



Dietary Tannins Reduce Soil Respiration after Goat Manure Application on an Irrigated Sandy Soil in Oman

¹Mariko Ingold, ²Sibylle Faust, ¹Philipp Holz, ¹Aboud Fayad and ¹Andreas Buerkert

¹Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics (OPATS), Universität Kassel-Witzenhausen, Germany

²Soil Biology and Plant Nutrition, Universität Kassel-Witzenhausen, Germany



Introduction

- High gaseous losses carbon (C) and nitrogen (N) are a major problem of irrigated agriculture on sandy soils in Oman
- Tannins used as feed additives can stabilize organic matter and N in manure
- Objective:** To investigate the effect of dietary tannins on soil respiration after fertilization of radish with goat manure

Materials & Methods

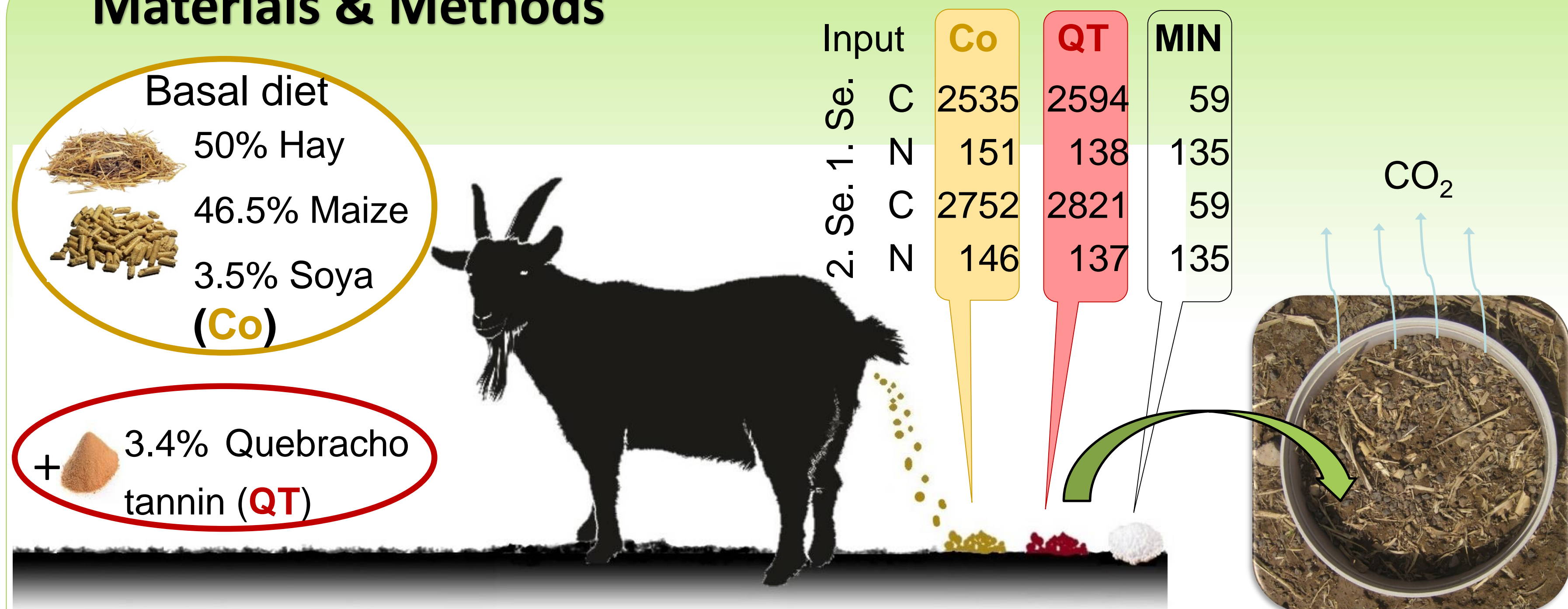


Figure 1 Schematic illustration of the experimental treatments **Co**, **QT** and **MIN** with C and N input levels in kg ha⁻¹ in Season 1 and 2, and soil ring for gas emission measurement in Sohar, Oman.

