

# Ethylene signaling increases reactive oxygen species accumulation to drive root hair initiation in *Arabidopsis*

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Root hair initiation is a highly regulated aspect of root development. The plant hormone ethylene and its precursor, 1-amino-cyclopropane-1-carboxylic acid, induce formation and elongation of root hairs. Using confocal microscopy paired with redox biosensors and dyes, we demonstrated that treatments that elevate ethylene levels lead to increased hydrogen peroxide accumulation in hair cells prior to root hair formation. In the ethylene-insensitive receptor mutant, *etr1-3*, and the signaling double mutant, *ein3eil1*, the increase in root hair number or reactive oxygen species (ROS) accumulation after ACC and ethylene treatment was lost. Conversely, *etr1-7*, a constitutive ethylene signaling receptor mutant, has increased root hair formation and ROS accumulation, similar to ethylene-treated Col-0 seedlings. The *caprice* and *werewolf* transcription factor mutants have decreased and elevated ROS levels, respectively, which are correlated with levels of root hair initiation. The *rhd2-6* mutant, with a defect in the gene encoding the ROS-synthesizing RESPIRATORY BURST OXIDASE HOMOLOG C (RBOHC), and the *prx44-2* mutant, which is defective in a class III peroxidase, showed impaired ethylene-dependent ROS synthesis and root hair formation via EIN3EIL1-dependent transcriptional regulation. Together, these results indicate that ethylene increases ROS accumulation through RBOHC and PRX44 to drive root hair formation.

## Reference:

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