中国科学院亚热带农业生态研究所
Institute of Subtropical Agriculture, The Chinese Academy of Sciences
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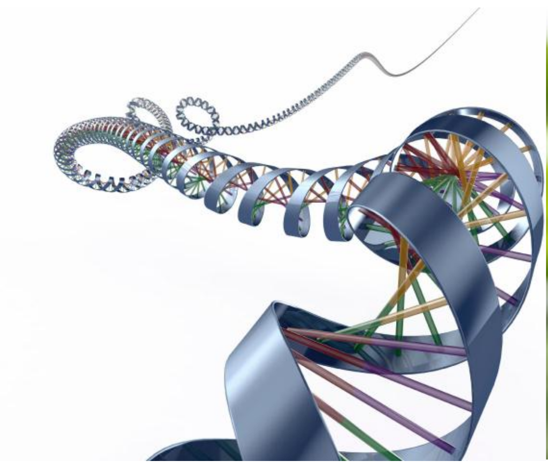
# Input and distribution of rice root-derived carbon in plant-soil-micro-ecological system following $^{14}C$ continuous labeling




Tida Ge, Jinshui Wu, Phil Brookes

Institute of Subtropical Agriculture, CAS

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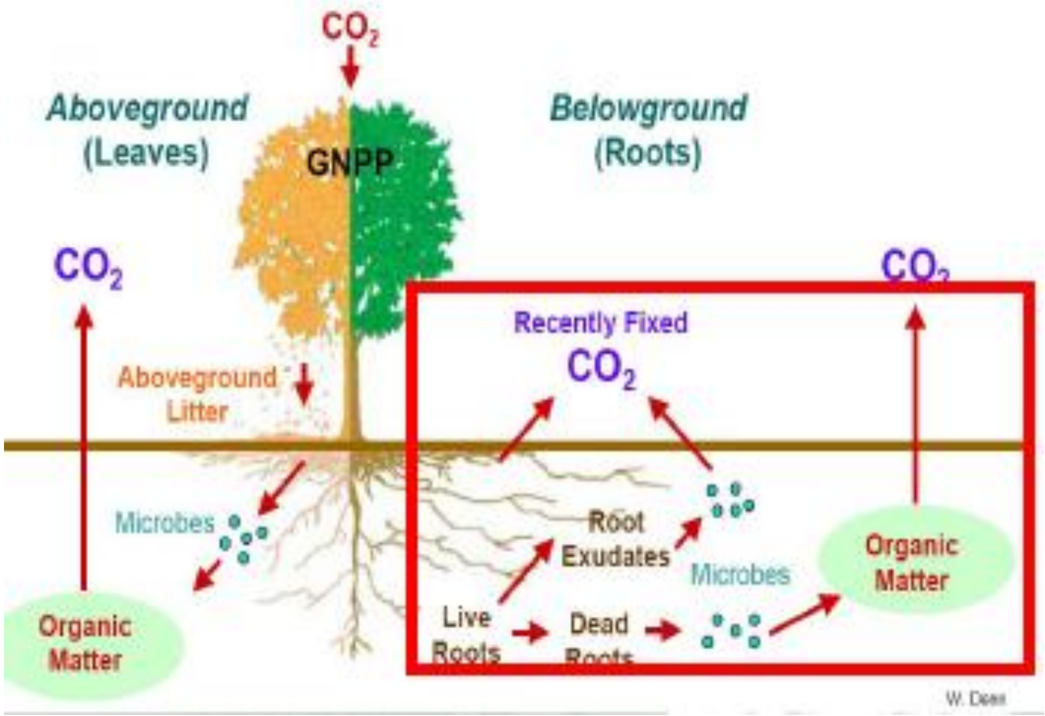
# Outline

- **Background**
- **Objective**
- **Materials and methods**
- **Results**
- **Conclusion**

# Background （1）

- **Photosynthetic C  is an important component in the C cycling of atmosphere-plant-soil system, and the main source of soil organic C**




**Giardina et al. (2002)**

# Background (2)

- The estimated total contribution of photosynthates to MBC amounted to 91 mg C $plant^{-1}$,corresponding to 28% of total MBC at the end of the season or a 100% increase in MBC over the growing season (Lu 2002).
- Only about 2%–5% of net plant C assimilation is retained in the soil (Hüsch et al., 2002).
- Currently, little known about the new C input to soil C pools and its potential contribution to more stable soil C storage

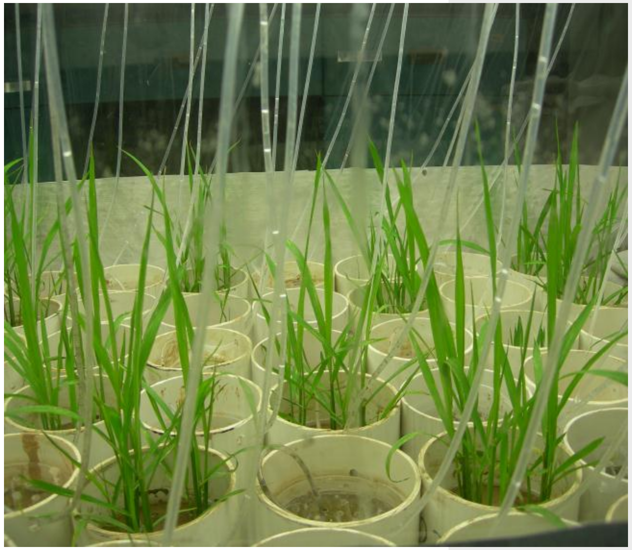
# Objective

- **To understand the root-derived C dynamics in the soil-plant-microbial ecosystem**
- **To investigate the influence of rice-photosynthesized C inputs on changes in mineralization (i.e. priming effects) of the native SOC pool after rice harvest**

