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# Carbon partitioning into *Lolium perenne* plant-soil-microorganisms system after 9 years of Free-Air CO<sub>2</sub> Enrichment (Swiss FACE)

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### CONTEXT

The Swiss FACE system is the oldest available in the world running with a temperate grassland ecosystem. Very few devices are available for long term studies of the consequences of elevated CO<sub>2</sub> on C allocation in the continuum atmosphere-plant-soil-microorganisms.

### HYPOTHESES

Long term soil CO<sub>2</sub> enrichment affect plant C partitioning and belowground C allocation. Climatic conditions, variations in the resource availability aboveground (defoliation rhythm) and belowground (mineral nutrient availability) influence the plant-soil-microorganisms responses to increased CO<sub>2</sub>.

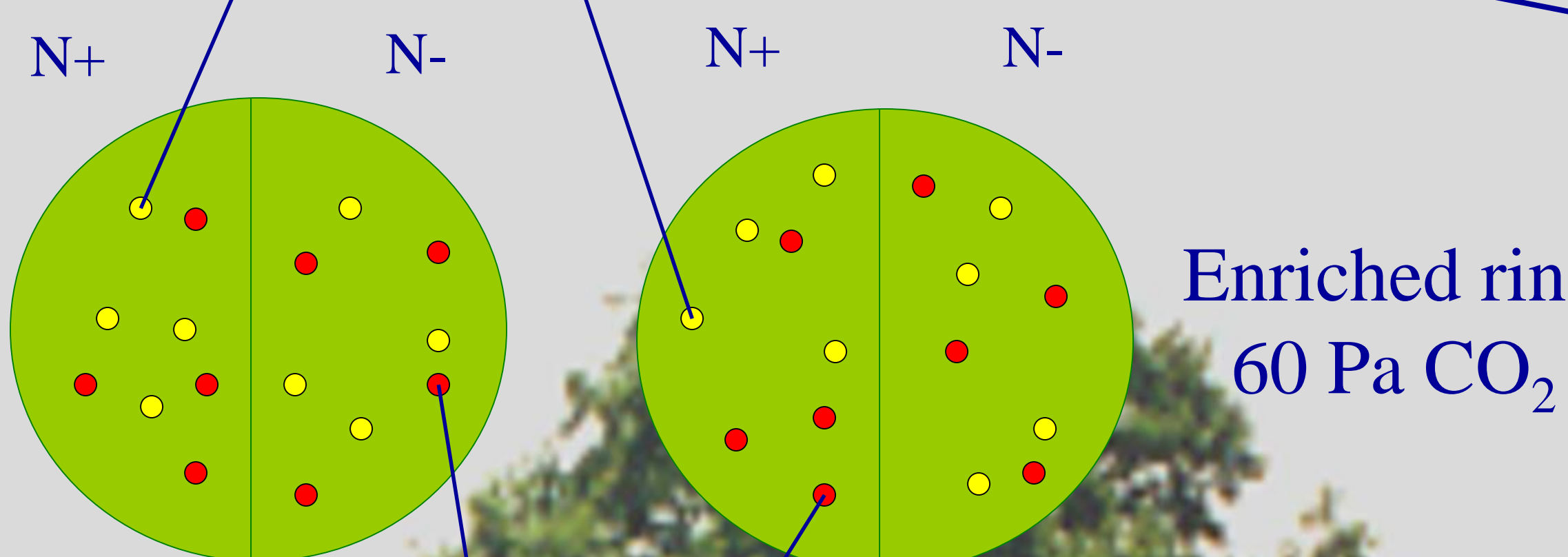
### OBJECTIVES

Dry matter production, C partitioning in rhizosphere compartments, microbial biomass growth and activity and soil C content were investigated at two distinct dates during growing season

### METHODS

Soil cores with growing rye grass excavated the 14<sup>th</sup> June 2002 (spring)

560 KgN.ha<sup>-1</sup>: N+  
 140 KgN.ha<sup>-1</sup>: N-



<sup>14</sup>C labeling procedure

Harvest

*Lolium perenne* monoculture plots

Soil cores with growing rye grass excavated the 27<sup>th</sup> September 2002 (autumn)

### RESULTS

#### 1. Dry matter production (DM)

Elevated CO<sub>2</sub> enhanced DM only at the autumn sampling (Table 1).

#### 2. C allocation in the belowground compartments

Recent C allocated to rhizosphere (AS) decreased in enriched rings at the autumn sampling.

Microbial C decreased at both date of sampling.

Total soil C content was unaffected by elevated CO<sub>2</sub> (Table 1).

#### 3. Mineralisation (autumn sampling)

The amount of <sup>14</sup>C mineralised was higher under elevated than ambient CO<sub>2</sub> (Figure 1).

