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Seed Coating Increases Seed Moisture Uptake and Restricts Embryonic Oxygen Availability in Germinating Cereal Seeds

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Abstract:

Seed coating is a technology to improve germination and homogenize stand establishment. Although coating often results in lower germination rates, seeds that do germinate grow more vigorously and show strongly reduced respiratory losses during reserve mobilization. We hypothesize that the higher mobilization efficiency is due to a shift in the enzymatic cleavage of sucrose from invertase to sucrose synthase in the embryonic tissue caused by a reduced oxygen availability induced by oversaturation with water caused by the coating during early germination. We investigated the effect of coating on barley, rye and wheat seed imbibition during the first 30 h after seeds were placed in moisture. We profiled oxygen in the embryos and measured sucrose and acid invertase levels as imbibition progressed. We found that seeds within coatings absorbed significantly more moisture than uncoated seeds. Coating resulted in near anoxic oxygen concentrations in the developing embryonic tissues in all three species. In barley, sucrose was not cleaved via the invertase pathway, despite the fact that invertase activity in coated seeds was increased. In rye and wheat, invertase activities were significantly lower in embryos from coated seeds without significantly changing the sugar composition.

Keywords: barley, imbibition, invertase, oxygen profile, rye, sucrose metabolism, wheat