

Reliable plant transpiration test system for phytotoxicity testing of xenobiotics

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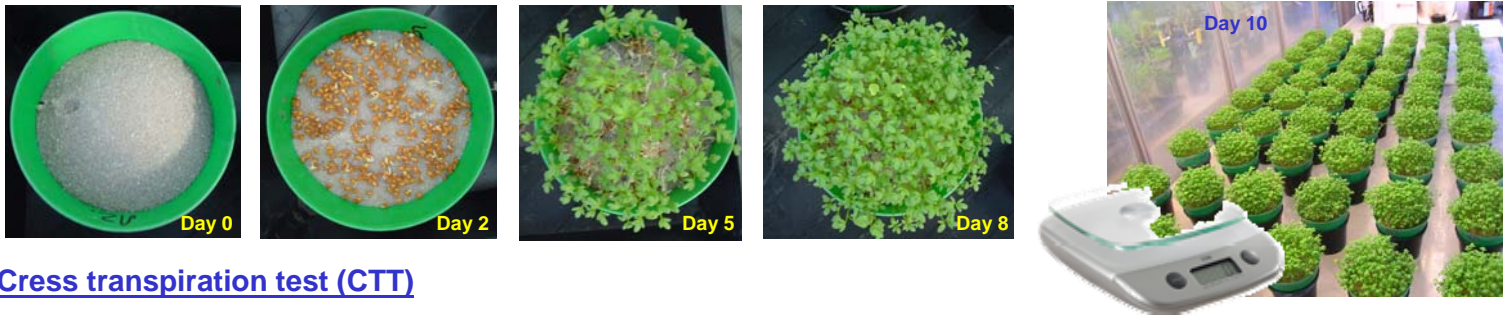
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Background

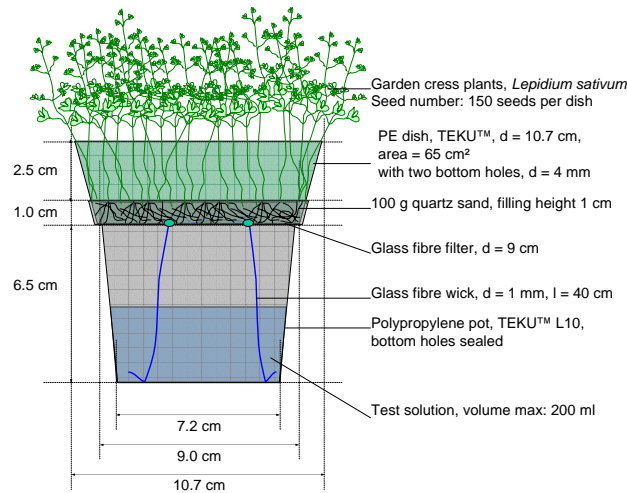
Phytotoxicity may not only be a problem concerning fertilizers or plant protection products but is also of interest regarding abiotic influence of environmental hazardous chemicals on plants.

Many phytotoxicity test systems, currently used, suffer from the problem, that the time course of phytotoxic effects cannot be displayed without high expense parallel plant test series. Often endpoint parameters like fresh mass, dry mass, shoot, and/or root elongation are measured. Where the test time period is willfully set, e.g. two to six weeks, sometimes misinterpretations of transient effects, like temporally occurring hormesis are observed. In some standard phytotoxicity test systems environmental chemicals are mixed into soil or other growth substrates. Here, binding to the soil humic matrix and absorption to clay minerals may bring about some difficulties for interpretation since nominal concentration applied and effective concentration may differ. Thus, bioavailability of the xenobiotic tested is often not assessable.



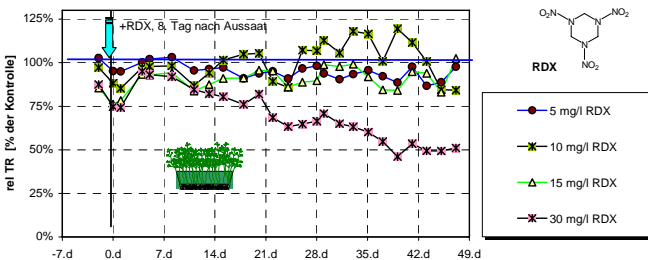
Cress transpiration test (CTT)

Application of bioavailable, aqueous solutions of xenobiotics to eight-days old cress is performed via glass fibre wicks every three days with freshly prepared solutions. Gravimetrically measurement of evapotranspiration and evaporation of unplanted quartz sand is commonly conducted in three-days intervals.

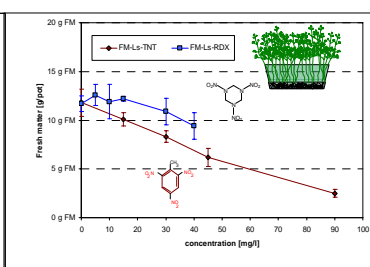
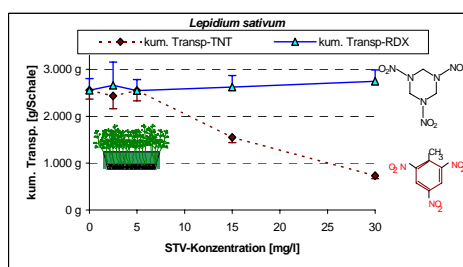
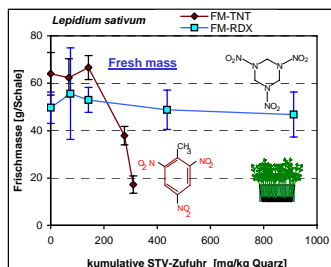
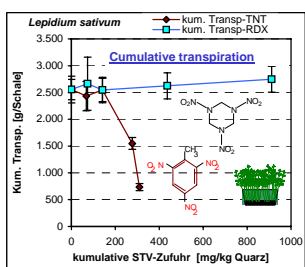


The Ten Main Features of CTT

1. CTT – is primarily designed as a contemporary **acute phytotoxicity** test (absolute and control dependent relative transpiration rate, cumulative transpiration).
2. CTT – is independent from the season and CTT is a **low-budget method**.
3. CTT – is applicable for **different solid growth substrates** with sorption dependent decreasing sensivity: glass fibre filter sheets > (vermiculite) > quartz sand > soil.
4. CTT – is **useable** for water-dissolved chemicals and for soil leachates.
5. CTT – is **adoptable** to other herbaceous plants like *Brassica rapa rapa*, *Avena sativa* and to broadleaf trees (*Populus*, *Salix*) or even coniferous trees (*Pinus*, *Picea*).
6. CTT – freshly prepared xenobiotic may be applied repeatedly and time dependent application mass as well as the actual nominal concentration of the xenobiotic are **quantifiable**.
7. CTT – single pulse application and xenobiotic removal from storage vessels is possible (**time-limited application**).
8. CTT – meets the **requirements of the OECD Guideline 208**. Common endpoint values like plant's fresh and dry mass as well as cumulative transpiration may be used for calculation of NOEL, NOEC, EC10, EC50 and other standard phytotoxicity parameters.
9. CTT – **bioconcentration factors** (BCF) for the respective xenobiotic are assessable.
10. CTT – may be extended to a **chronic phytotoxicity** test (e.g. grain yield).



Time course of relative transpiration rate (rel ETR, % of control) in dependence of concentration applied.



Dependence of cumulative transpiration on applied concentration of TNT or RDX.

Cumulative transpiration and endpoint fresh mass is dependent on supplied mass of the xenobiotics TNT or RDX in the same manner.