

不同时期叶面施锌对苹果果实中还原糖及糖代谢相关酶活性的影响

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Effects of Aerial Zinc Application on Carbohydrate Metabolism-related Enzymes Activities in Apple Fruit

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**摘要** 在不同物候期对13年生盛果期‘富士’苹果树进行叶面喷锌处理,测定果实锌含量、还原糖含量及相关酶活性。结果表明,喷锌显著提高了果实中的锌含量和成熟期果实中的还原糖含量。萌芽前和花后3周喷锌的植株,幼果发育期(花后10~80 d)果实山梨醇脱氢酶(SDH)活性显著高于对照;春梢停长期喷锌的植株,膨大期(花后80~160 d)果实中SDH的活性显著高于对照;膨大期喷锌的植株,成熟期(花后160~190 d)果实中SDH显著高于对照。喷锌对果实中山梨醇氧化酶(SOX)活性无显著影响。萌芽前、花后3周喷锌显著提高了幼果发育期果实中蔗糖合酶(SS)分解方向的活性和酸性转化酶(AI)的活性;果实膨大期处理显著提高了成熟期果实中AI的活性,对中性转化酶(NI)则无显著影响。不同物候期喷锌处理均增加了锌向果实中的富集,从而提高了果实中山梨醇代谢酶及蔗糖分解酶活性,有利于蔗糖和山梨醇的快速卸载,促进了果实中还原糖的积累。

**关键词:** 苹果 锌 还原糖 山梨醇代谢酶 蔗糖分解酶

**Abstract:** Zn was sprayed on thirteen-year-old ‘Fuji’ apple trees at different developmental stages. The effects of Zn on Zn contents of fruits, reducing sugar content and activities of carbohydrate metabolism-related enzymes were investigated. The results showed that the Zn treatments significantly increased the Zn contents and the reducing sugar in fruits at mature stage. The activity of sorbitol dehydrogenase (SDH) was significantly higher in the fruit of apple trees treated prior to bud break and at three weeks after bloom than the control at young fruit stage. The SDH activity of the fruit treated when the spring shoots stopped growth was higher than the control during fruit expansion period. The fruit treated at fruit expanding stage showed higher SDH activity than the control during fruit mature stage. The sorbitol oxidase (SOX) activity of all the treatments was not significantly different compared with the control. The Zn treatment did not show significant effects on sorbitol oxidase (SOX) activity of fruits. The Zn treatments before bud break and at three weeks after blooming significantly increased the activities of sucrose synthase (SS) and acid inverse (AI) at young fruit stage. The Zn treatments at fruit expanding stage significantly increased the activity of AI at mature stage, while there were no effects on the activity of neutral inverse (NI). Our results showed Zn treatments enhanced the biofortification of fruit Zn, which resulted in the higher activities of carbohydrate metabolism-related enzymes and the accumulation of sugar in fruits.

**Keywords:** [apple](#), [Zn](#), [reducing sugar](#), [sorbitol metabolism enzymes](#), [sucrose lyase](#)

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