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On the relationships between isoprene emission and light and dark respiration in hybrid poplars under free-air CO_2 enrichment

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Climate change may have contrasting effects on isoprene emitted by forest and agri-forest vegetation. Many studies have shown that elevated [CO_2] may reduce isoprene emission in poplar. However, it can be expected that rising temperature will increase the rate of isoprene emission. Rosenstiel *et al*. (2003) data suggested that isoprene emission competes with mitochondrial respiration for cytosolic phospho-enolpyruvate (PEP). Increasing rates of mitochondrial respiration are therefore likely to cause a decrease in isoprene emission, by reducing the intracellular concentration of PEP. As for isoprene, also respiration is very sensitive to temperature, and may increase in response to rising temperatures. The trade-off between all of these contrasting effects is not known. We tested if increasing respiration leads to a decrease of isoprene emission in a *Populus* $\times$ *euramericana* closed canopy plantation grown in free air CO_2 enrichment (FACE) located in Central Italy. Isoprene emission and light and dark respiration were measured with portable infrared gas analyzer and gas-chromatograph on-line and in-situ in developing and developed poplar leaves at the temperatures of 25 and 35 $^{\circ}$C. Our data show that when isoprene emission rates are lower than $\sim$30 nmol $m^{-2}s^{-1}$, an inverse relationship exists between both light and dark respiration and isoprene emission, in both CO_2 treatments. However, when isoprene emission rates are enhanced, principally by exposure to elevated temperature, this relationship is reversed, and light and dark respiration increase concurrently with isoprene emission.

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