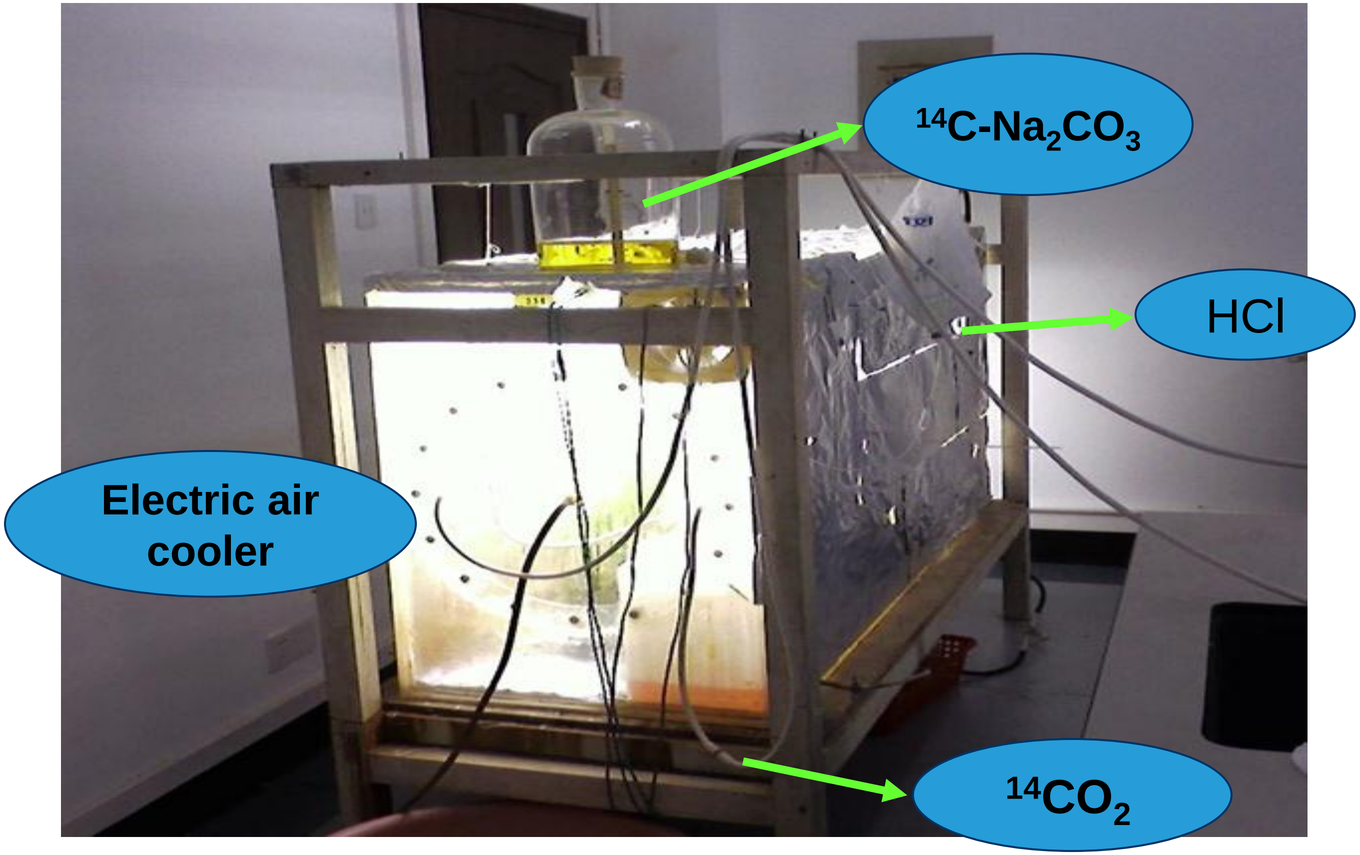
# Materials and methods

- **Crop: Rice (Two-line hybrid rice *Peiyliangyou* 288)**
- **Soils: Four typical paddy soils (P1,P2, P3, P4)**
- **$^{14}C$ tracing technique: Generated through the reaction between $^{14}C$-$Na_2CO_3$ and HCl**
- **Two principal treatments were set up:**
  - **rice-planted paddy soil**
  - **unplanted paddy soil**
- **Harvest time: 80 d after $^{14}C$ labeling**
- **Indices analysis**

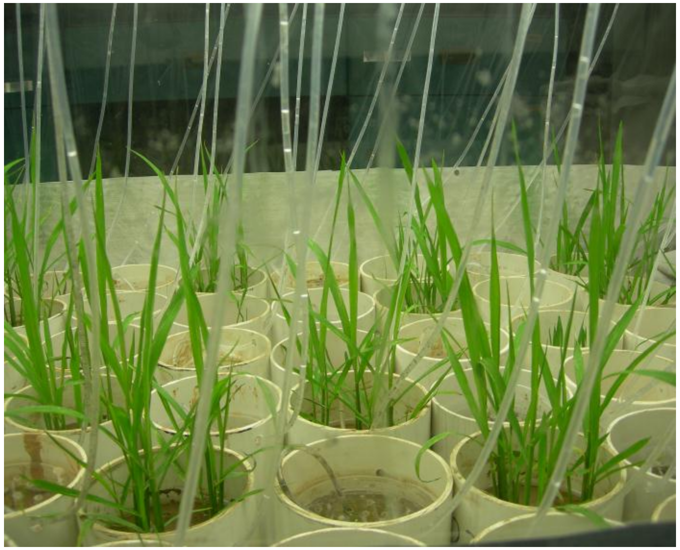
**$^{14}C$-SOC, $^{14}C$-DOC, $^{14}C$-MBC**

