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THE EFFECT OF SELENIUM ON THE PHOTOSYNTHETIC EFFICIENCY OF KALE MICROGREENS

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Introduction

Microgreens are young seedlings, rich in phytonutrients and secondary metabolites, and thus considered "superfoods." Biofortification enhances the nutritional value of crops by increasing the content of essential micronutrients. Selenium (Se), an essential trace element, is crucial for human health through selenoproteins, mainly involved in antioxidative activity. A significant portion of the world's population is affected by Se deficiency, making Se biofortification a promising solution for the rapid cultivation of fresh microgreens rich in microelements to meet the recommended daily intake.

Materials and methods

Hydroponically grown microgreens of kale (*Brassica napus* var. *pabularia*) were treated with three concentratiums of selenium: 2 (Se2), 5 (Se5) and 10 mg/L (Se10), while non-treated plants served as a control (Ctrl). Five days after treatment photosynthetic efficiency was determined by measuring the chlorophyll *a* fluorescence (Handy PEA, Hansatech UK).

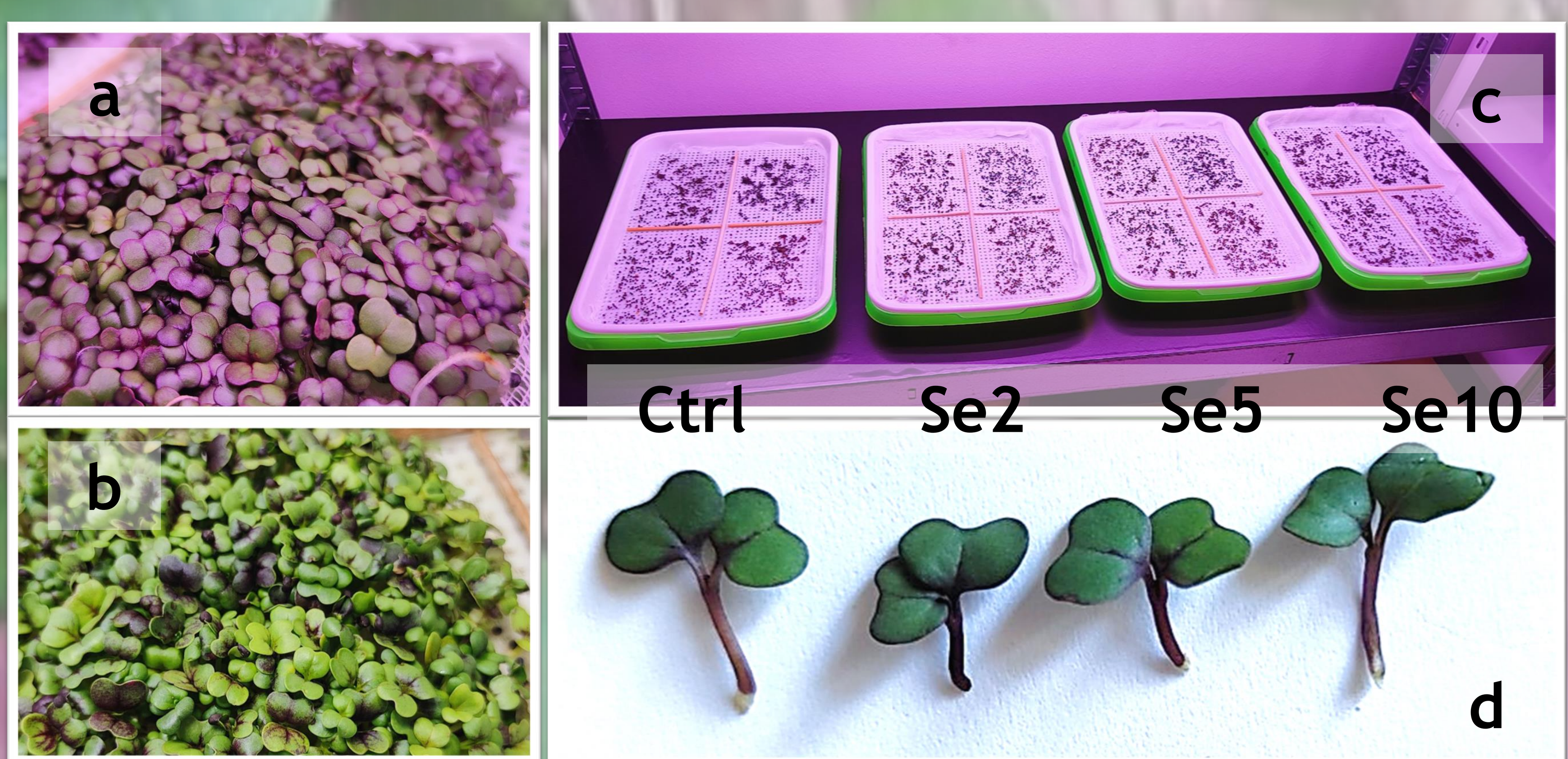

Figure 1. Red variety of kale microgreens (*Brassica napus* var. *pabularia*; **a, b**) grown hydroponically (**c**) in controled conditions (16/8, 20±2°C), biofortified with selenium (**d**).

