



## NOTE

### Determination of Trace Element Nutrition and Risk Assessment of Heavy Metals in Se-Enriched *Camellia oleifera* by ICP-MS

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*Camellia oleifera* and Se elements both have health care function for human body, but Se-enriched *Camellia oleifera* has not been studied. The changes of trace elements and heavy metals contents of *Camellia oleifera* seed after selenium enriching were studied. The results showed that (1) Selenium can promote the absorption of *Camellia oleifera* seeds to Li, P, K, Si and Mg; (2) Selenium can promote the absorption of *Camellia oleifera* seeds to many trace elements beneficial for human health including Ca, Fe, Cu and Mo; (3) Selenium can reduce the absorption of *Camellia oleifera* seeds to Hg, Pb, Ti and Ni. It is suggested that selenium can improve the nutrition of *Camellia oleifera* oil and reduce the risk of heavy metals.

**Key Words:** *Camellia oleifera* seed, Trace elements, Heavy metals, ICP-MS.

*Camellia* (*Camellia oleifera* A Bel), regarded as tea seed tree, is an important woody oil tree species originated in China. *Camellia* seed oil from tea seed oil is a kind of high-quality natural-health edible oil, which be loved by the vast number of consumers. *Camellia* oil is mainly distributed in 18 provinces in South China, Hunan, Jiangxi, Guangxi, Guizhou (area), whose cultivation area is ca. 3.67 hm × 106 hm with an annual output of ca. 200,000t of *camellia* oil. *Camellia oleifera* seed contains high nutrition, so it is extremely vital significant to its in-depth study<sup>1</sup>.

With the development of modern living standard, people's demand for edible oil nutrition and health care are also more and more high. Selenium is important in scavenging free radicals, antiaging, anticancer element, so the *Camellia oleifera* after enriching selenium should improve the quality of *Camellia oleifera* oil<sup>2</sup>.

However, selenium-enriched tea has not been done, it is very important for the evaluation of changes of nutritional components and harmful components in *Camellia oleifera* after selenium enriching. This paper studies the changes of trace elements and heavy metals contents of *Camellia oleifera* seed after selenium enriching, provide technical support to production and application of Se-enriched *Camellia oleifera*.

Select cultivars Cen soft No. 3 (Guangxi cultivars) with a certain number of fruit for experiment in Nanning of Guangxi

province, repeat four times. The nutrient solution diluted 200 times was sprayed on the whole plant leaf of plants. The selenium solution was sprayed three times, August 10th, September 8th and October 10th. Harvesting mature seeds, drying, grinding for detection.

The instrument is ICP-MS (Perkin-Elmer Sciex Elan 5000, USA). The parameters referred to Guo's method<sup>3</sup>.

**Contents of plant nutritional elements:** Plant nutritional elements are the basis of agricultural products, especially P, K, Si, Mg and B, most of which is beneficial for human health. The Selenium-enriched *Camellia oleifera* seeds contained more Li, P, K, Si and Mg than normal *Camellia oleifera* seeds, but the B elements reverse (Table-1). The results proved that Se can promote the absorption of most of plant nutritional elements.

**Contents of beneficial elements for the human body:** *Camellia oleifera* seeds contained many trace elements beneficial for the human body, including Ca, Mn, Fe, Cu, Zn, Se, Mo and I. Selenium content in *Camellia oleifera* seeds was 40 times more than normal *Camellia oleifera* seeds, which proved that selenium fertilizer were much absorbed into *Camellia oleifera* seeds, which is favorable to our purpose. Furthermore selenium-enriched *Camellia oleifera* seeds contained more Ca, Fe, Cu and Mo than normal *Camellia oleifera* seeds, other elements have no significant changes

TABLE-1  
COMPARISON OF PLANT NUTRITIONAL ELEMENTS  
IN Se-ENRICHED SEEDS AND CONTROL ( $\mu\text{g/g}$ )

Element	Normal seeds	Selenium-enriched seeds
Li	0.010 $\pm$ 0.007	0.015 $\pm$ 0.009
B	10.222 $\pm$ 2.986	7.945 $\pm$ 0.893
P	1371.535 $\pm$ 34.216	1542.025 $\pm$ 225.063
K	3455.319 $\pm$ 108.320	3790.088 $\pm$ 443.358
Na	34.981 $\pm$ 20.593	10.403 $\pm$ 1.459
Mg	650.202 $\pm$ 20.862	688.493 $\pm$ 50.920
Si	9.198 $\pm$ 1.523	18.855 $\pm$ 8.278

(Table-2), spraying Se can promote the absorption of many trace elements beneficial for human health.