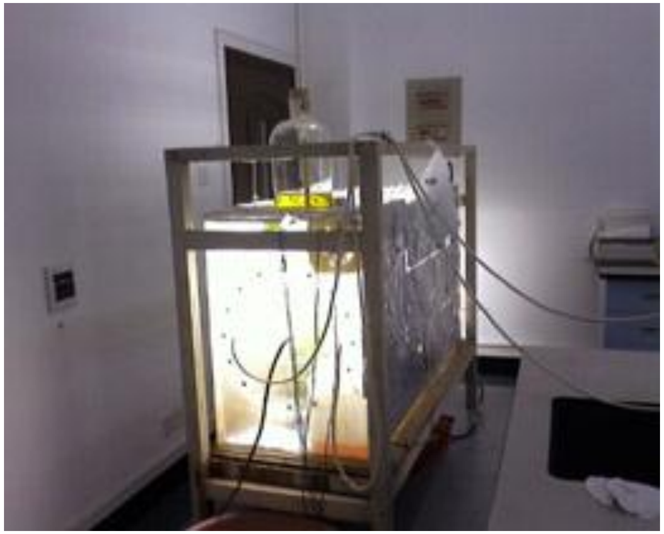


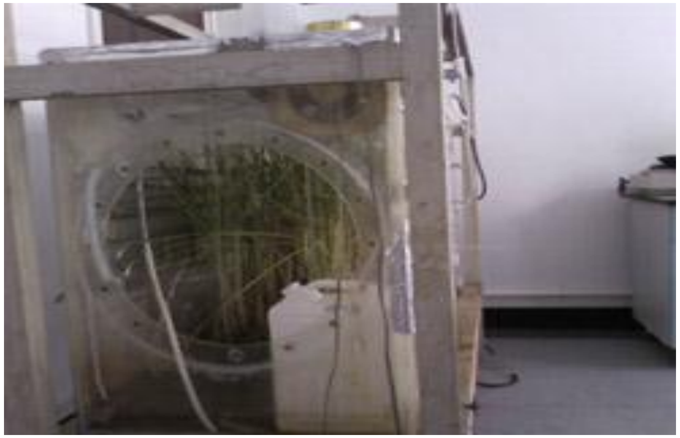
# Experimental system



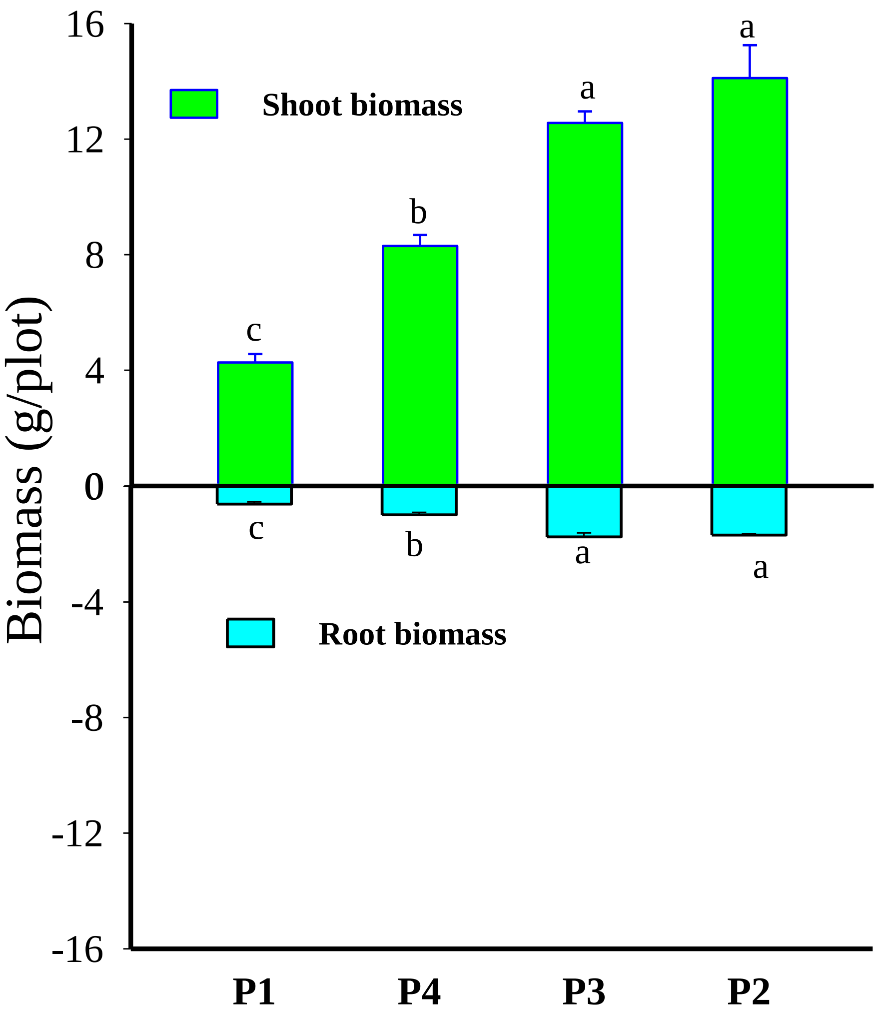

- $^{14}C$-$CO_2$ concentration: 270-350 ppm；
- relative humidity: 80%–90%
- day/night temperatures： 31 ± 1° C /24 ± 1° C
- light intensit: 12 h, 500 mmol photons $m^{-2}$ $s^{-1}$ PAR