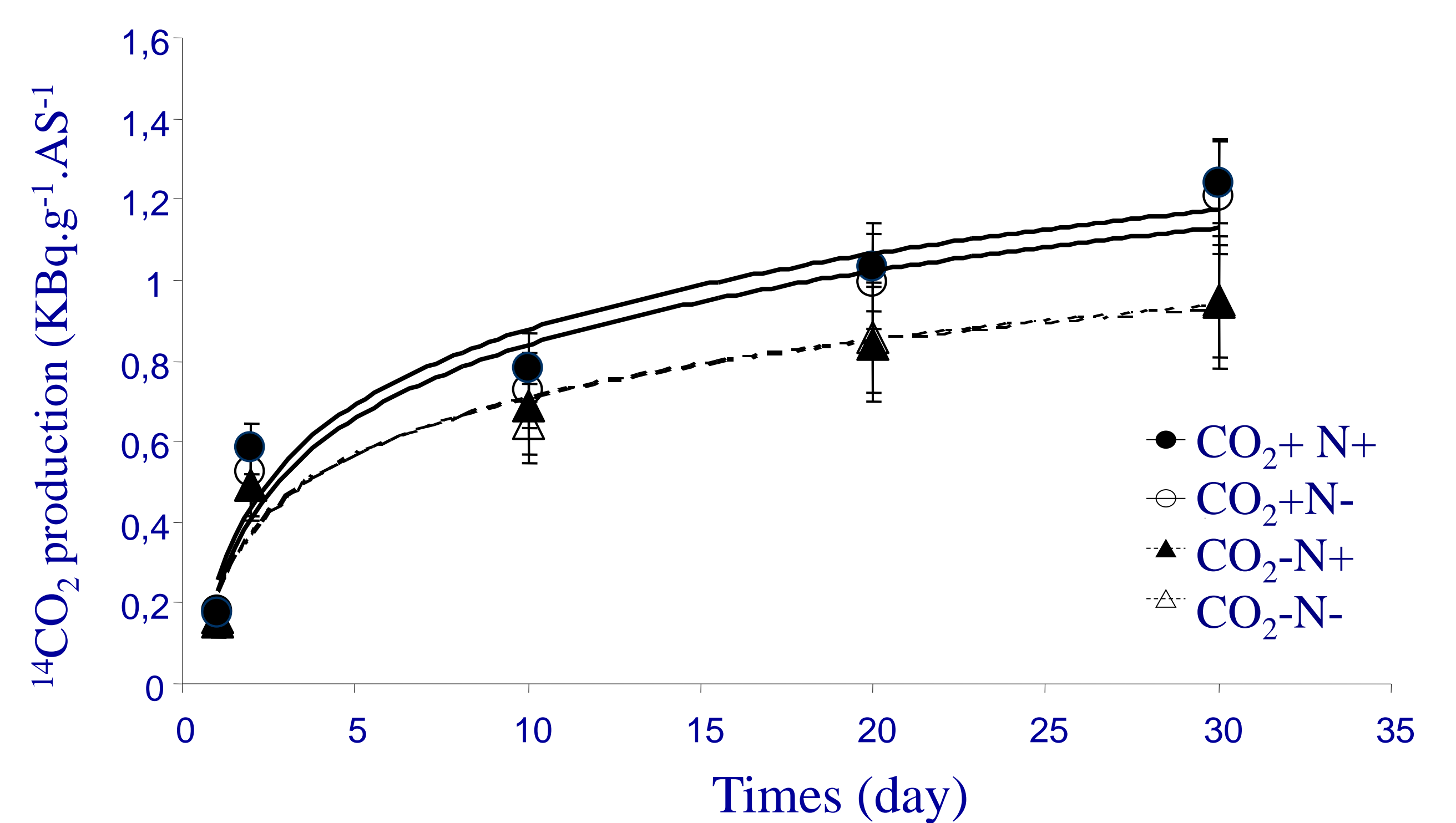


Figure 1 : Kinetic of mineralisation of <sup>14</sup>C organic compounds in AS (Beq.g<sup>-1</sup> AS) measured for 30 days after harvest of AS.

		Biomass		Microbial C		%TRR Belowground		Soil C content	
		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
CO <sub>2</sub> <sup>+</sup>	N+	4 (1.0)	4.2 (0.8)	355 (99)	304 (81)	38.3 (7)	24.9 (5)	7108 (772)	6578 (839)
	N-	2.9 (0.7)	1.9 (0.4)	400 (94)	343 (72)	53.5 (8)	34.5 (6)	6676 (824)	6064 (728)
CO <sub>2</sub> <sup>-</sup>	N+	3.7 (0.9)	2.6 (1.0)	528 (66)	538 (121)	41 (7)	42.9 (8)	6178 (817)	5959 (1151)
	N-	3.1 (0.8)	1.3 (0.2)	471 (109)	646 (59)	62.6 (8)	43 (8)	6713 (853)	5718 (928)
Statistics	CO <sub>2</sub>	ns	P=0,068	ns	P=0,021	ns	P=0,050	ns	ns
	N	ns	P=0,004	ns	ns	P=0,011	ns	ns	ns
	N X CO <sub>2</sub>	ns	ns	ns	ns	ns	ns	ns	ns

Table 1: Plant dry matter production (grams.plant<sup>-1</sup>), microbial C (mg C.Kg<sup>-1</sup>) from adhering soil, <sup>14</sup>C assimilate partitioning (percentage of total radioactivity recovered %TRR) in belowground and total soil C content (0-20cm depth in g.C.m<sup>-2</sup>)

### CONCLUSIONS

It is likely that the lower amounts of rhizodeposited C allocated to the rhizosphere of enriched rings at the autumn sampling result from complex interactions between plant physiology, environment (CO<sub>2</sub>, climate) and management of the plots (N, defoliation).

In spite of a decreased microbial C, mineralisation activity was higher under elevated than ambient CO<sub>2</sub> due to different microbial communities structure and / or composition of rhizodeposits.