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Booklets

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Title: Effects of selenium on yield, seed size, and phenolic compound content of common bean (Phaseolus vulgaris L.)

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Introduction

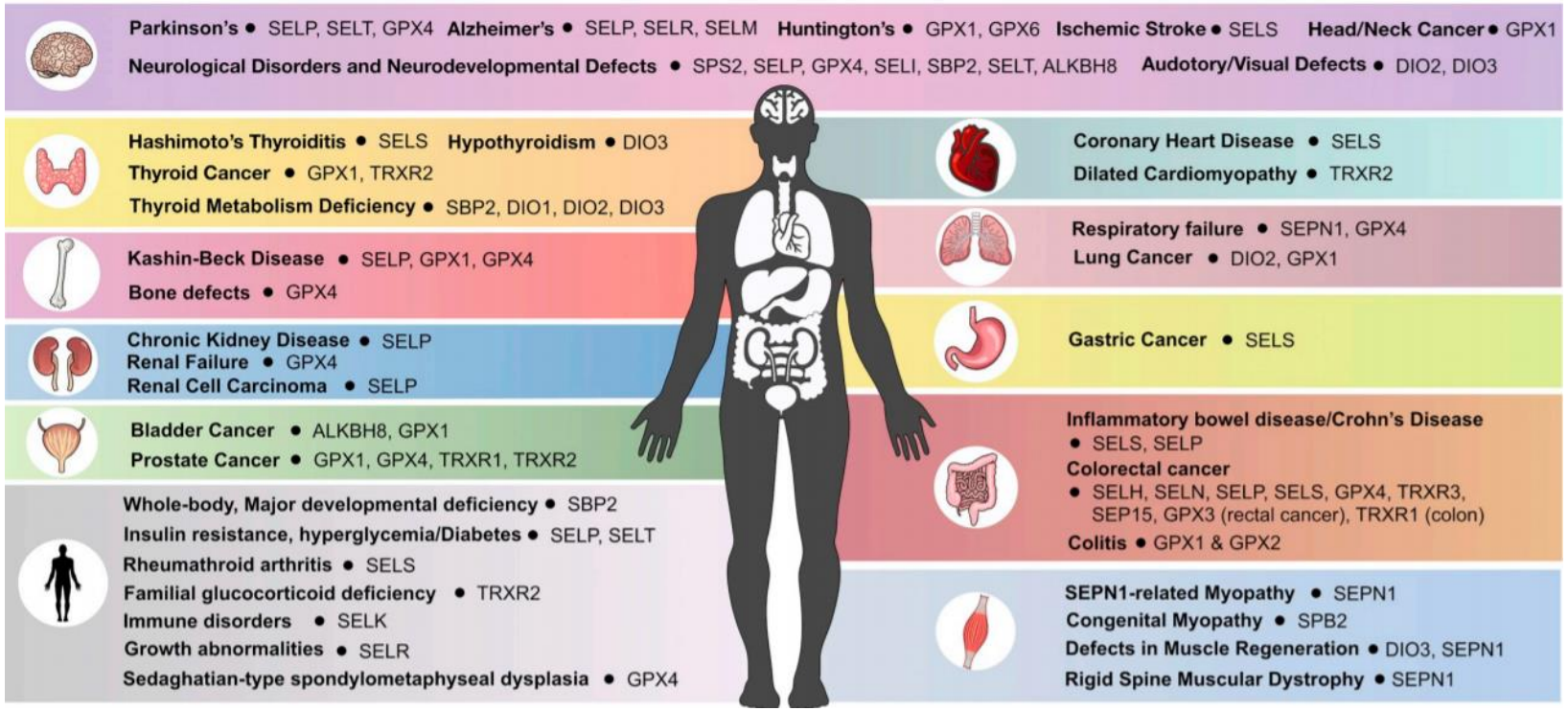
Role of Selenium (Se) in humans

- Selenoproteins are key regulators of stress responses, metabolism, and immunity.
- A majority of selenoproteins play a role in maintaining cellular redox homeostasis and viability, serving as antioxidant enzymes to mitigate damage caused by reactive oxygen species (ROS).

25 selenoproteins have been discovered in humans.

Selenoproteins can be classified into 6 functional groups:

- peroxidase/reductase activity,
- redox signaling,
- hormone metabolism,
- protein folding,
- selenium transport and
- Sec synthesis.