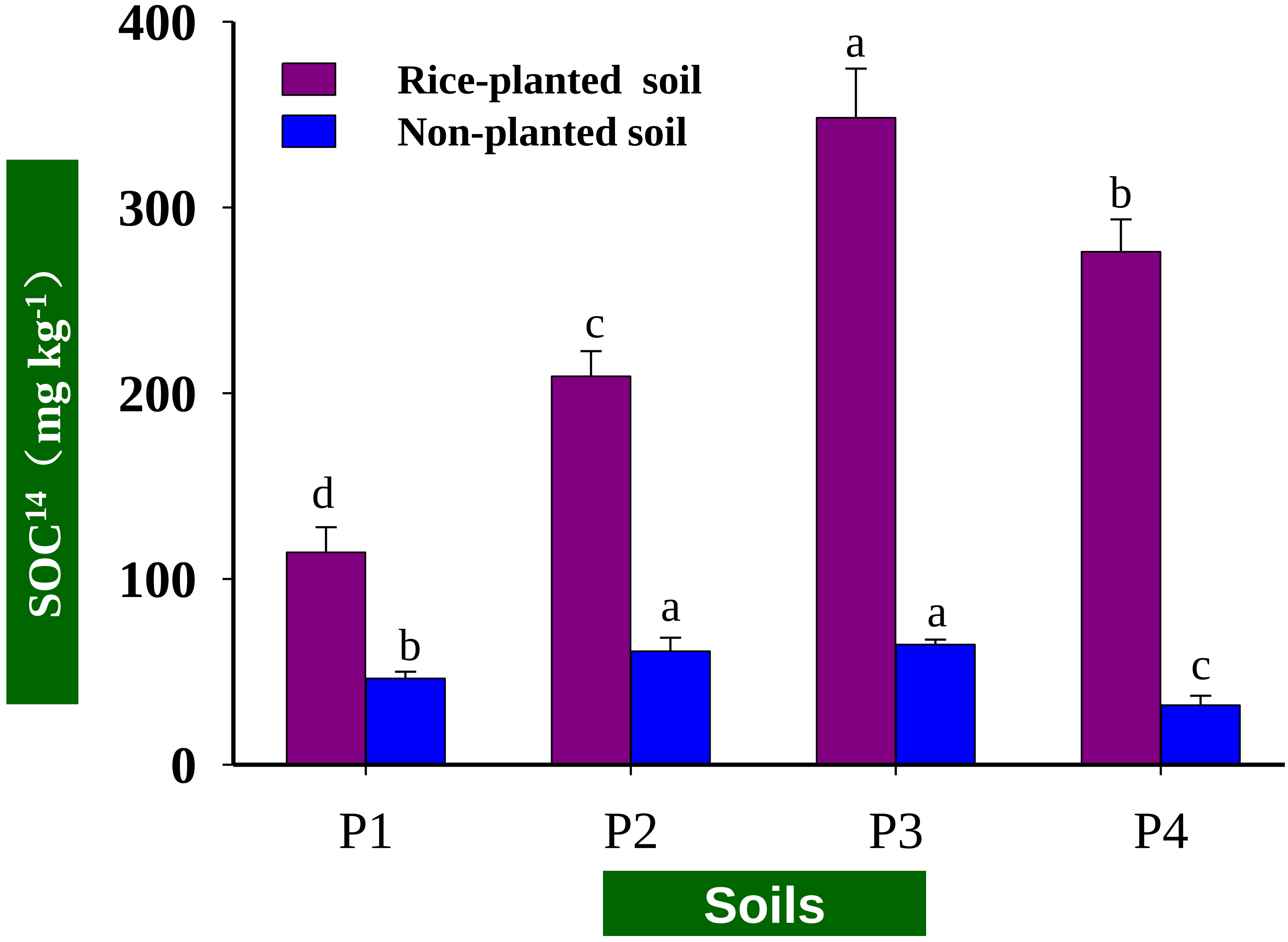


# Amounts of rice biomass in four different paddy soils after continuous labelling for 80 days

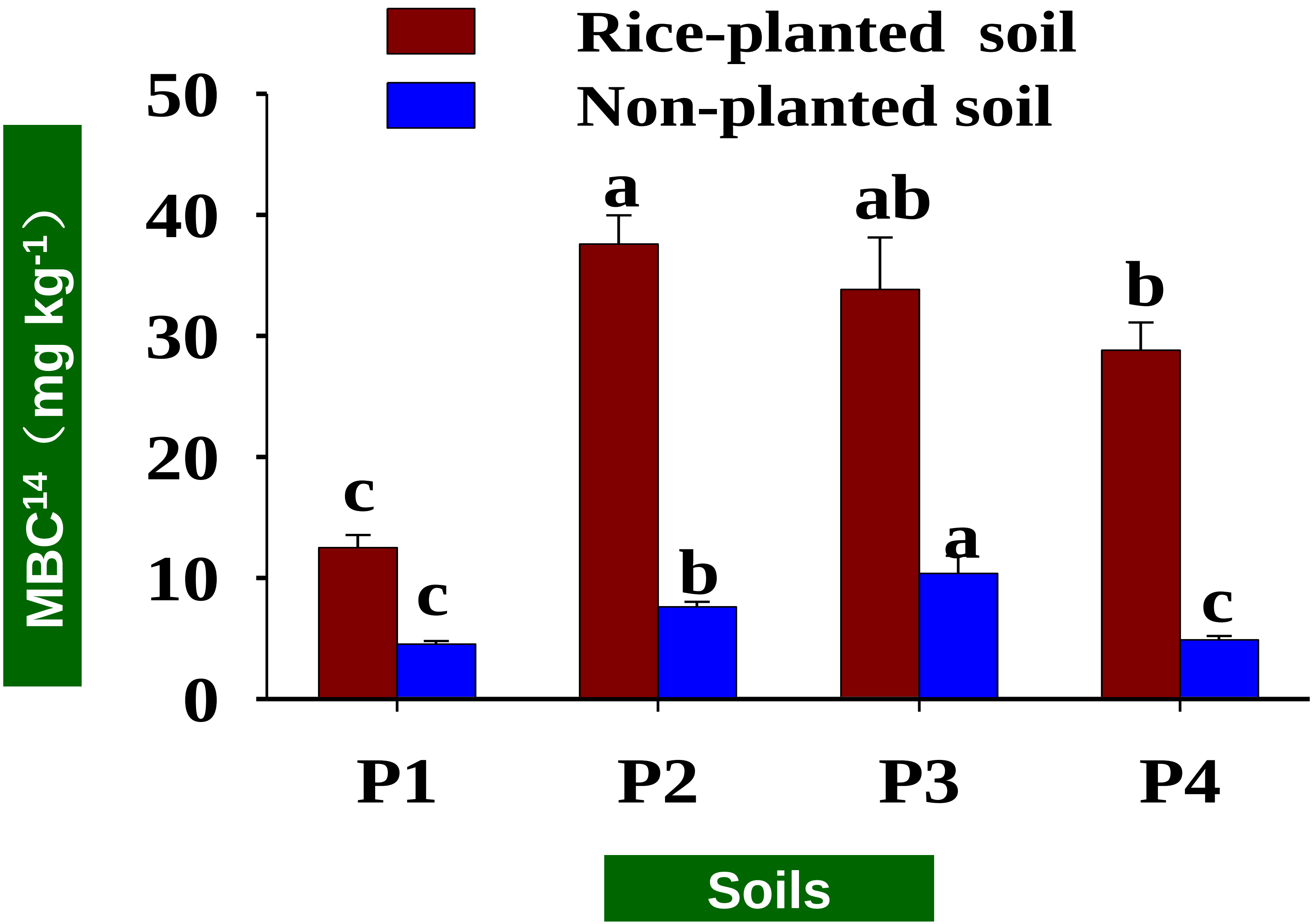



