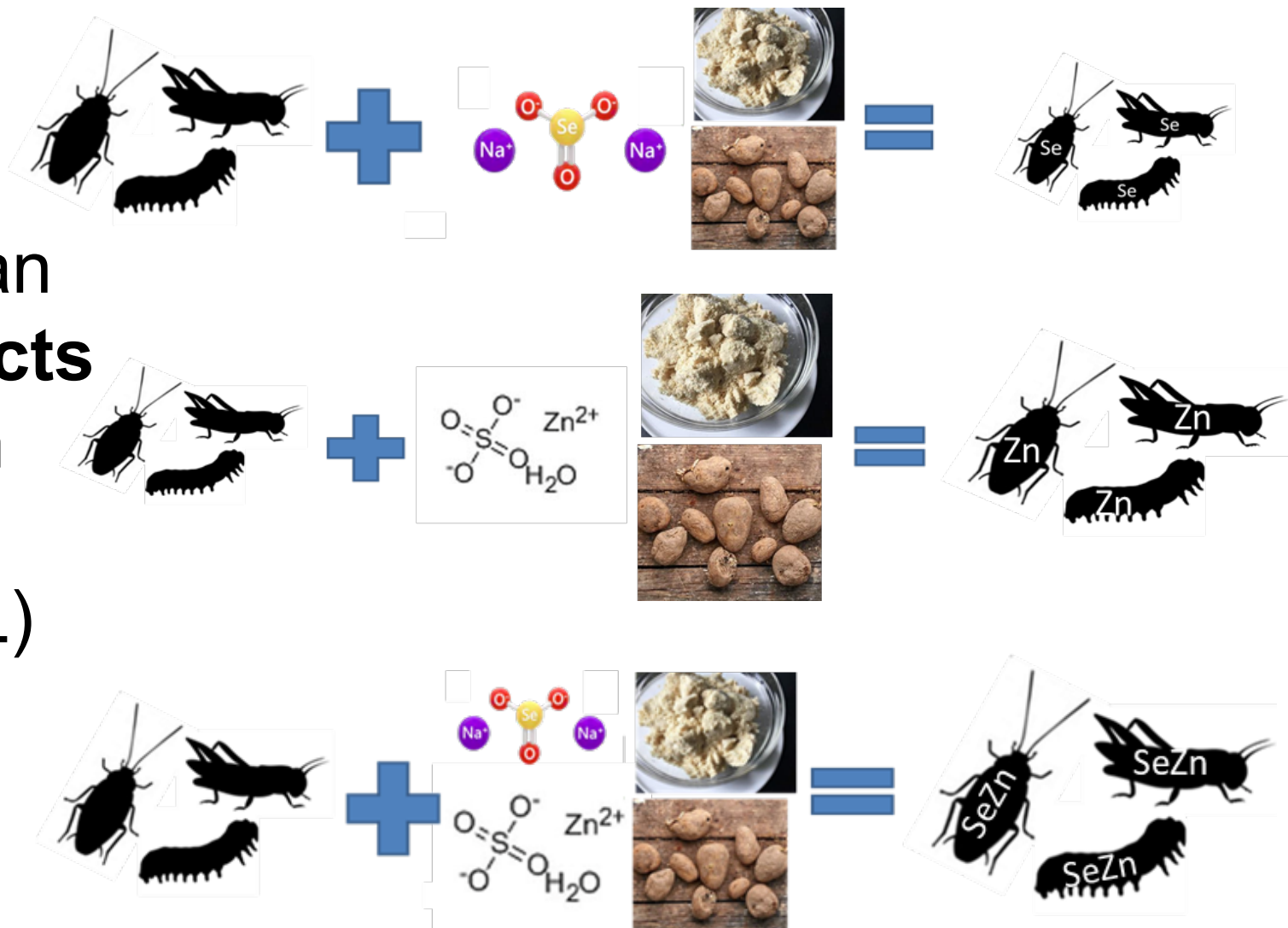
L. Ferrari¹, V. Sele², M. Silva², P. Bonilauri³, F. De Filippo³, F. Selmin⁴, R. Ørnsrud², L. Pinotti^{1,5*}  and M. Ottoboni¹



It is possible to biofortify insects with Se

Aim

Analyze the effects of an
agricultural co-products
substrate enriched with
Zn and/or Se on black
soldier fly larvae (BSFL)
and verify insects'
biofortification.