TABLE-2  
COMPARISON OF BENEFICIAL ELEMENTS FOR THE HUMAN  
BODY IN Se-ENRICHED SEEDS AND CONTROL ( $\mu\text{g/g}$ )

Element	Normal seeds	Selenium-enriched seeds
Ca	631.175 $\pm$ 30.957	693.069 $\pm$ 53.917
Mn	110.180 $\pm$ 4.082	110.269 $\pm$ 8.719
Fe	1.598 $\pm$ 0.231	2.119 $\pm$ 0.156
Co	0.157 $\pm$ 0.107	0.119 $\pm$ 0.002
Cu	4.741 $\pm$ 0.117	5.156 $\pm$ 0.636
Zn	7.097 $\pm$ 1.548	6.911 $\pm$ 0.679
Se	0.060 $\pm$ 0.013	2.653 $\pm$ 1.871
Mo	0.014 $\pm$ 0.002	0.030 $\pm$ 0.005
I	0.652 $\pm$ 0.111	0.496 $\pm$ 0.048
Cs	0.043 $\pm$ 0.008	0.051 $\pm$ 0.023

**Contents of heavy metals:** All samples contained little heavy metals, which is relative to the soil of experimental location. Hg, Pb, Ti and Ni reduced in se-enriched *Camellia oleifera* seeds, but Al and Cr reverse, other heavy metals have no significant change after spraying Se (Table-3). The results proved that Se can reduced the absorption of some heavy metals into *Camellia oleifera* seeds.

TABLE-3  
COMPARISON OF HEAVY METALS IN  
SE-ENRICHED SEEDS AND CONTROL ( $\mu\text{g/g}$ )

Element	Normal seeds	Selenium-enriched seeds
Hg	0.020 $\pm$ 0.014	0.004 $\pm$ 0.002
Tl	0.020 $\pm$ 0.017	0.021 $\pm$ 0.002
Pb	0.013 $\pm$ 0.011	0.002 $\pm$ 0.003
Ti	1.047 $\pm$ 0.585	0.919 $\pm$ 0.564
Cr	0.314 $\pm$ 0.248	0.730 $\pm$ 0.409
Al	101.399 $\pm$ 13.014	129.281 $\pm$ 11.586
Ni	2.943 $\pm$ 0.876	2.366 $\pm$ 0.151
As	0.004 $\pm$ 0.003	0.004 $\pm$ 0.002
Cd	0.005 $\pm$ 0.005	0.007 $\pm$ 0.001
Sn	0.007 $\pm$ 0.007	0.002 $\pm$ 0.001
Sb	0.001 $\pm$ 0.001	0.000 $\pm$ 0.000

**Contents of rare earth elements:** All samples contained little rare earth elements and all rare earth elements have no significant change after spraying Se (Table-4).

TABLE-4  
COMPARISON OF RARE EARTH ELEMENTS  
IN Se-ENRICHED SEEDS AND CONTROL ( $\mu\text{g/g}$ )

Element	Normal seeds	Selenium-enriched seeds
La	0.006 $\pm$ 0.001	0.008 $\pm$ 0.005
Ce	0.009 $\pm$ 0.002	0.016 $\pm$ 0.010
Pr	0.002 $\pm$ 0.000	0.003 $\pm$ 0.003
Nd	0.007 $\pm$ 0.001	0.006 $\pm$ 0.005
Sm	0.000 $\pm$ 0.000	0.002 $\pm$ 0.002
Eu	0.001 $\pm$ 0.000	0.002 $\pm$ 0.001
Gd	0.002 $\pm$ 0.001	0.002 $\pm$ 0.002
Tb	0.000 $\pm$ 0.000	0.001 $\pm$ 0.001
Dy	0.002 $\pm$ 0.001	0.002 $\pm$ 0.001
Ho	0.001 $\pm$ 0.000	0.002 $\pm$ 0.001
Er	0.001 $\pm$ 0.001	0.002 $\pm$ 0.001

## Conclusion

Se can promote the absorption of *Camellia oleifera* seeds to Li, P, K, Si and Mg. Se can promote the absorption of *Camellia oleifera* seeds to many trace elements beneficial for human health including Ca, Fe, Cu and Mo. Se can reduce the absorption of *Camellia oleifera* seeds to Hg, Pb, Ti and Ni.

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