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Basic Formation for Regulation of Fruit Size by Cell Wall Remodeling under the Salinity Condition

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Summary

Abiotic stresses, such as drought, salinity, extreme temperatures, chemical toxicity and oxidative stress are serious threats to plants and the natural status of the environment. Especially, high salinity causes ionic and osmotic stress, affecting plant growth and metabolism. However, it is known that salinity stress improves the fruit quality of tomato by increasing the level of total soluble solids, including sugars, organic acids, and amino acids in fruits. However, it also causes negative aspects such as reduction of fruit size, number and increase of fruit firmness. However, few studies have reported the effect of salt on this sizing. Biochemical analysis is quite difficult because the transition from ovary to fruit is performed in a very small tissue. In this study, to understand the mechanisms of fruit size reduction under the salinity conditions, we used the immunohistochemical method using by monoclonal antibodies against each cell wall component, and cell wall-related gene expression analysis. The reduction in fruit size occurred very early stage, 3 and 5 days after pollination. On the 5th day, when the cuticle layer thickness was confirmed to decrease in fruit size, there was no difference between the control and salinity treatment. Therefore, the cause of the fruit size reduction may not be due to the cuticle layer development. Immunohistochemical observations revealed that cellulose, which contributes most to the hardness of the cell wall, accumulated very early stages of fruit under salt stress conditions. In addition, gene expression levels of cellulose synthase were also high in the same stage. It was also found that the expression and accumulation of expansin, contributing to loosening the cell wall, was not affected by salinity conditions. Our results suggested that cuticle development did not contribute to the reduction of fruit size under salinity conditions, and cellulose, contributing to rigid cell wall property, accumulates very early stage of fruit development. Therefore, this study suggests that accumulation of cellulose strengthens cell wall properties and prevents increase of fruit size.