Materials and method

500 4-day-old BSFL for each group on 500 g (WW) of substrate

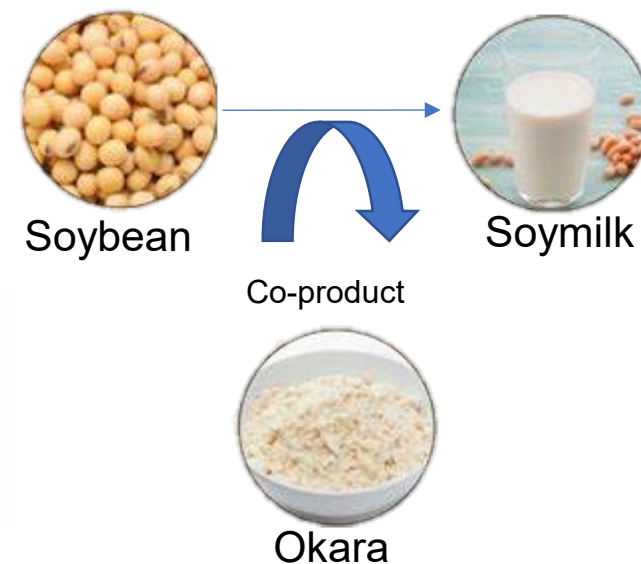
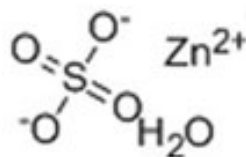
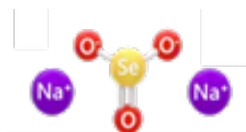
Five substrates with five replicates:

- I. **CTR** = Gainesville diet
- II. **OP**=50% Okara+50% Potato co-products
- III. **OP-Se**= OP+ 0.3 Se mg/kg
- IV. **OP-Zn**=OP+ 150 Zn mg/kg
- V. **OP-Zn+Se**=OP+0.3 Se mg/kg + 150 Zn mg/kg

Enrichment:

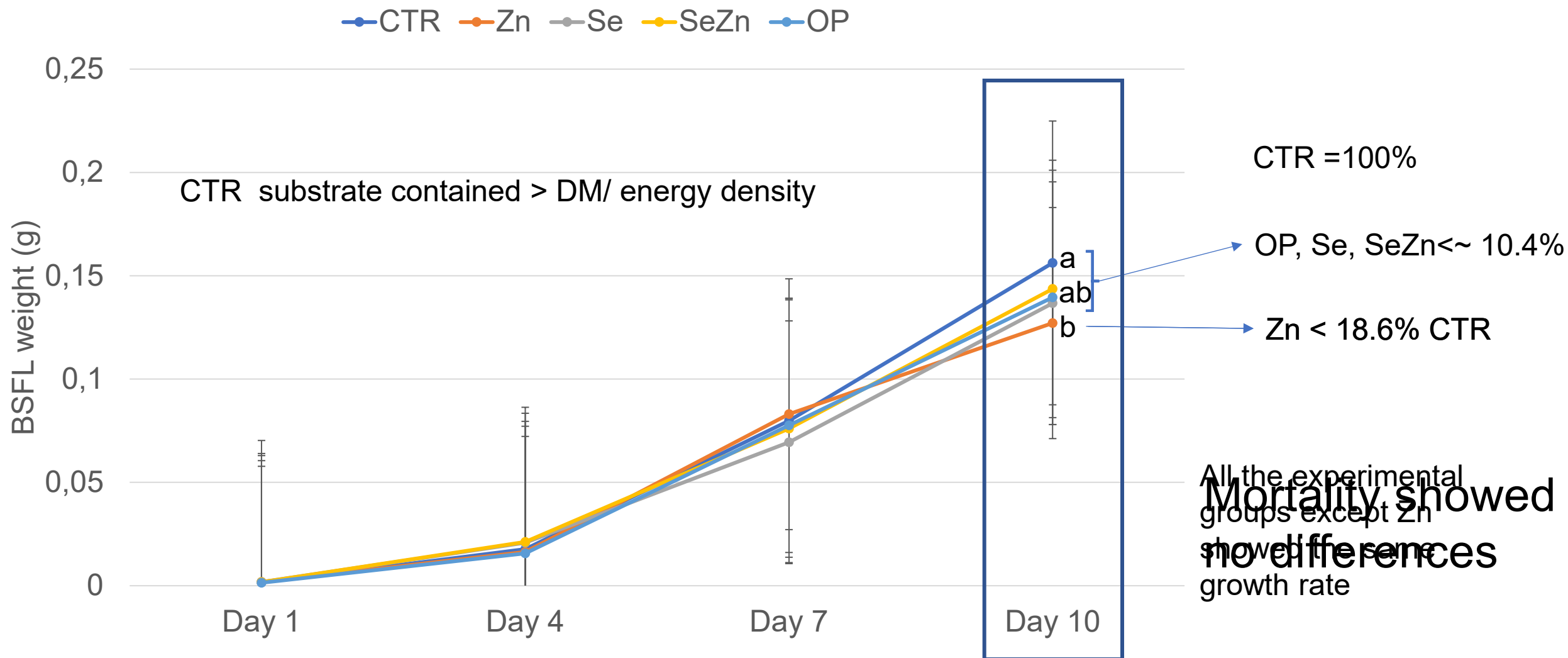
Inorganic minerals

- Se=sodium selenite
- Zn=zinc sulfate monohydrate

