**Introduction**

It is well known that photosynthesis, and particularly Photosystem 2, is very sensitive to a wide range of stress conditions and could be an early indicator for detecting plant stress. One of the most employed biochemical methods to study the function of Photosystem 2 in vivo and in situ is chlorophyll fluorescence, or prompt fluorescence (PF). Another signal that is even more sensitive and information rich than PF is delayed fluorescence (DF), or delayed luminescence (see Box 1). However, DF has not gained the same popularity and attention as PF, partly by applying photosynthetic inhibitors to the sample, thus restricting electron transport and making the system simple.

In order to better understand DF it is useful to follow the correlation between PF and DF measured simultaneously from the same sample during the induction period of dark to light adaptation (Golterman, et al., 2003). Further information could be drawn by applying photosynthetic inhibitors to the sample, thus restricting the electron transport and making the system simple.

In this study, the photosynthetic herbicides diuron and atrazine, which block the electron transport between Q$_{b}$ and Q$_{a}$ (see Bossuyt et al., 1991), were applied to pea plants and the simultaneously measured PF and DF induction curves were analyzed. Our goal was to elucidate the nature of the different DF peaks appearing in the induction curve.

**Materials and Methods**

14 days-old pea plants grown hydroponically under controlled conditions (60 µmol photons m$^{-2}$ s$^{-1}$, 23-25°C) were used. The roots were cut under water and the plants were kept on bicarbonate solution for 12 h in darkness and 8 h under illumination with growth light.

PF and DF induction curves were measured simultaneously from dark-adapted detached leaves using an FL-2006 fluorometer (Fig. 1) even though U was changing, and DF (Fig. 2D) was at all times of the induction period. PF and DF can be measured at different times of the induction period. PF and DF are related to the transmembrane electrochemical gradient induced by charge separation.

**Results**

In control plants the phase diagrams (plots A, B) exhibited three distinct phases, described below.

**Conclusions**

> DF is a highly sensitive non-destructive probe for the action of photosynthetic herbicides in vivo.

**Acknowledgement**

This work was financially supported by the Swiss National Science Foundation (SCF/PSC000-2003-grant 787199).