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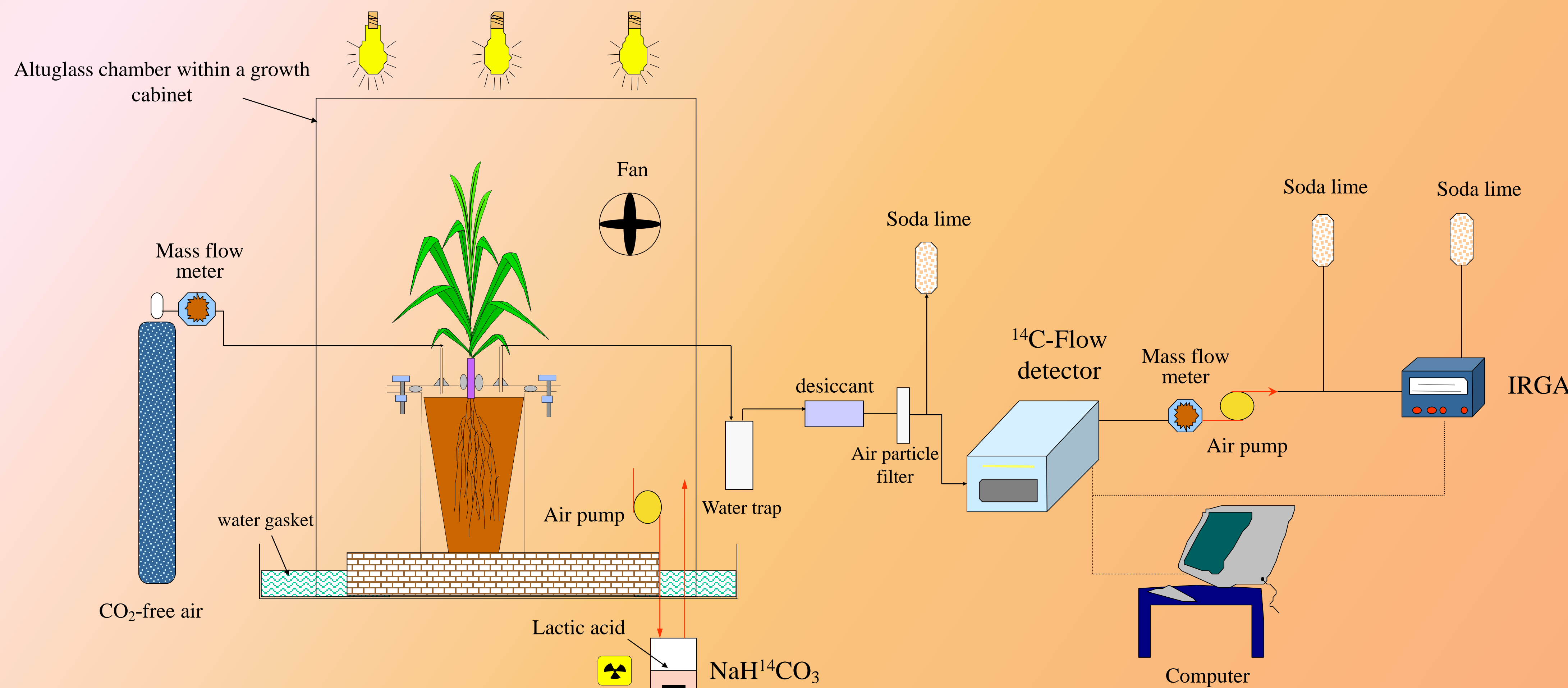
# A novel method for the dynamic measurement of belowground respiration after $^{14}\text{C}$ pulse-labelling of plant shoots

## Introduction

Quantification of organic carbon released into soil by plant roots requires to take into consideration rhizo-microbial respiration (= mineralisation of rhizodeposits). This latter can not be measured directly because  $\text{CO}_2$  evolved from the soil atmosphere is also produced by the root respiration.

In that framework, we set up a method which allows the continuous monitoring of  $^{14}\text{CO}_2$  in rhizosphere respiration after a  $^{14}\text{C}$  pulse-labelling of maize shoots.

## Method for a continuous monitoring of $^{14}\text{CO}_2$ and total $\text{CO}_2$ of belowground respiration



Shoots of maize plant were pulse labelled with  $^{14}\text{CO}_2$  for 20 min. The  $^{14}\text{CO}_2$  and the total  $\text{CO}_2$  evolved from belowground respiration were continuously monitored with a flow radioactivity detector (A500TR Packard Instruments Co. Inc., CT, USA) coupled on line with an infra red gas analyser for 4 days after the  $^{14}\text{C}$  initial pulse (Nguyen et al., 1999).