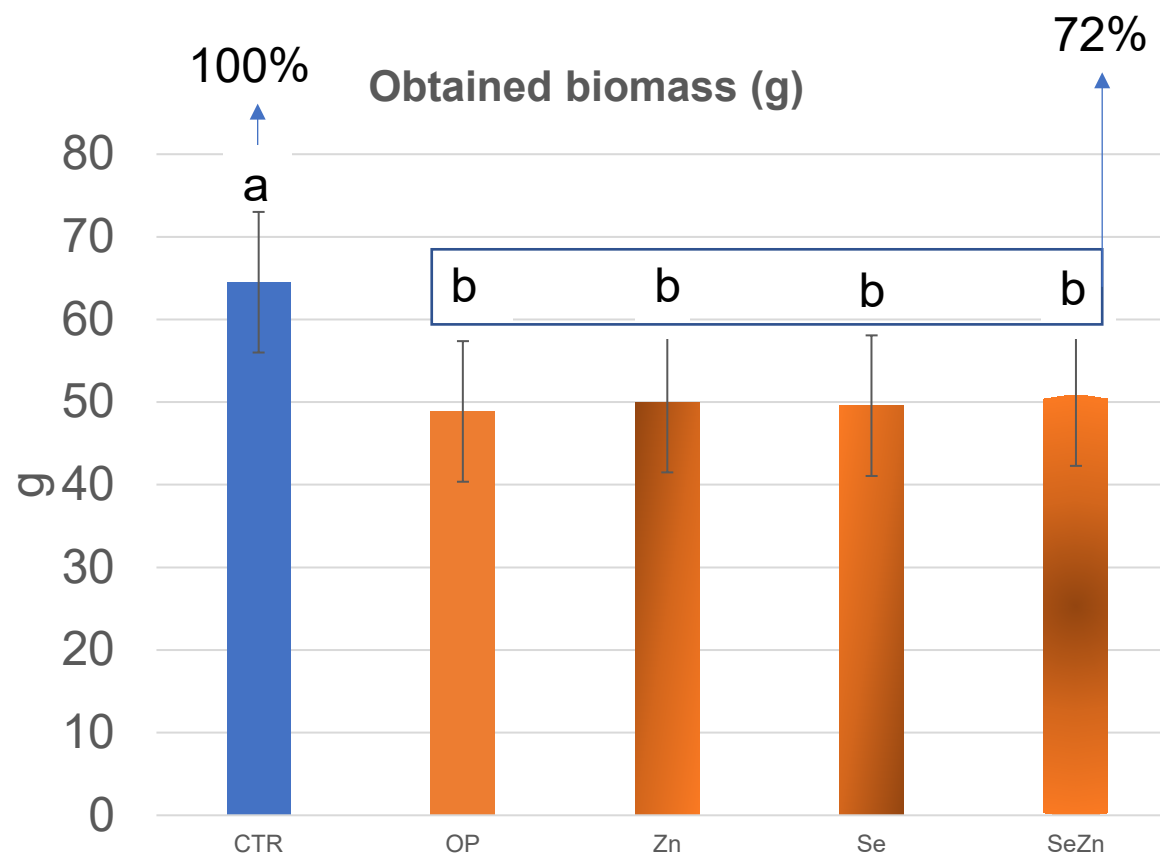


The larvae were collected at the emergence of the first prepupae (day 10th).

