The substrate supply system for shoot and root respiration of *Lolium perenne* L. and its responses to the level of nitrogen fertilization.

Christoph Lehmeier[1], Fernando Lattanzi[1], Rudi Schäufele[1], Melanie Wild[2], Hans Schnyder[1]

[1]Lehrstuhl für Grünlandlehre, TU-München
[2]Bayerische Landesanstalt für Landwirtschaft, Freising

The substrate supply system for respiration of a grass was characterized in terms of component pools (pool's sizes, half-lives and contributions to respiration), and its response to nitrogen fertilization.

The studies were performed in controlled environments, with *Lolium perenne* L. growing with continuous light and two contrasting rates of nitrogen supply (1.0 mM and 7.5 mM nitrate, respectively). Plants were labeled with $^{13}CO_2/^{12}CO_2$ for intervals of 1 h to 1 month, followed by measurements of rates and $^{13}C/^{12}C$ ratios of CO_2 dark-respired by shoots and roots.

Compartmental analysis of tracer kinetics indicated that -in both nitrogen supply levels- shoot and root respiration was fed by three substrate pools whose half-lives were, due to strong similarities in shoot and root kinetics, near-identical in shoot and root within one treatment.

In high nitrogen, pool half-lives were <30 min, ~3 h and 33 h; short-term stores supplied the major part of carbon, and 43% of respiration was promoted by current photosynthate. With nitrogen deficiency, half-lives were much longer, and long-term stores ($t_{1/2}$ >10 d) provided 30% of respired carbon.

The size of the respiratory supply system increased, while the respiration rate decreased by one third with nitrogen deficiency; the mean residence time of carbon in the respiratory supply system increased from 4.6 d to 9.2 d. We argue that the mean residence time is controlled by the shoot *via* current photosynthate and storage deposition/mobilization fluxes.