| | $^{14}C$-SOC/ rice biomass C (%) |
|---|---|
| P1 | 5.42 a |
| P2 | 5.62 ab |
| P3 | 5.55ab |
| P4 | 4.09b |

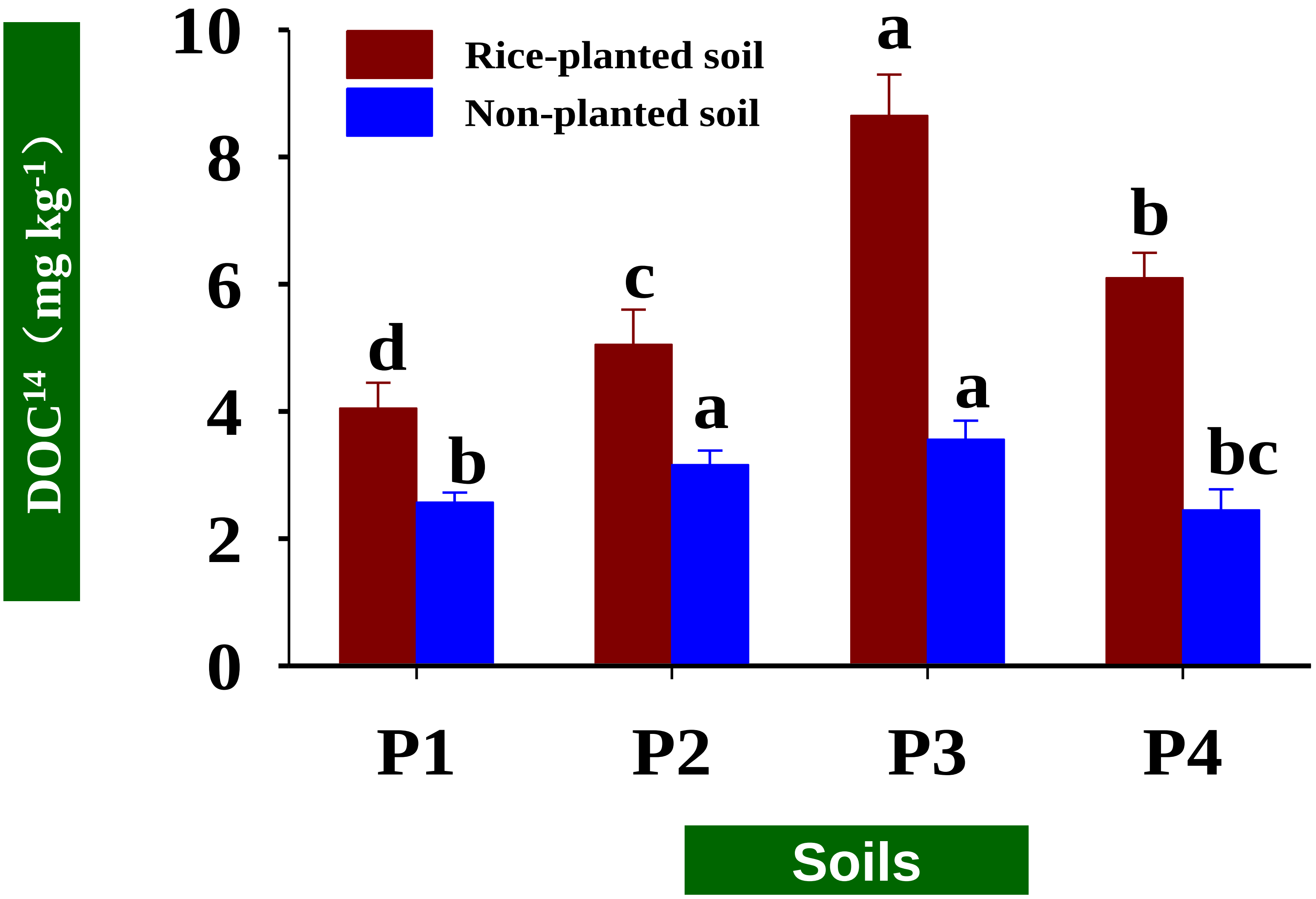
# Contribution of photosynthesized C to SOC in different soils



