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Shading Promoted Theanine Biosynthesis in the Roots and Allocation in the Shoots of the Tea Plant (*Camellia sinensis* L.) Cultivar Shuchazao

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Title

Shading Promoted Theanine Biosynthesis in the Roots and Allocation in the Shoots of the Tea Plant (*Camellia sinensis* L.) Cultivar Shuchazao

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Abstract

Shading was thought as an effective approach to increase theanine in harvested tea shoots. Previous studies offered conflicting findings, perhaps since the integration of theanine metabolism and transport in different tissues was not considered. Theanine is synthesized primarily in the roots and is then transported, via the vascular system, to new vegetative tissues. Here, we found that theanine increased in the stem, was reduced in the leaf, and remained stable in the roots, under shading conditions. Notably, in tea roots, shading significantly increased ethylamine and activated the theanine biosynthesis pathway and theanine transporter genes. Furthermore, shading significantly increased the expression of theanine transporter genes, CsAAP2/4/5/8, in the stem, while decreasing the expression of CsAAP1/2/4/5/6 in the leaf, in accordance with shading effects on theanine levels in these tissues. These findings reveal that shading of tea plants promotes theanine biosynthesis and allocation in different tissues, processes which appear to involve the theanine biosynthesis pathway enzymes and AAP family of theanine transporters.