Growth parameters- Larvae bw



Growth parameters- total biomass (g)



The obtained biomass did not differ among groups suggesting that the inclusion of Zn and/or Se did not affected the larval growing performances

Composition Substrates

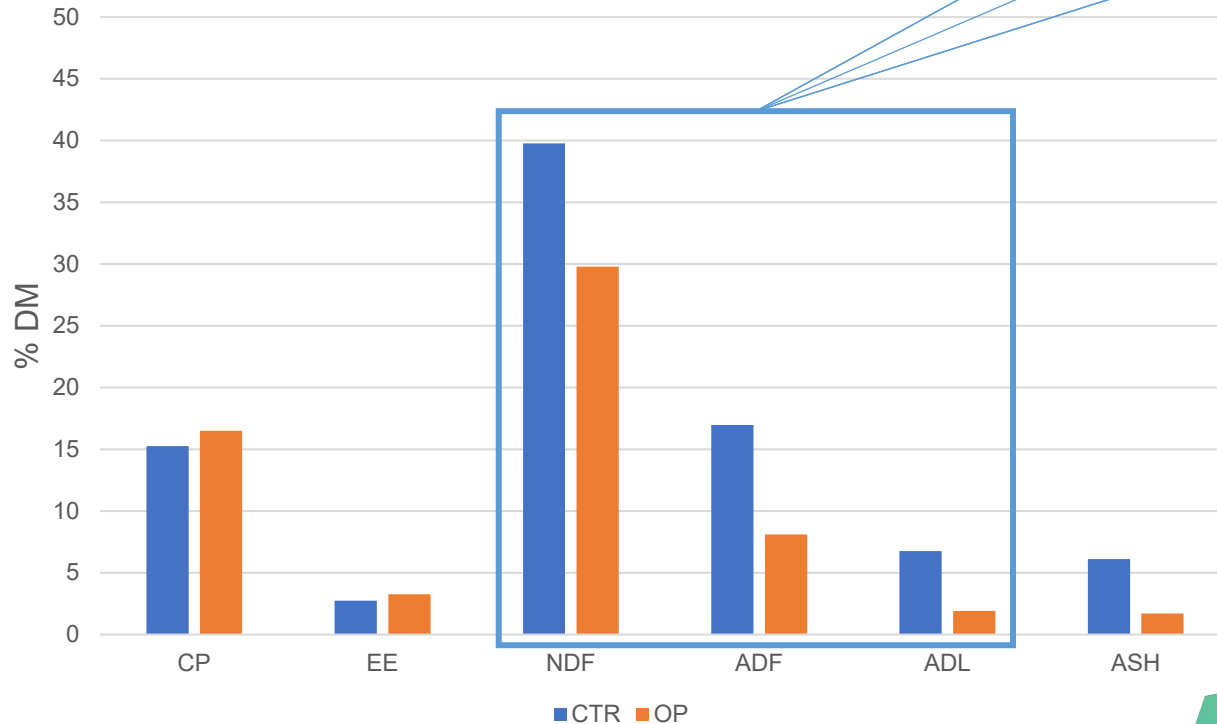
Glucosylated (CTR):

50% barilla: 45% NDF, 34% ADF, 4% lignin

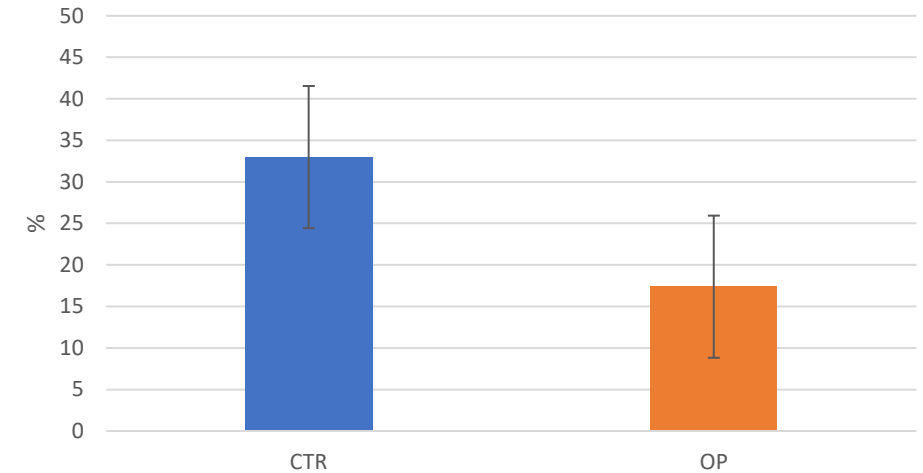
30% alfalfa meal: 46% NDF, 33% ADF, 8.5% lignin