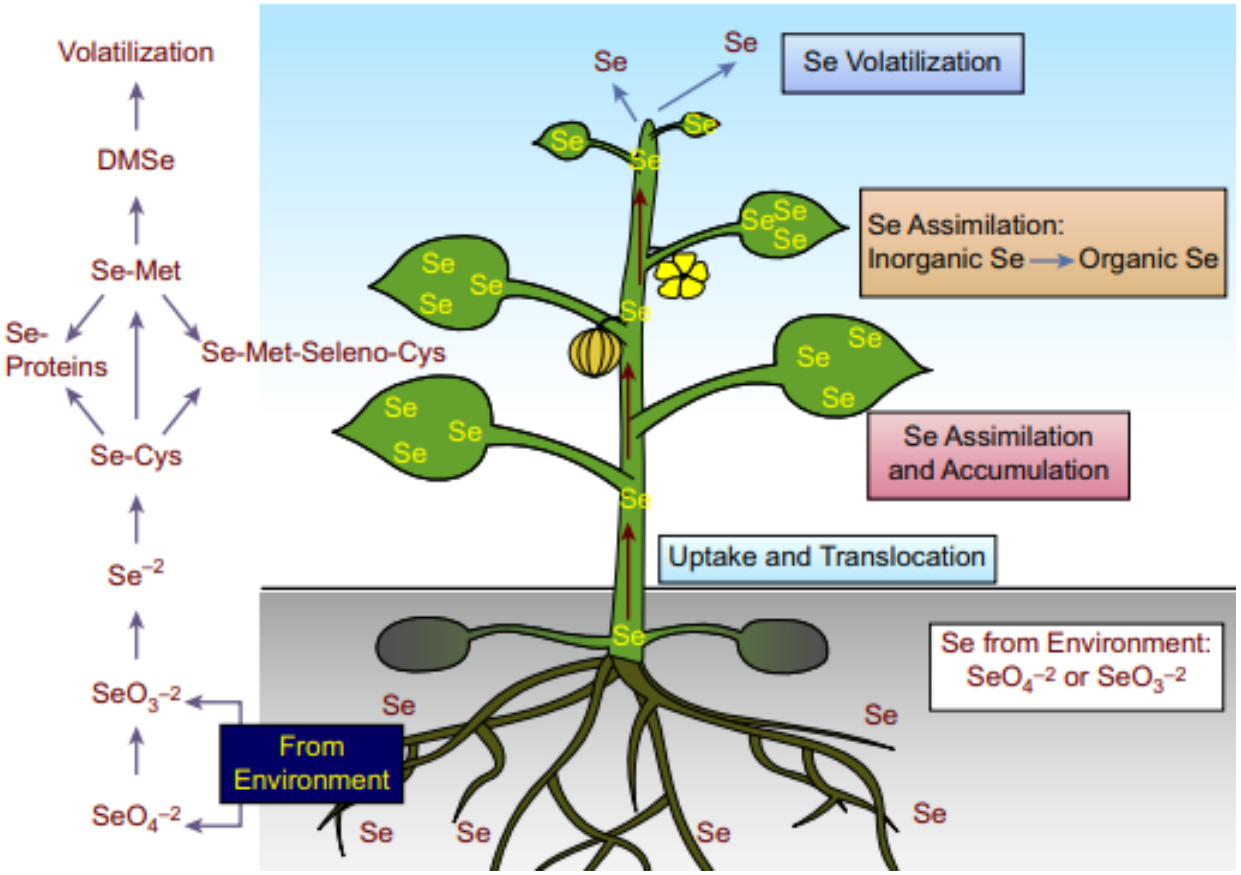
Leonardi et al., 2019

Introduction

Role of Se in plants

- Selenium can be beneficial to plants depending upon Se concentration, speciation and the type of plant species.
- Plants can absorb selenium in the forms of selenite (SeO_3^{-2}) and selenate (SeO_4^{-2}), the most common inorganic compounds present in the soil.
- Selenium, at low concentrations, acts as an antioxidant and can stimulate plant growth and improve tolerance to oxidative stress.
- In contrast, it acts as a pro-oxidant at high concentrations, which reduces plant growth by interfering with the sulfur metabolic pathway

This work aims to determine the effects of selenium on the yield, seed size, and phenolic compound content of common bean varieties with white seed coats.