## Results

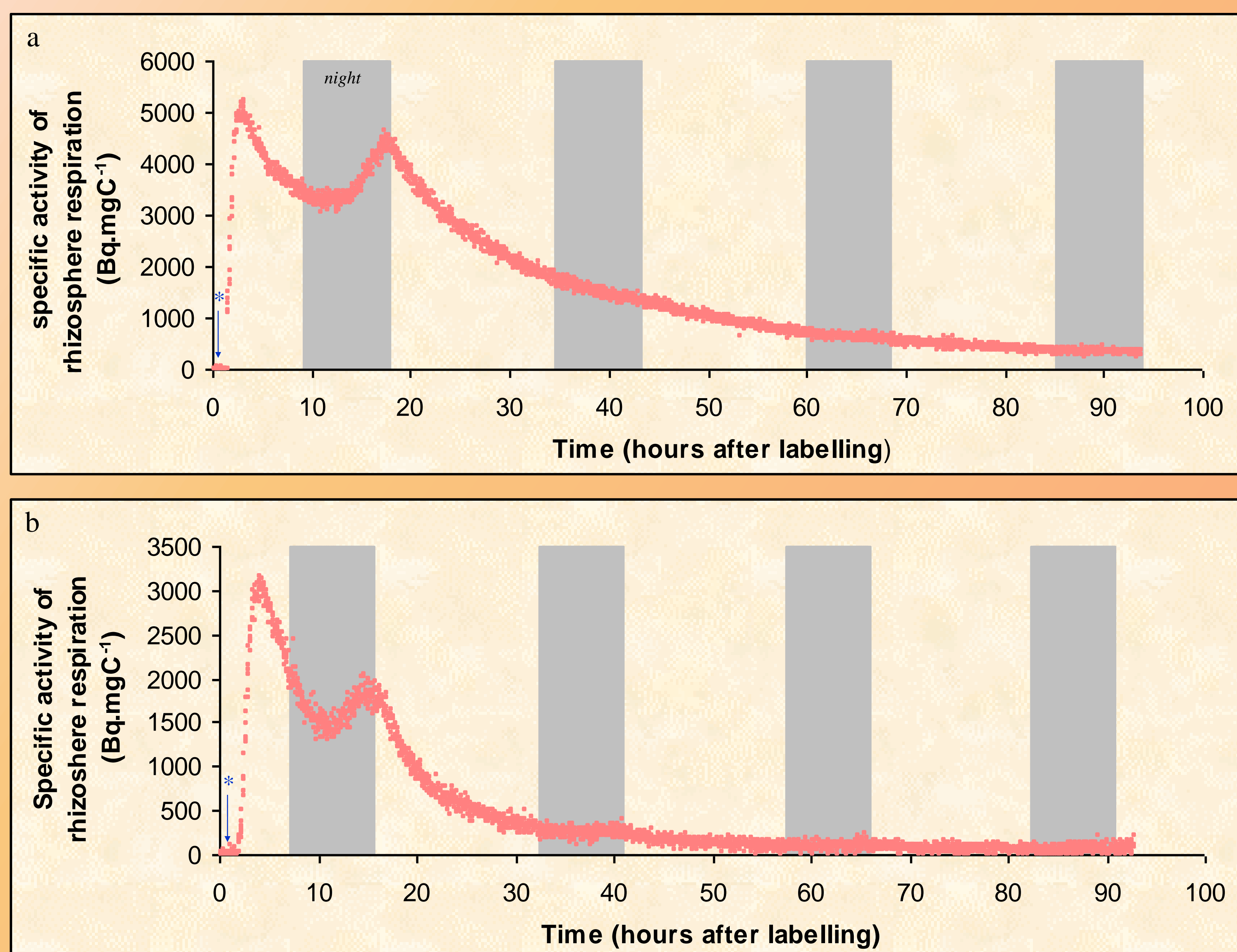


Figure 1: Time-course of rhizosphere respiration specific activity in a 3 week-old maize grown in non-sterile (a) and sterile belowground conditions (b). \*  $^{14}\text{CO}_2$  pulse-labelling.

We observed the succession with time of two  $^{14}\text{C}$ -activity peaks as demonstrated in wheat by Warembourg and Billès (1979) using NaOH traps. However, at the opposite of results in wheat, we found the second  $^{14}\text{CO}_2$  peak in case of belowground sterility. This questions Warembourg and Billès (1979) hypothesis according to which the second phase of respiratory activity results solely from microbial utilisation of complex compounds such as root mucilage.