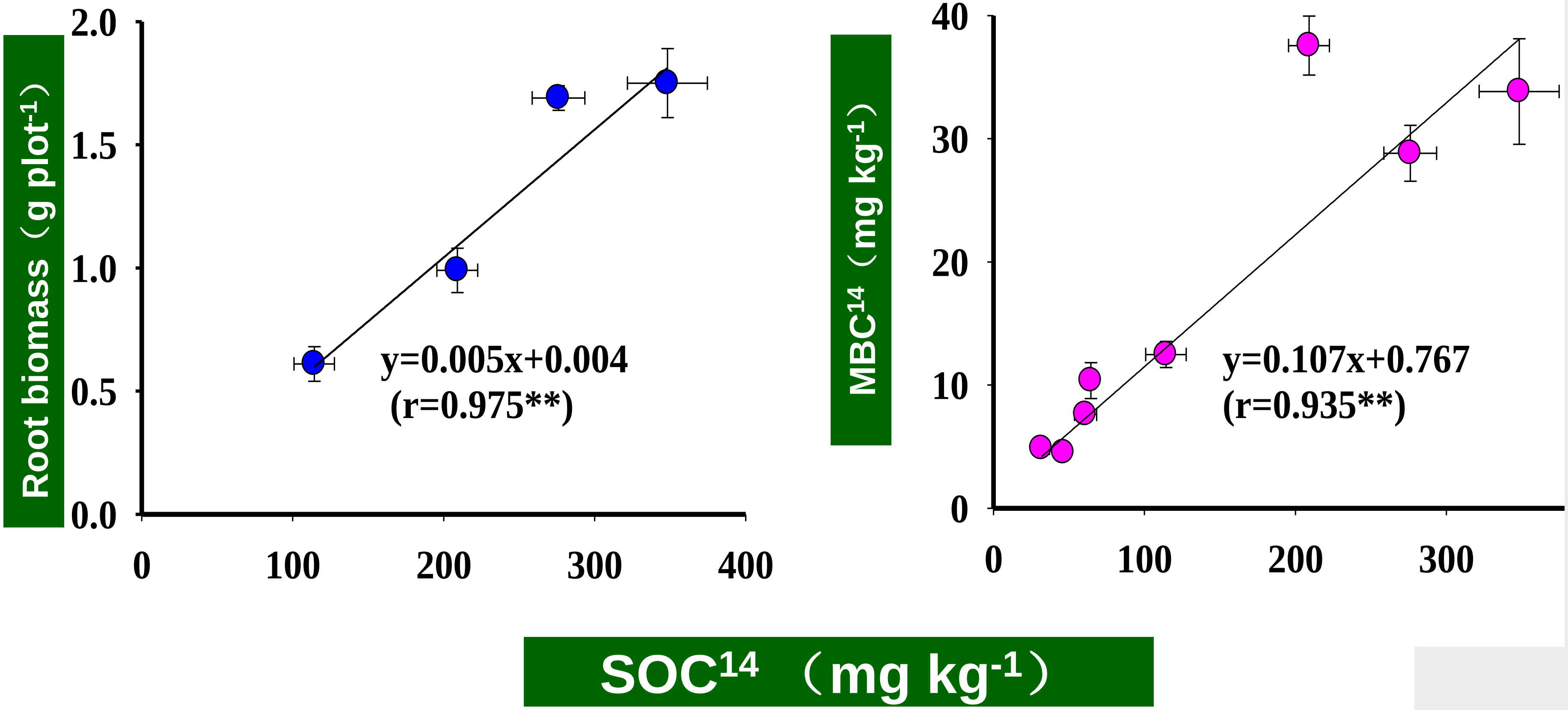
# Contribution of photosynthesized C to MBC in different soils