Handa et al., 2016

Methodology

Common bean varieties

OX-7

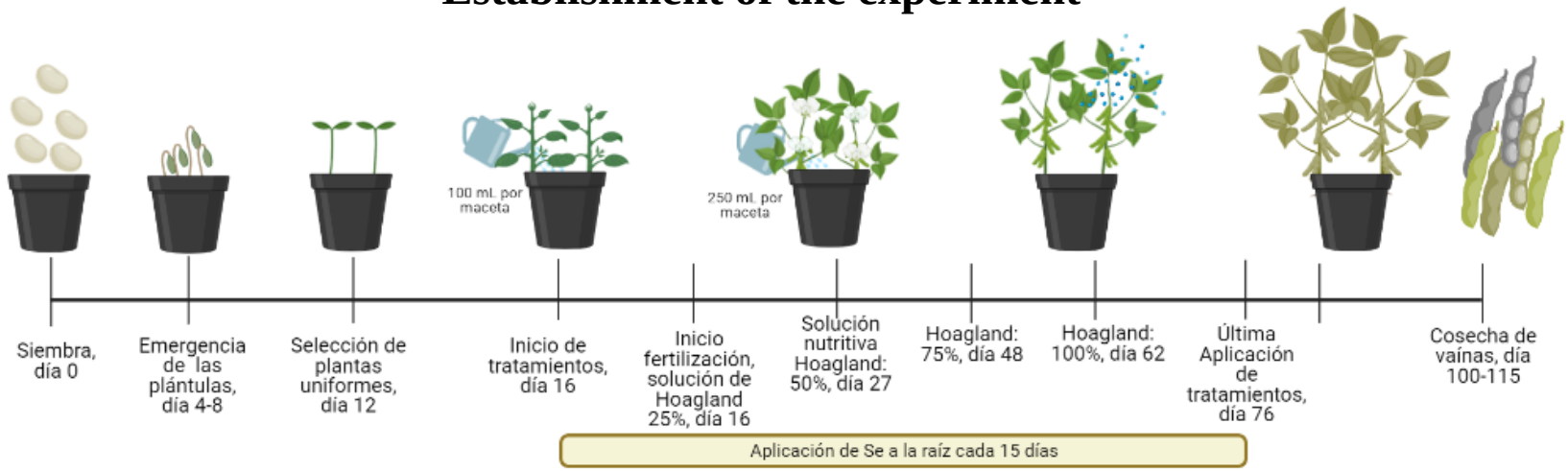
OX-11

OX-14

Na_2Se_3 (μM)

- 0
- 2.5
- 5
- 10

Establishment of the experiment

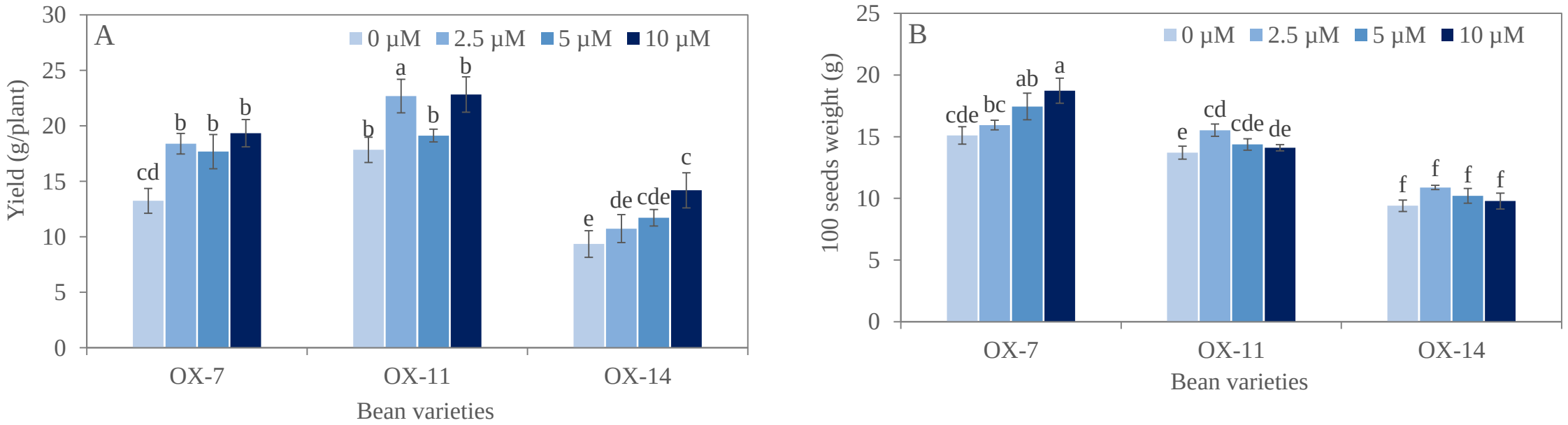


Parameter determination

- Determination of the number and lengths of pods
- Determination of bean seed size
- Determination of the weight of 100 seeds
- Determination of total phenolic content
- Determination of flavonoid content

Results

Effect of selenium on the yield production of common bean



Graphic 1. *Total yield per plant (A) and 100-seed weight (B) of white bean varieties grown under the application of different concentrations of sodium selenite (Na_2SeO_3).*