20% patate: 21% NDF, 19.7% NFC

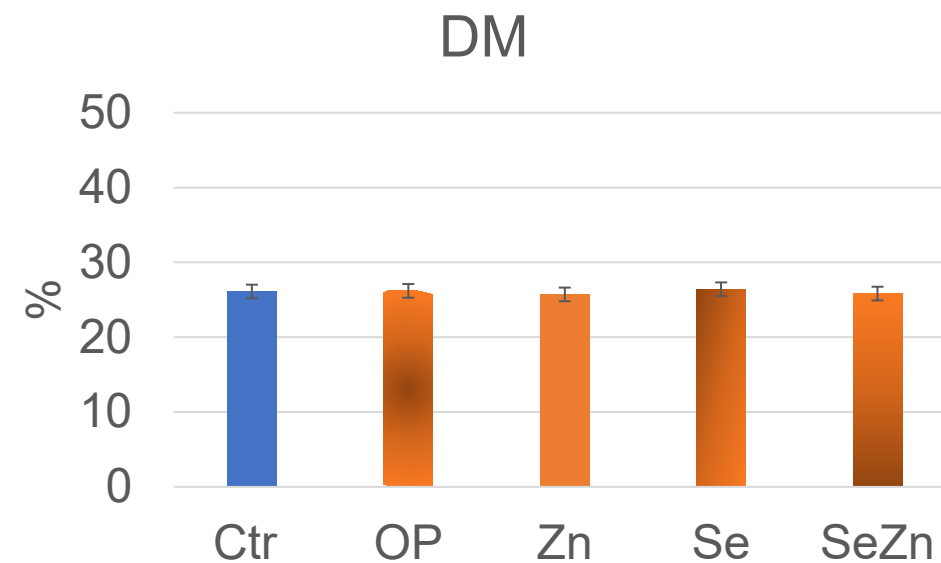
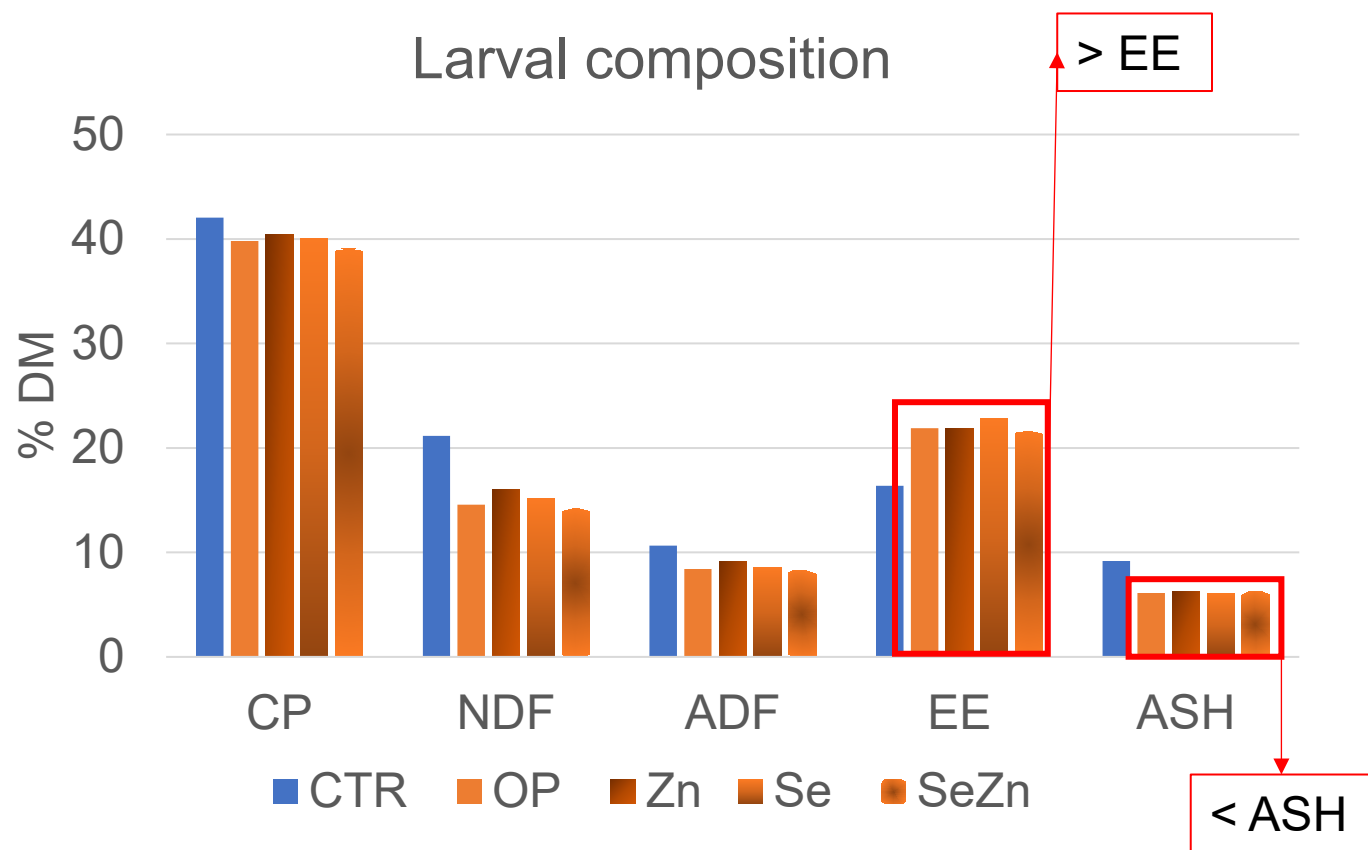
Substrate composition