Conclusions

Cultivation of red kale microgreens biofortified with Se5 significantly increased overall photosynthetic performance (PI_{total}) which reflects the vitality of the plants subjected to certain environmental conditions. Therefore, such results suggest that out of investigated Se concentrations, 5 mg/L of Se had the most benefit for overall performance and could potentially be used for biofortification of kale microgreens.

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References: P. D. R. van Heerden et al. 2003, Physiol. Plant. 117; H. Kalaji et al. 2017, Photosynth. Res. 136; ; I. Mezeyová et al. 2022, Agronomy 12; A. W. Ebert, 2022, Plants, 11; M. Tavan et al. 2024, Sci. Hortic. 323M. Viltres-Portales et al. 2024, Plant Physiol. Bioch. 206

Results

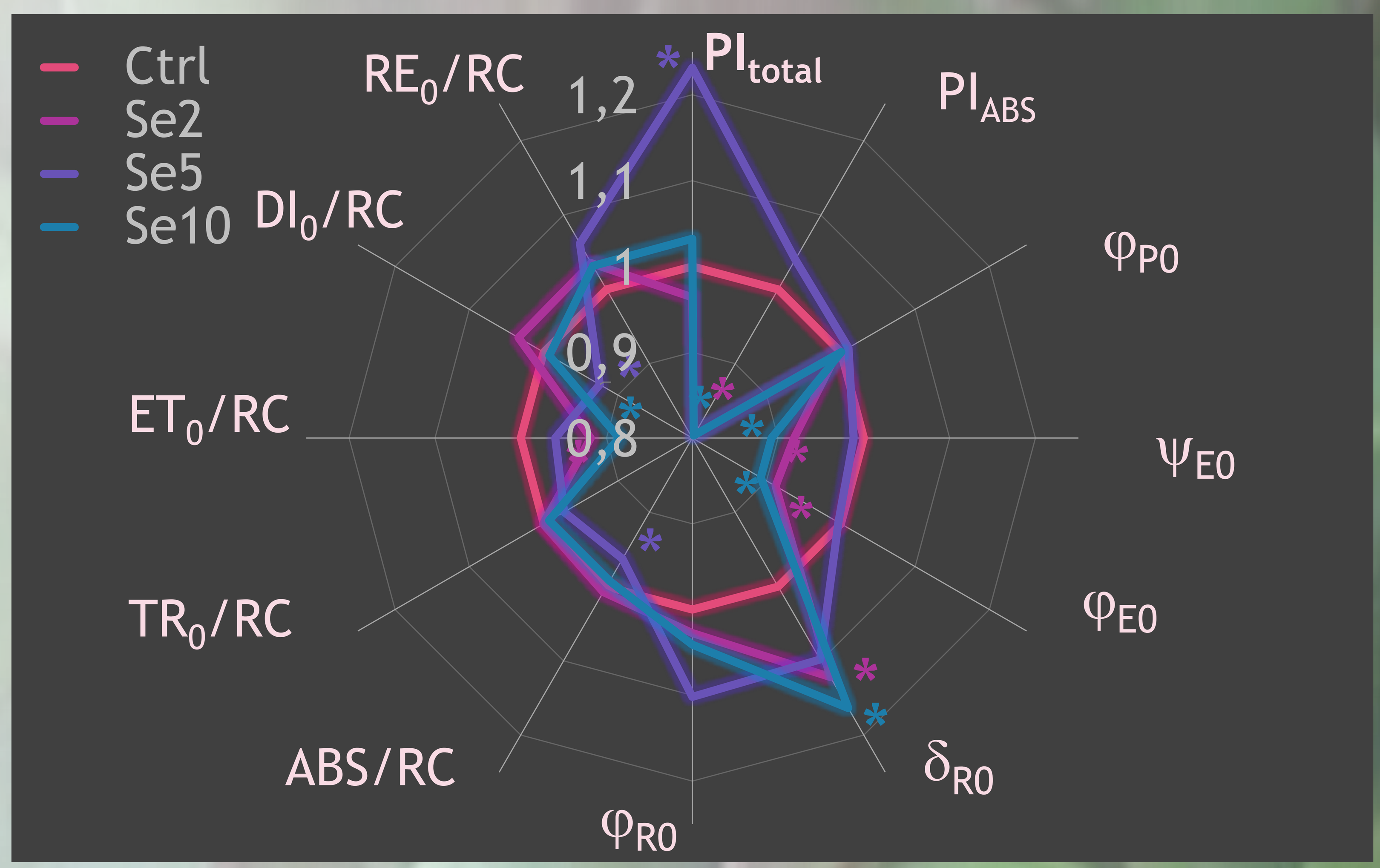