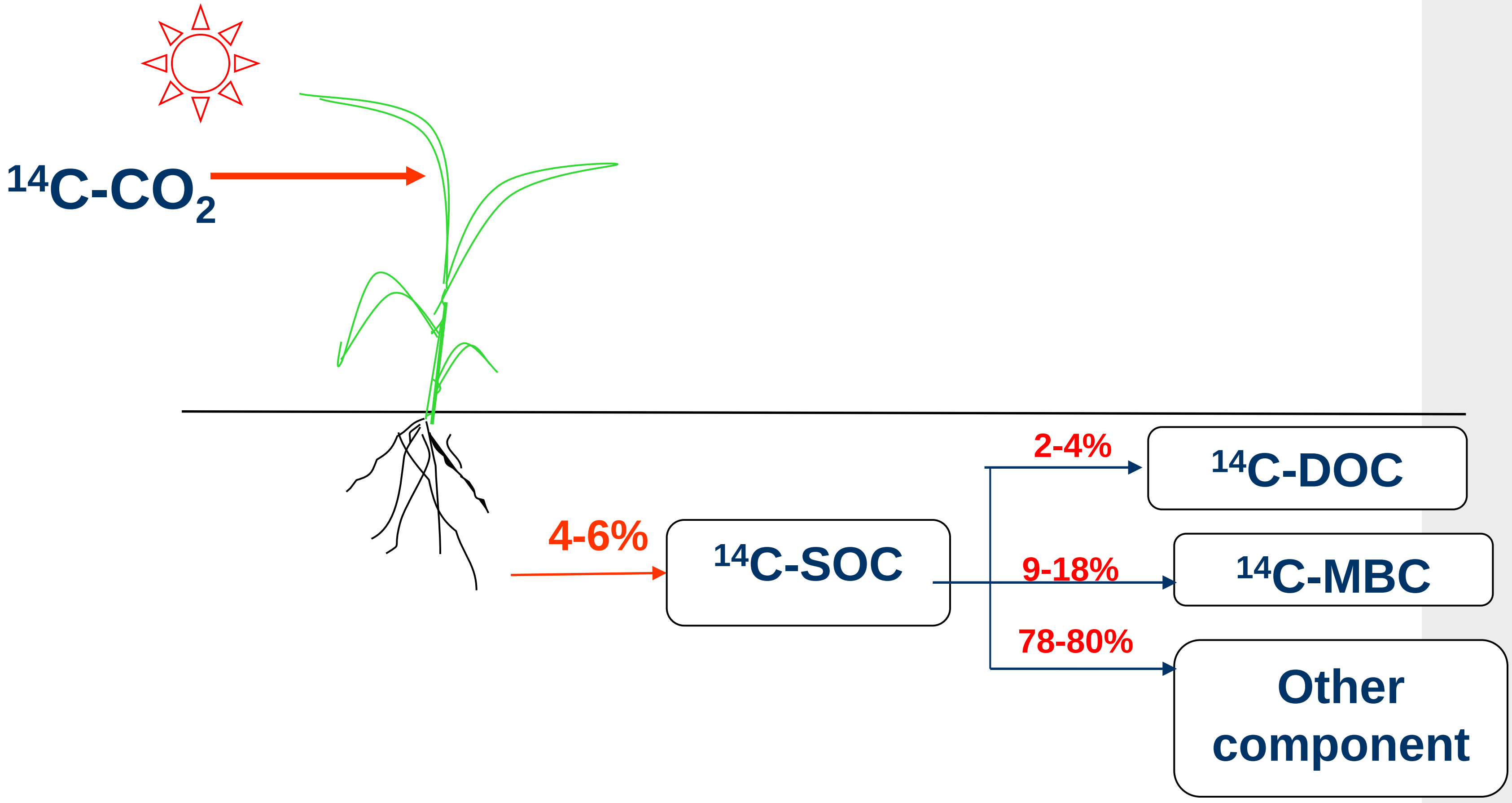
# Contribution of photosynthesized C to DOC in different soils



# SOC14 VS rice root biomass, MBC14



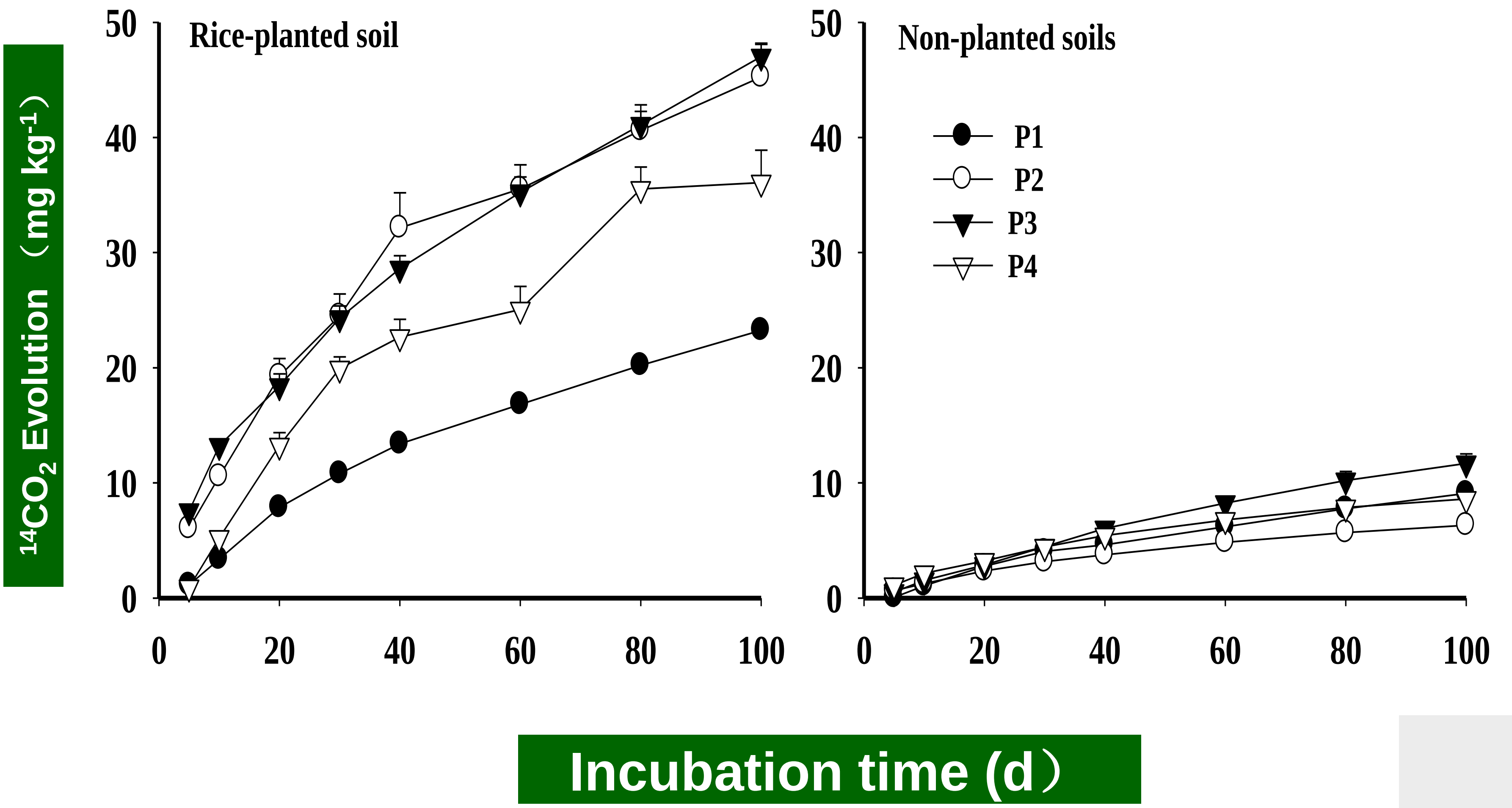
# A simple model of the contribution of rice photosynthesized carbon to DOC and MBC in a flooded rice system