- Manure from male Jebel Al Akhdar goats, sun-dried and pooled
- Urea (**MIN**), control manure (**Co**) and Quebracho tannin-enriched manure (**QT**)
- Soil: hyperthermic torrifluent, 82% sand, 16% silt, 2% clay
- Climate: mean monthly temperature was 22° C (Min 10° C, Max 36° C), with 0 mm cumulative precipitation in February and March in two seasons
- Irrigated sweet corn-radish rotation in two-year field experiment in Sohar, Oman
- Analysis of CO₂-C emission rates during radish (*Raphanus sativus* L.) cultivation
- Photo-acoustic multi-gas analyzer (Innova 1312) connected to a closed chamber (4 min accumulation period)
- Gas fluxes calculation with linear regressions (R package 'gasfluxes', regressions were considered valid with p < 0.1)



Figure 2 (a) Radish field with PVC ring installed for gas measurements and (b) gas measurement in the field

Results

- Across both seasons daily CO₂-C emission rates significantly different for all three treatments (mixed model ANOVA, with treatment as fixed effect, p<0.001)
- MIN lost 11-16-times more C than input
- In goat manure treatments 50 to 87% of applied organic C lost
- QT** reduced CO₂ emissions in tendency by 5-10% compared with **Co**

Conclusions

- High gaseous C loss in all treatments → importance of organic matter input to irrigated sandy soils in the Subtropics
- Feeding Quebracho tannin stabilized organic matter in manure, though the effect was small