Figure 2. Significant increase of PI_{total} at Se5 compared to Ctrl indicated beneficial influence of Se on photosynthetic performance of kale microgreens. Moreover, decrease of ABS/RC and DI_0/RC suggested efficient allocation of absorbed energy that can be efficiently utilized in primary photochemistry. However, decreased PIABS and electron transport efficiencies (j_{E0}, y_{E0} and ET_0/RC) at Se2 and Se10 indicates less efficient electron transport compared to Ctrl.

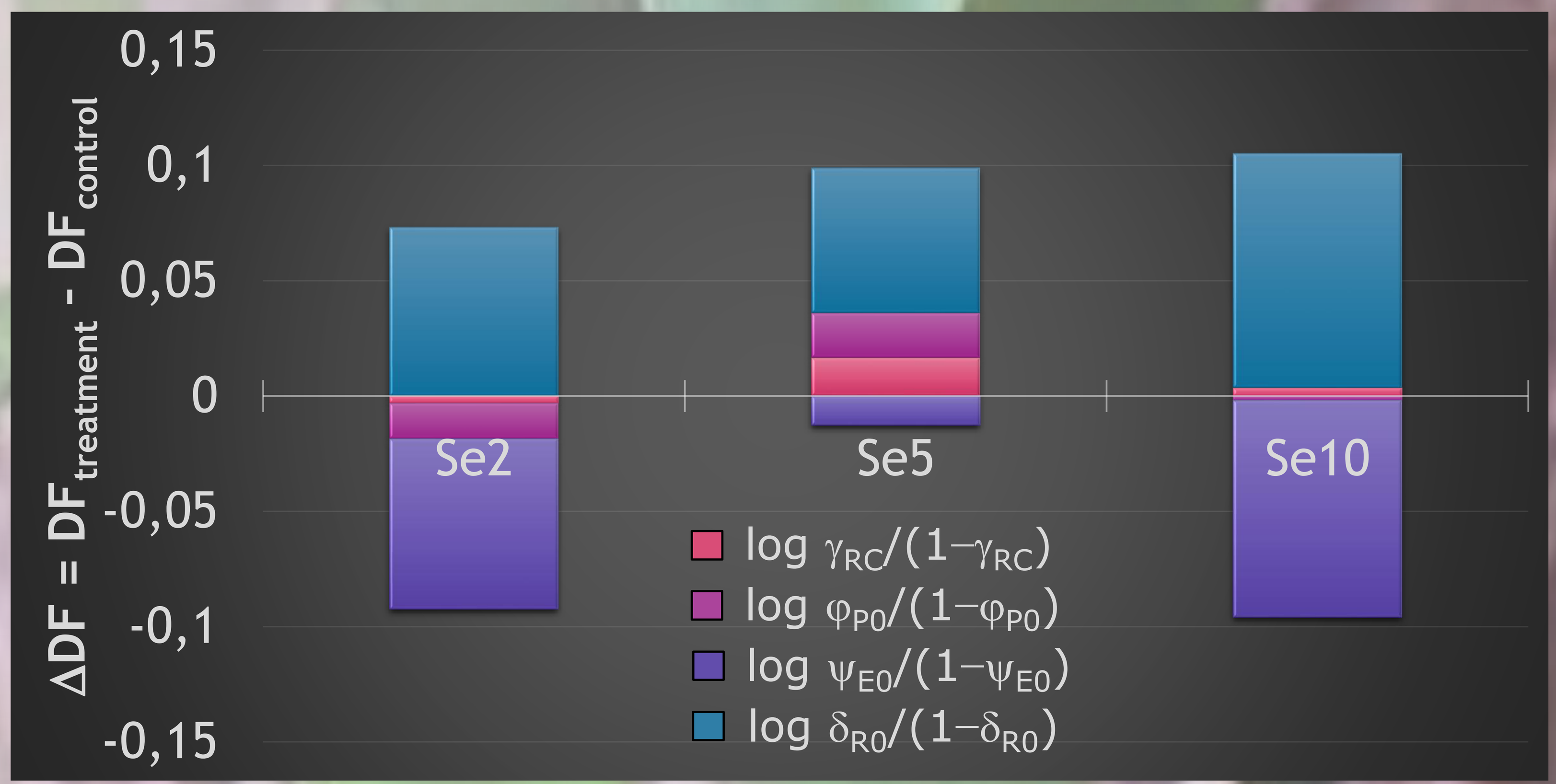

Figure 3. PI_{total} showed significant increase at Se5 compared to Ctrl. Such increase was mostly achieved due to positive reactions contributed to the PSII antenna size and/or the density of RC [log $\gamma_{RC}/(1-\gamma_{RC})$], primary photochemistry [log $\varphi_{P0}/(1-\varphi_{P0})$] and reduction events of PSI as [log $\delta_{R0}/(1-\delta_{R0})$].

