

Title Post-translational regulation of invertase activity by overexpression of a vacuolar invertase inhibitor reduces cold-induced sweetening of potato tubers

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Abstract

Cold-induced sweetening is a serious postharvest storage problem for potato tubers. During storage at cold temperatures (below 8°C), many cultivars accumulate free reducing sugars derived from a breakdown of starch to sucrose that is ultimately cleaved by acid invertase to produce glucose and fructose. When affected tubers are processed by frying or baking, these reducing sugars react with free amino acids by the Maillard reaction, resulting in unacceptably dark coloured product and generating the probable carcinogen acrylamide as a by-product. We have previously identified a vacuolar invertase inhibitor whose expression correlates both with low invertase activity and with resistance to cold-induced sweetening. In this work, we describe the generation of two transgenic populations of potatoes: one a cold-induced sweetening sensitive line in which the vacuolar invertase inhibitor is overexpressed, the second a resistant line in which the vacuolar invertase inhibitor is suppressed. Following cold storage of the transgenic tubers invertase activity and sugar content were assessed, and acrylamide content determined after fry tests. The results show that post-translational regulation of vacuolar invertase by the invertase inhibitor is an important component of resistance to cold-induced sweetening.