



NOTE

Determination of Heavy Metals and Trace Elements in Selenium-enriched Cherry Fruit by ICP-MS

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To investigate the food safety and nutritional characteristics of cherry fruits after spraying the Se-enriched foliar fertilizer. Nine kinds of heavy metals and seven kinds of beneficial trace elements in Se-enriched cherry fruits and normal cherry CK (not applying Se-enriched foliar fertilizer) were determined by ICP-MS. The results showed that (1) selenium can reduce the contents of heavy metals (Pb, Cu, Cr, Ni, Cd and V) in fruits of Cherry; (2) selenium-enriched foliar fertilizer can promote the absorption of other trace elements (K, Ca and Fe) in addition to increasing the selenium content in fruit of cherries. So selenium fertilizer can increase nutrition of fruits and reduce the harm of fruits.

Key Words: Se-fertilizer, Heavy metals, Trace elements, Cherry fruit.

Selenium, as one of the essential trace elements, has many important physiological functions on the human body, including antioxidant effects, cardiovascular protection, detoxification, as well as to promote growth and to protect the visual organs and improve immunity role, so selenium-enriched foodstuff is popular¹. Selenium deficiency can cause a variety of diseases, such as Keshan disease and Kashin-Beck disease; however, if too much intake of selenium will be harm to human body, Se-enriched foods must meet the appropriate standards before eating.

More than half of soil in China lacks selenium, so selenium-enriched agricultural products have great market, but selenium-enriched agricultural products is not very standardized. Whether the selenium fertilizer application would affect the food safety or not also require close monitor, especially the change of other harmful ingredients and nutrients in agricultural products after spraying the selenium fertilizer requires further research².

Zhang *et al.*³ proved that the strawberry had the highest absorption capacity of selenium in the leaf-expansion period and full opening flower period and selenium could slow down the damage of cell membrane integrity by removing malonaldehyde (MDA) accumulation of membrane lipid peroxidation. Further, the toxicity of heavy metals was reduced and the deposition of cadmium and lead in the strawberry leaves and fruits was effectively reduced. This research shows

spraying Se-fertilizer to leaves is a sound method for supplementing selenium to the strawberries and suitable amount of selenium can alleviate the toxic to the strawberry caused by heavy metal³. But the impact of selenium on absorption of heavy metals in cherries has not been reported.

Selenium was determined by Atomic Fluorescence Spectrometry, the model is AFS-230E produced by Beijing Kechuang Haiguang Instrument Co. Ltd, Beijing of China. This instrument has many advantages of high sensitivity, less interference and wide linear range. The detection limit (DL) is less than 0.09 ng mL⁻¹.

The selenium-enriched cherry was sprayed selenium fertilizer produced by Beijing Sevkon Ecological Science and Technology Limited Company, from the flowering stage, spraying once every 3 weeks. The control is strawberry grown without selenium fertilizer.

Instrument parameters and test procedures referred to Chen's method⁴. Table-1 shows that the descending order of heavy metals content in cherry is Pb > Cu > Cr > Ni > Cd > As > Co > V > Tl and only Pb is higher 100 ng mg⁻¹, the vast majority elements are lower than 5 ng mg⁻¹.

Compared with normal cherry (CK), the contents of Pb, Cu, Cr, Ni, Cd and V in selenium-enriched cherry are significantly lower than those in normal cherry, while Co and As, Tl has no significant difference.

TABLE-1
HEAVY METAL CONTENT OF SELENIUM-ENRICHED
CHERRY AND NORMAL CHERRY (ng mg⁻¹, n = 4)

Elements	Normal cherry	Se-rich cherry
V	0.054	0.051
Cr	3.465	3.163
Co	0.129	0.174
Ni	2.156	1.968
Cu	5.559	3.053
As	0.323	0.352
Cd	0.38	0.112
Tl	0.004	0.003
Pb	102.063	18.934

Selenium can inhibit the cherry to absorb most of the harmful elements.

Table-2 gives the contents of beneficial elements in normal cherry and selenium-cherry, that the descending order of beneficial elements content in cherry is K > Ca > Fe > Mn > Zn > Se.

TABLE-2
BENEFICIAL ELEMENTS CONTENT OF SELENIUM-
ENRICHED CHERRY AND NORMAL CHERRY (n = 4)

Elements	Normal Cherry	Se-rich cherry
Ca (µg mg ⁻¹)	1.172	1.285
Fe (µg mg ⁻¹)	0.085	0.114
K (µg mg ⁻¹)	14.06	16.259
Mn (µg mg ⁻¹)	0.025	0.025
Zn (µg mg ⁻¹)	0.017	0.015
Se (ng mg ⁻¹)	0.024	0.119

After applying selenium fertilizers, the contents of K, Ca, Fe and Se in selenium-enriched cherry are significantly higher than those in normal cherry, Mn and Zn have no significant difference.

Selenium can promote cherries to absorb beneficial trace elements.

Conclusion

Selenium can reduce the contents of heavy metals (Pb, Cu, Cr, Ni, Cd and V) in fruits of cherry. Selenium-enriched foliar fertilizer can promote the absorption of other trace elements (K, Ca and Fe) in addition to increasing the selenium content in fruit of cherries.

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