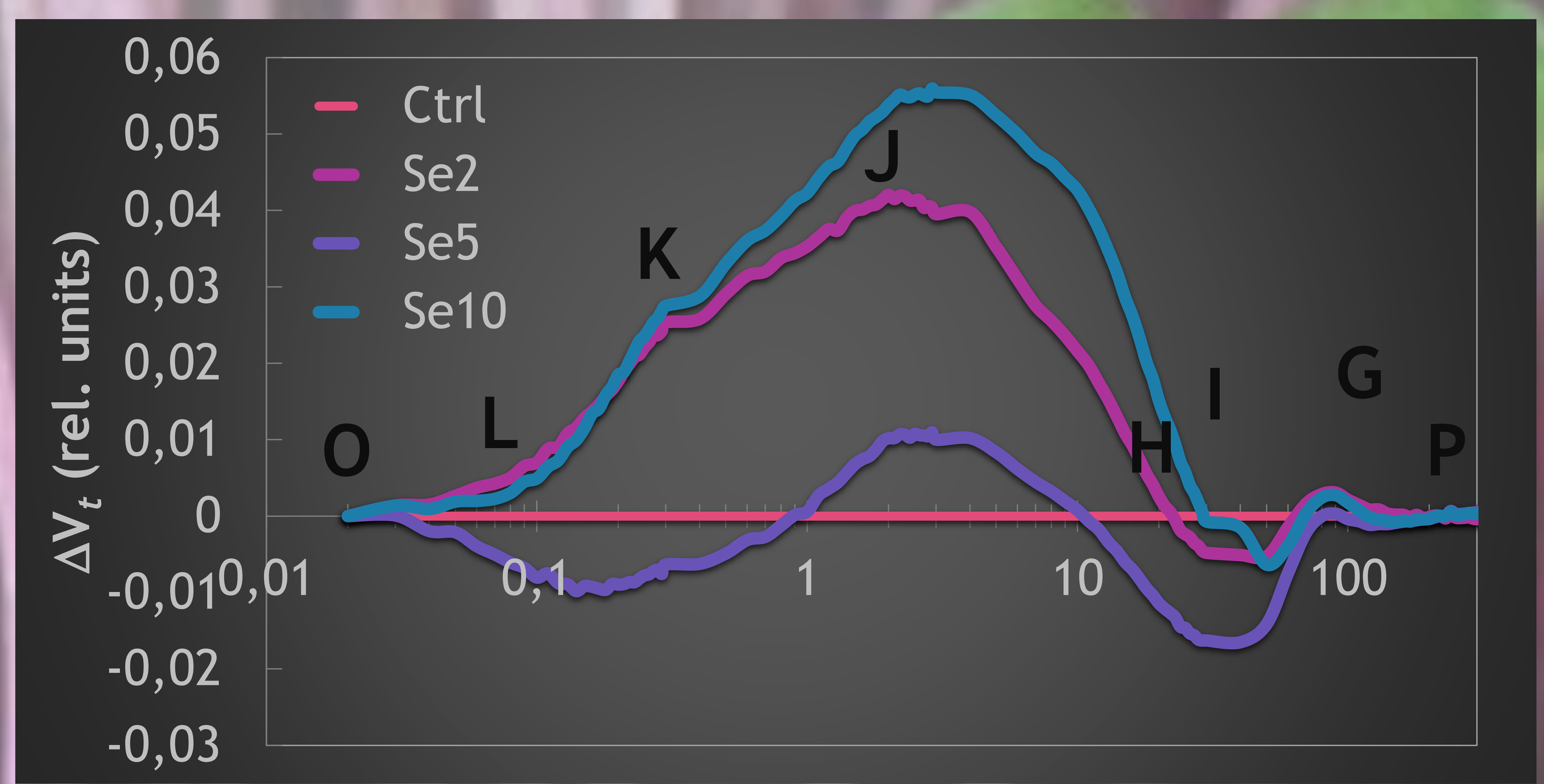

Figure 4. Negative amplitudes of L, K, H, and G steps influenced by Se5 compared to Ctrl suggested positive influence on specific events of primary photochemistry. On the other hand, positive amplitudes induced by Se2 and Se10 corraborated previous results on less benefficial influence of those Se concentrations.