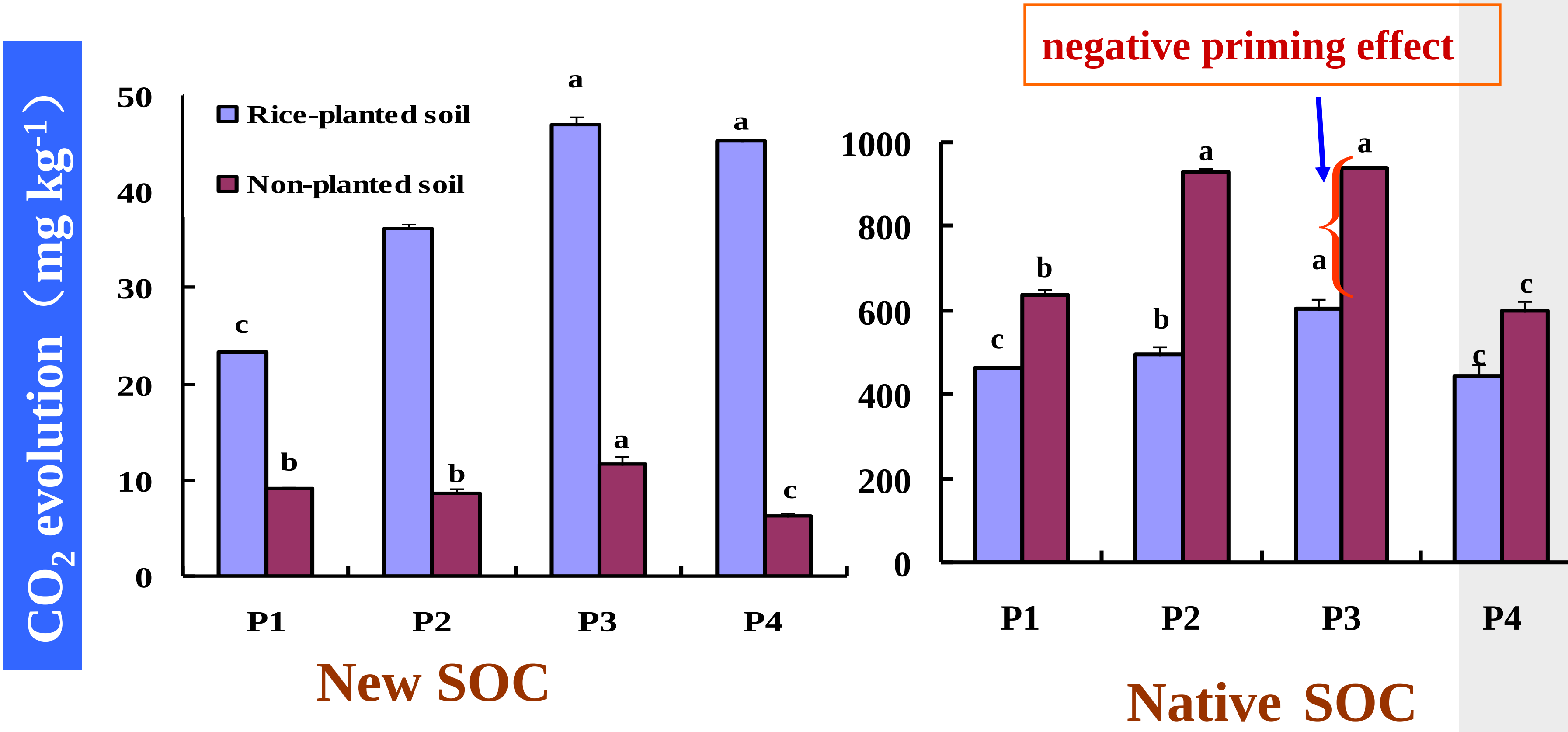
**new and native SOC mineralization: 25℃, 100% air humidity soil incubation**

**5, 10, 20, 30, 40, 60, 80 and 100 d of incubation analyze $^{14}C$-$CO_2$ and $CO_2$**

# Cumulative $CO_2$ efflux derived from new C  in rice-planted, non-planted soils



# The amount of $CO_2$ derived from native and new SOC in rice-planted and non-planted paddy soils



# Conclusion

- **At 80-d uniform labeling, organic $^{14}C$ in rice-planted soils 4× more than in non-planted soils**
- **At 80-d of labeling, $SOC^{14}$ concentration was positively correlated with biomass $C^{14}$**
- **The distribution and transformation of the photosynthesized C had greater influence on the dynamics of DOC and MBC than that of SOC**
- **Less native SOC mineralization (i.e. a negative priming effect) found in some soils**

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Institute of Subtropical Agriculture, The Chinese Academy of Sciences
www.isa.ac.cn

# Thank you for attention

**Tida Ge**

**Mapoling of Changsha City, Hunan province, China 410125**

**Institute of Subtropical Agriculture (ISA), the Chinese Academy of Sciences (CAS)**

**Email: gtd@isa.ac.cn**

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