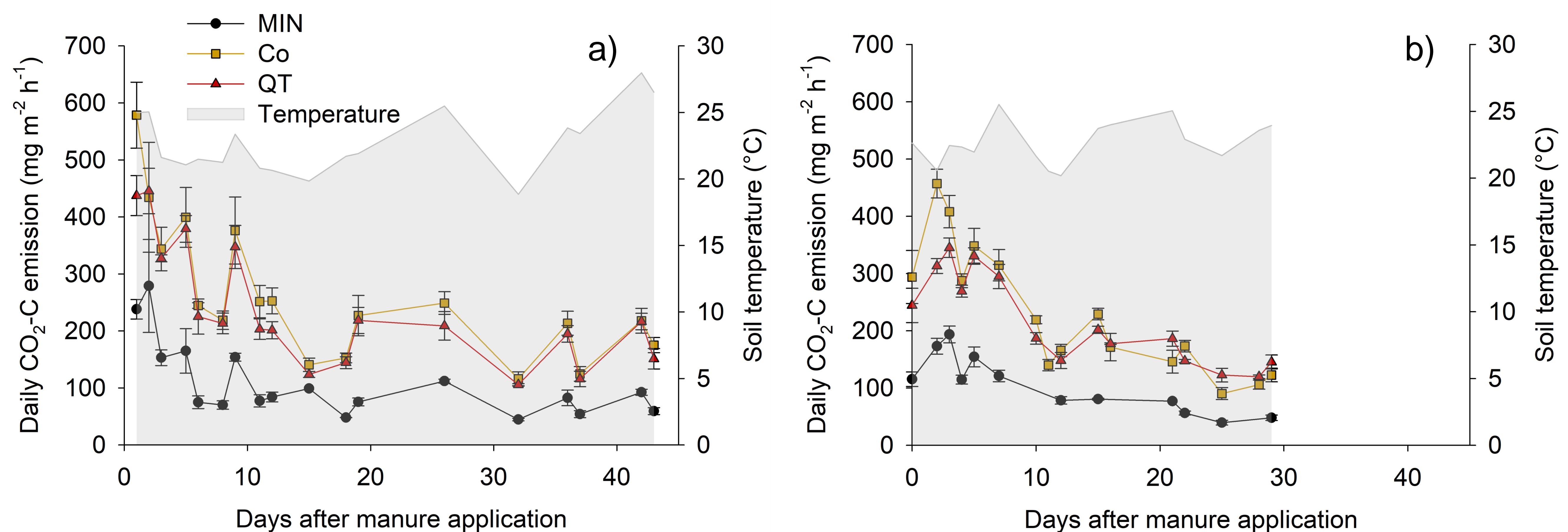
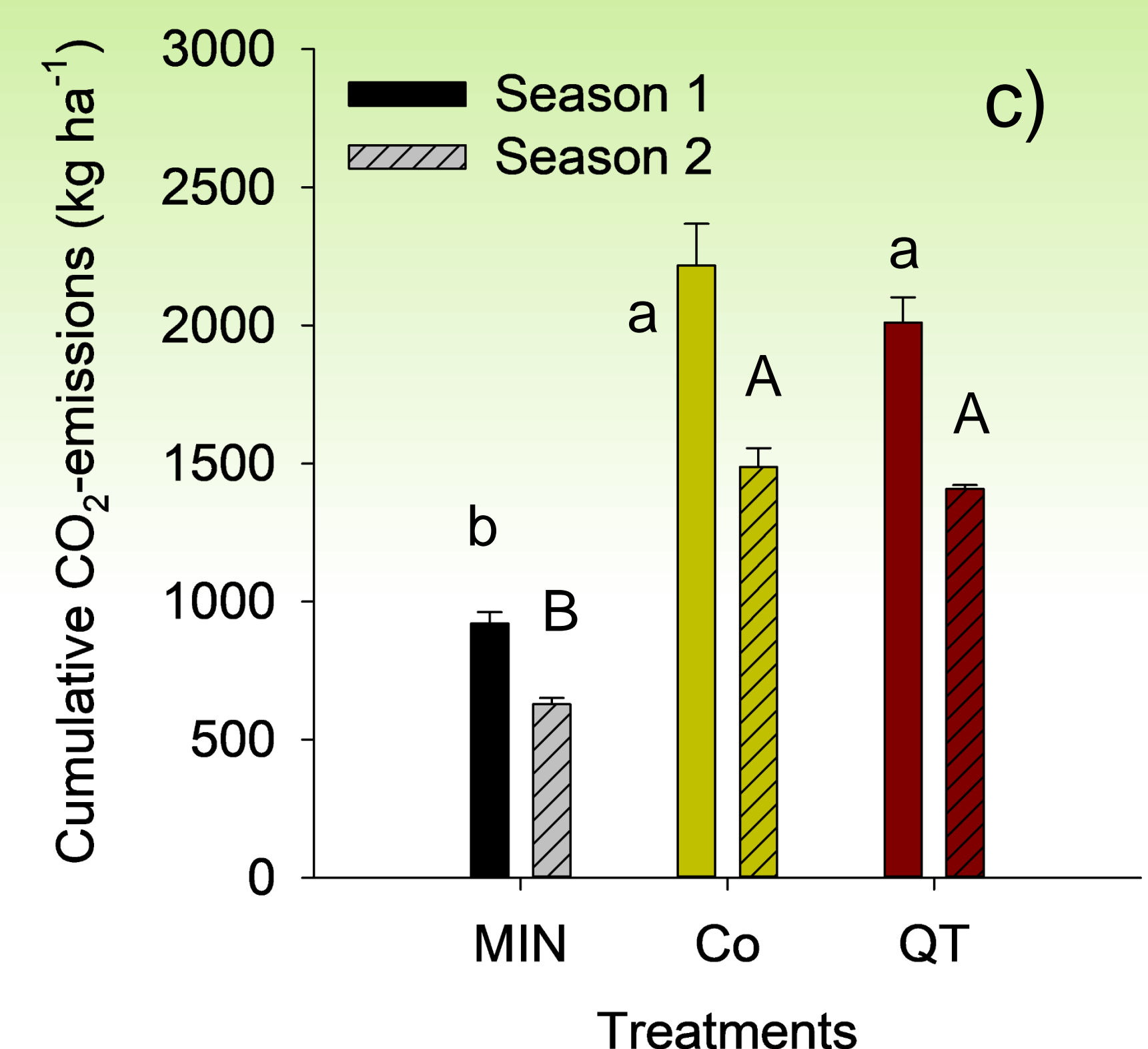


Figure 4 Average daily CO₂-C emission rates during radish cultivation in Sohar, Oman, over a period of 43 days in Season 1 (a) and 29 days in Season 2 (b), and cumulative CO₂ emissions in season 1 and 2 (c). Whiskers indicate \pm standard error of means. Small letters indicate significant treatment effects (Tukey test, p < 0.05) for Season 1 and capital letters for Season 2. **MIN** = Urea, **Co** = control goat manure, **QT** = Quebracho tannin-enriched manure.