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Quality Control of Japanese Wines by Salt-Regulated Proline Synthesis

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Summary

A large proportion of proline in grape berries remains in wine, since wine yeasts can't assimilate proline in grape berries. Proline in wines seems to contribute to wine quality. In general, plants maintain their homeostasis by accumulating proline in the plant cells under environmental stresses. In the present study, we investigated the molecular mechanism of proline synthesis in wine grapes under salinity stress. Grape cultured cells, detached leaves and potted grapevines were treated with sodium chloride to load salinity stress. Proline concentration in the grape samples under salinity stress was higher than that of non-treated samples. The expression of delta-1-pyrroline-5-carboxylate synthase (*P5CS*) genes *P5CS1* and *P5CS2*, which are key enzymes of proline synthesis in plants, was upregulated in the grape samples under salinity stress. It was surprising that single soil application of sodium chloride (500 mg/kg of soil) to potted grapevines at véraison accumulated more proline content in grape berries as compared with control grapevines. In contrast, foliar application of 100 mM sodium chloride solution to potted grapevines from véraison to end of ripening induced leaf withering and early defoliation. Promoter assay demonstrated that *P5CS1* promoter is regulated by sodium chloride. Taken together, we concluded that grape cells accumulate proline by upregulation of *P5CS* transcription through salt-regulated promoter under salinity stress. The present results may provide the best information to us for improvement of cultural practices in vineyards to control proline content in grape berries.