DM

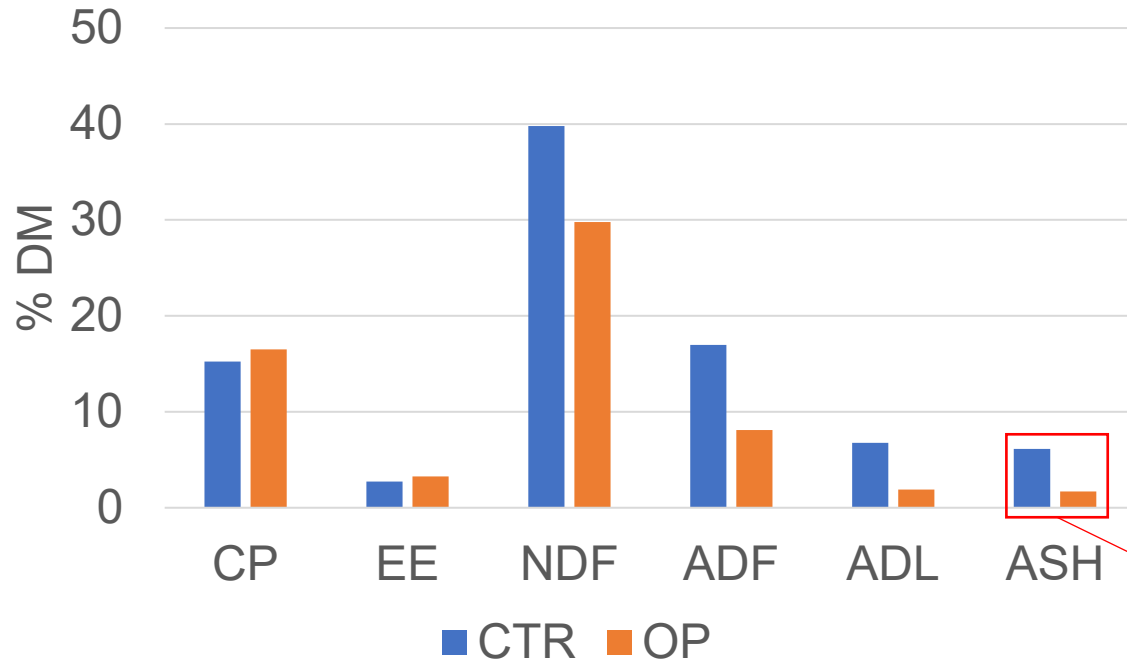


Composition Larvae

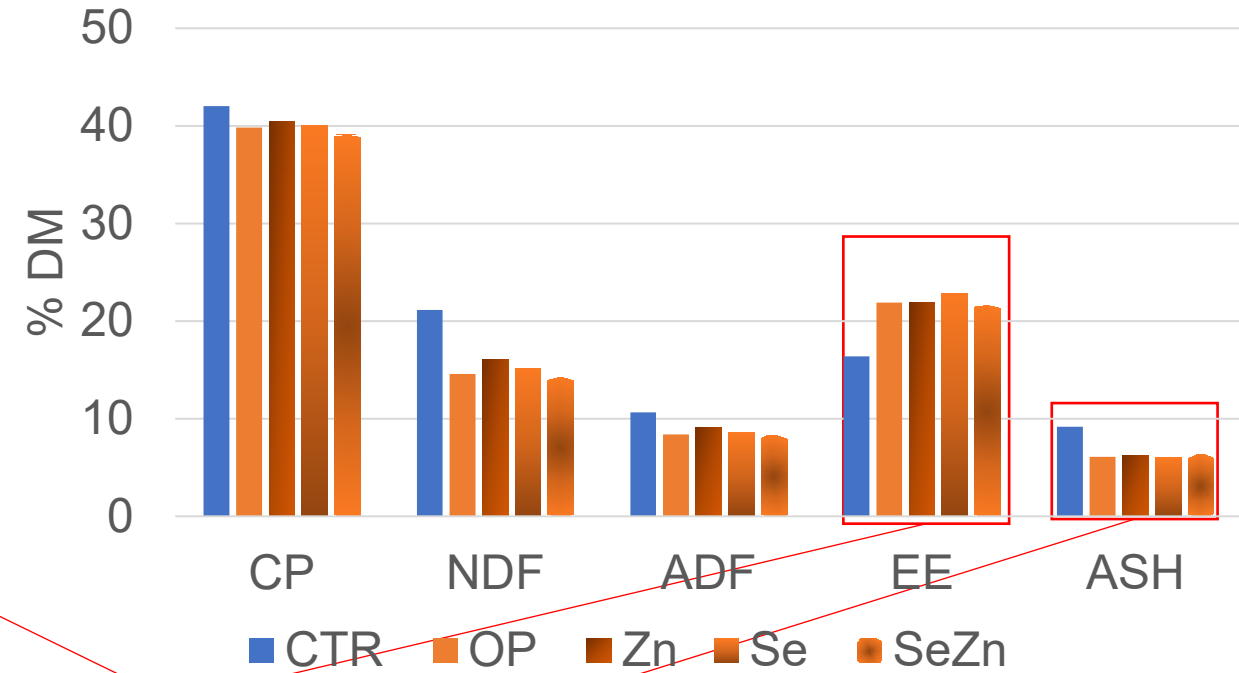


Composition: Substrate & Larvae

Substrate composition



Larval composition



Potato:
2.4% NDF, 75% NFC
Okara:
33% NDF, 48.9% NFC

Okara+potato based substrates showed a >EE level, probably due to the > NFC

>ASH

Inclusion of Zn and/or Se appears not to have

changed the nutritional composition of the larvae.

Larvae Minerals uptake



**Department of
Marine Technology
(IMT)**

Se relative to CTR
Se: 3x
SeZn: 2.5x

Preliminary results
suggest a good uptake
of both **Se** and **Zn**

Zn relative to CTR
Zn: 5.5x
SeZn: 6.1x

Conclusion:

OP substrate influenced larval growth due > moisture content than the CTR group.

The addition of Zn and Se did not affect:

- Larval growth performance
- Larval nutritional content

But affected the Se and Zn content



**Biofortified
insects**

Future perspectives:

- Specify the species of Zn and Se and understand if the larvae converted them in an organic form
- Verify the reproductive performances of BSF grown on biofortified substrates

The present study have been done in the frame of:
Project **Agritech National Research Center** and received funding from the **European Union Next-GenerationEU** (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – **MISSIONE 4** COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022

Centro Nazionale di Ricerca per
le Tecnologie dell'Agricoltura

Agritech

Plan. Plant. Planet.

Thank you

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Phd in nutritional science