Results

Characteristics of bean seeds due to the effect of selenium

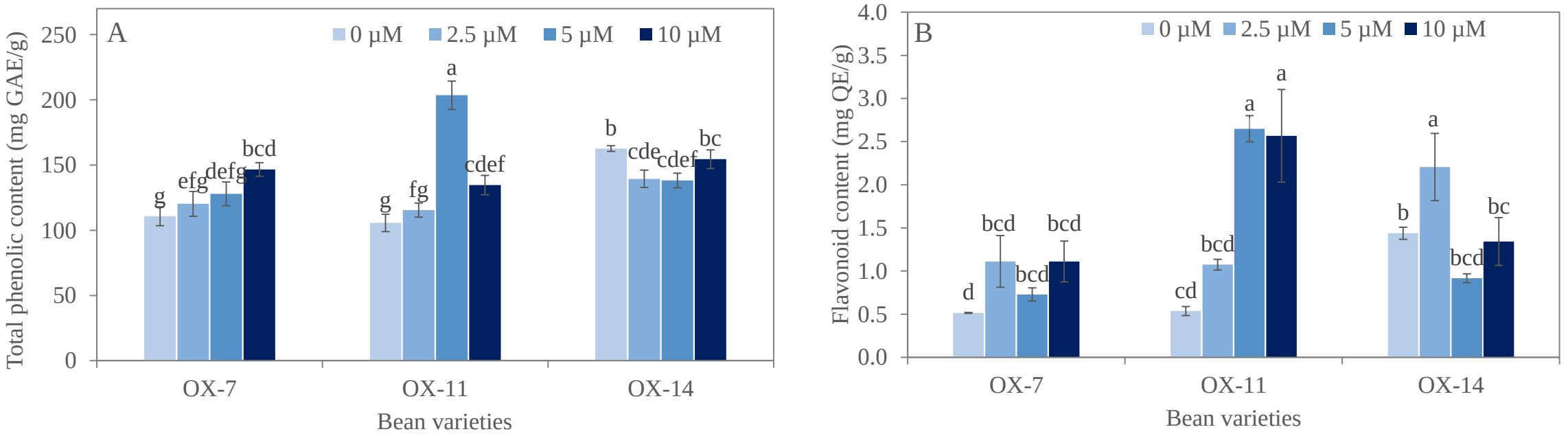
Table 1. *Seed and pod characteristics of white bean varieties supplemented with different concentrations of Na_2SeO_3 (Se).*

Bean varieties	Se [µm]	Seed lenght (mm)	Seed width (mm)	Seed thickness (mm)	Pod number	Pod length (cm)
OX-7	0	9.61±0.33ab	5.64±0.23c	4.51±0.26d	22.67±2.02ef	7.51±0.45bcd
	2.5	9.30±0.29de	5.63±0.16c	4.74±0.18c	28.33±2.07cd	8.02±0.39ab
	5	9.06±0.35f	5.70±0.20c	4.87±0.24bc	23.00±3.22ef	6.87±0.30e
	10	9.77±0.42a	5.90±0.19b	4.86±0.19bc	26.17±1.53de	8.22±0.19a
OX-11	0	9.62±0.31ab	4.92±0.14e	3.96±0.19e	32.67±2.80abc	7.73±0.22abc
	2.5	9.30±0.37cde	5.32±0.31d	4.49±0.37d	36.33±1.91a	7.35±0.36cde
	5	9.50±0.34bc	4.95±0.14e	4.02±0.16e	30.67±0.61bc	7.50±0.18cd
	10	9.62±0.34ab	4.85±0.14e	3.97±0.16e	33.33±1.37ab	7.41±0.15de
OX-14	0	9.52±0.46bc	6.14±0.19a	5.22±0.19[a]	17.00±0.63g	6.89±0.34e
	2.5	9.11±0.68ef	5.73±0.39c	4.85±0.37bc	15.33±1.21g	7.76±0.27abc
	5	9.23±0.42def	5.91±0.20b	4.96±0.22b	19.33±0.93gf	7.46±0.28cd
	10	9.39±0.42bcd	5.99±0.20b	5.12±0.23[a]	19.83±1.83gf	7.16±0.21de

Means with different letters indicate significant differences according to Duncan's test ($p<0.05$), ± standard deviation.

Results

Total phenol and flavonoid contents in bean seeds with different concentrations of Se



Graphic 2. *Effect of Na_2SO_3 (Se) in the content of total phenolic compounds (A) and flavonoids (B) in seeds white bean varieties.*

Conclusions

- Variety OX-7 had the longest seeds, and no significant differences in yield were observed among the applied treatments.
- Variety OX-11 had the highest number of pods, with no significant differences in pod length but with the highest yield.
- Variety OX-14 had the lowest number of pods and the lowest yield.

The beneficial effect of Se depends on the concentration and the variety and stage of development of the plant.

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