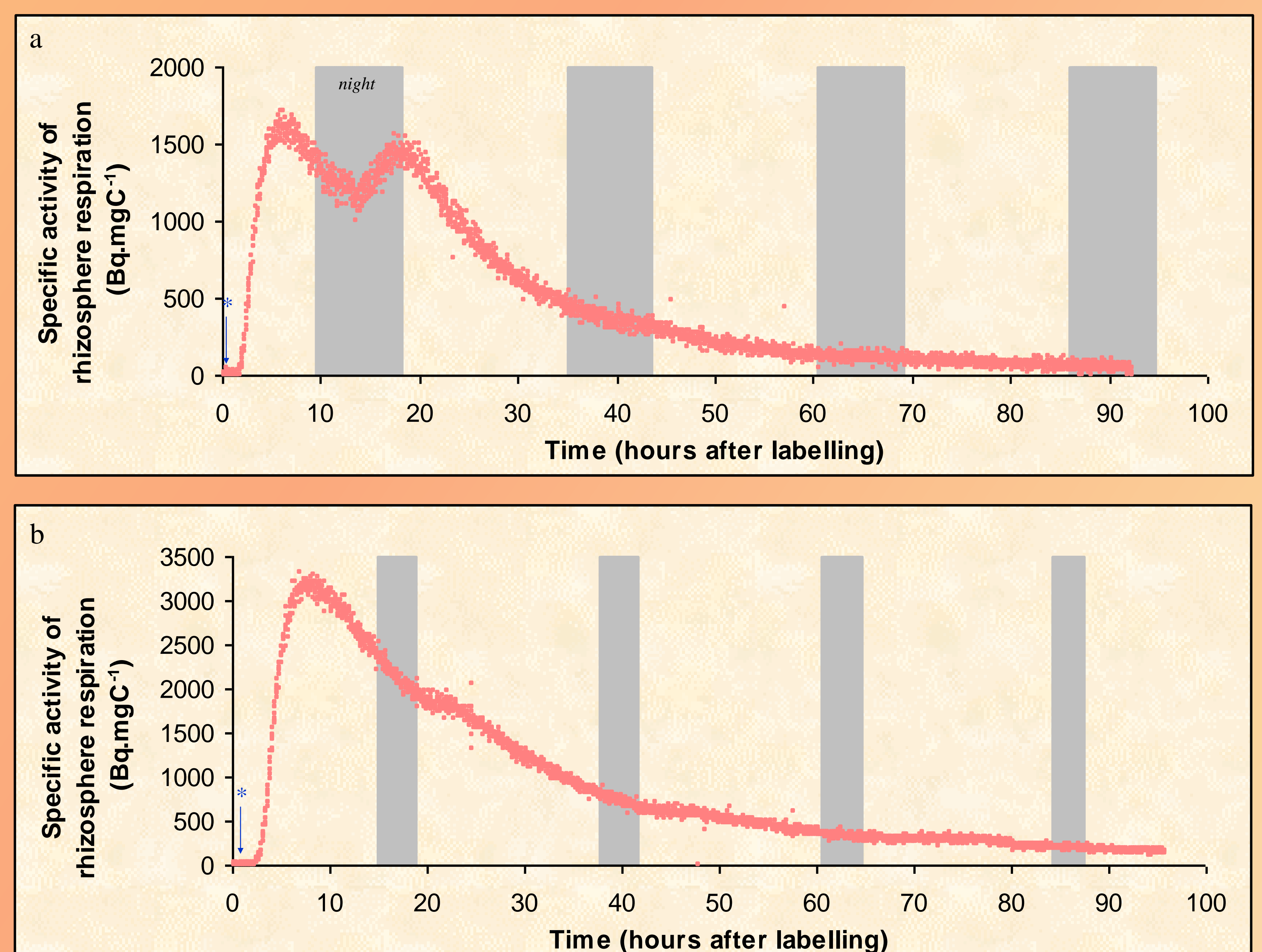


Figure 2: Time-course of rhizosphere respiration specific activity in a 5 week-old maize grown under 16 h (a) and 20 h of photoperiod (b). \*  $^{14}\text{CO}_2$  pulse-labelling.

Our results showed that the second activity phase was closely related to the photoperiod duration. We suggested that during the night,  $^{14}\text{C}$ -plant assimilates stored during the previous light period are likely mobilised and respired again by root and microbial biomass.

## Conclusion

The flow radioactivity detector coupled with an IRGA has a fine temporal resolution and is consequently a relevant tool to study carbon dynamics in the rhizosphere at a short time scale.