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Methanol emissions from plants: interacting controls by growth rate and stomatal openness.

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Methanol (MeOH) production by plants is believed to be associated with growth processes. However, information of the mechanisms of MeOH emissions from plants are scarce. We investigated MeOH emissions from several plant species under controlled conditions. For poplar the daily integrated MeOH emissions were strongly related to the daily average leaf growth. Contrary, the diurnal variations of MeOH emissions were mainly determined by stomatal conductance as well as by solution / dissolution of MeOH between the liquid phase of leaves and the intercellular air spaces, respectively. Evidence for a direct impact of stomatal aperture was detected using leaves with oscillating stomatal aperture (cotton, soybean). Although temperature and light intensity (PAR) were held constant, oscillations in stomatal conductance were accompanied by parallel oscillations in MeOH emissions. In particular for cotton and poplar the MeOH emissions peaked with the onset of illumination. We attributed this burst to MeOH accumulation in the liquid phase during darkness when stomata are nearly closed. Increases of stomatal aperture may lead to a pulsed MeOH release due to a delivery from the liquid phase of the leaves. Only indirect relations were found between MeOH emissions and PAR or temperature, respectively. These indirect relations were due to the impacts of temperature and PAR on stomatal conductivity and the rate of transpiration.