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Impact of elevated CO₂ on rhizodeposition of ryegrass grown on FACE soils exposed to CO₂ enrichment

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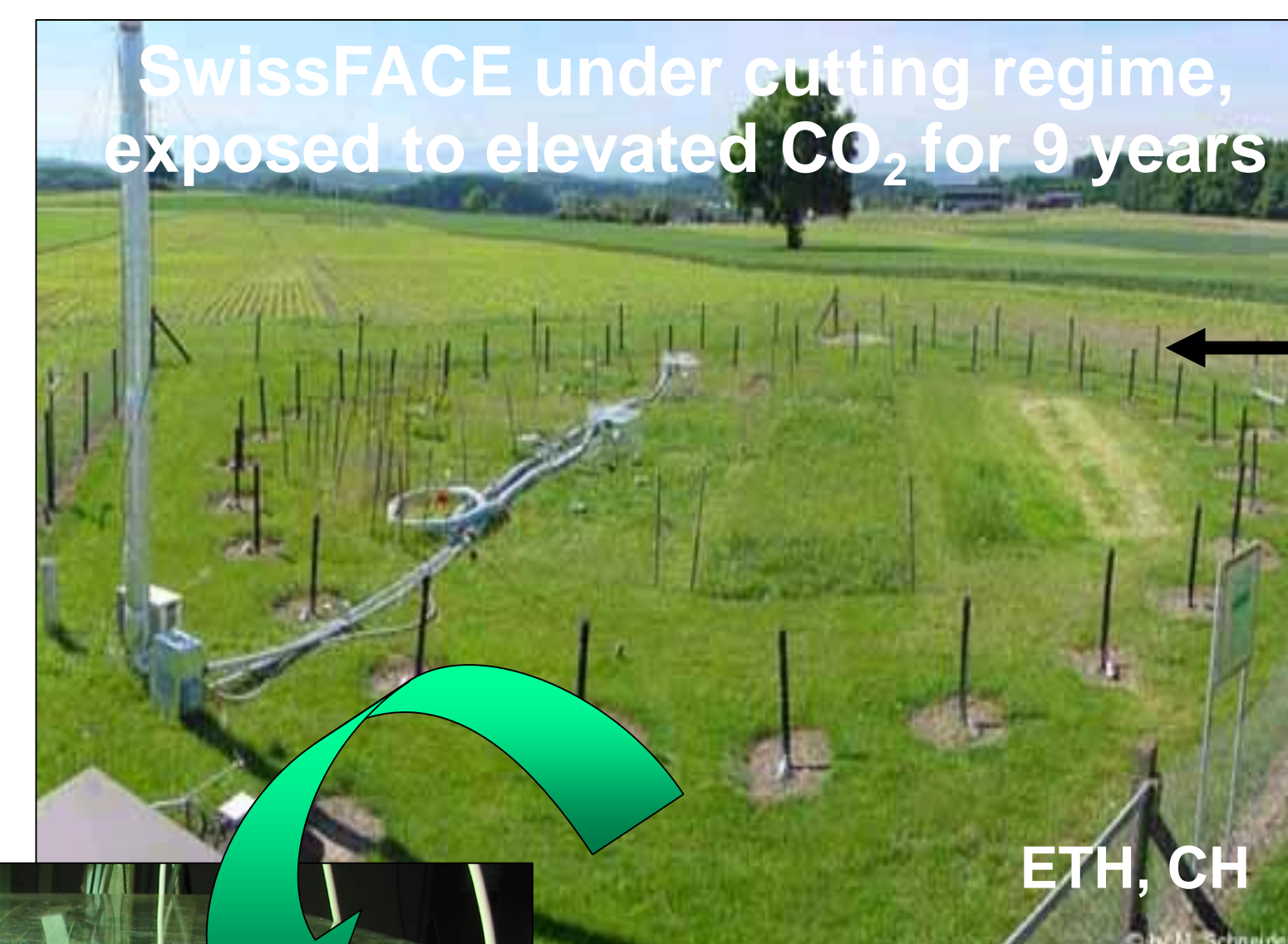
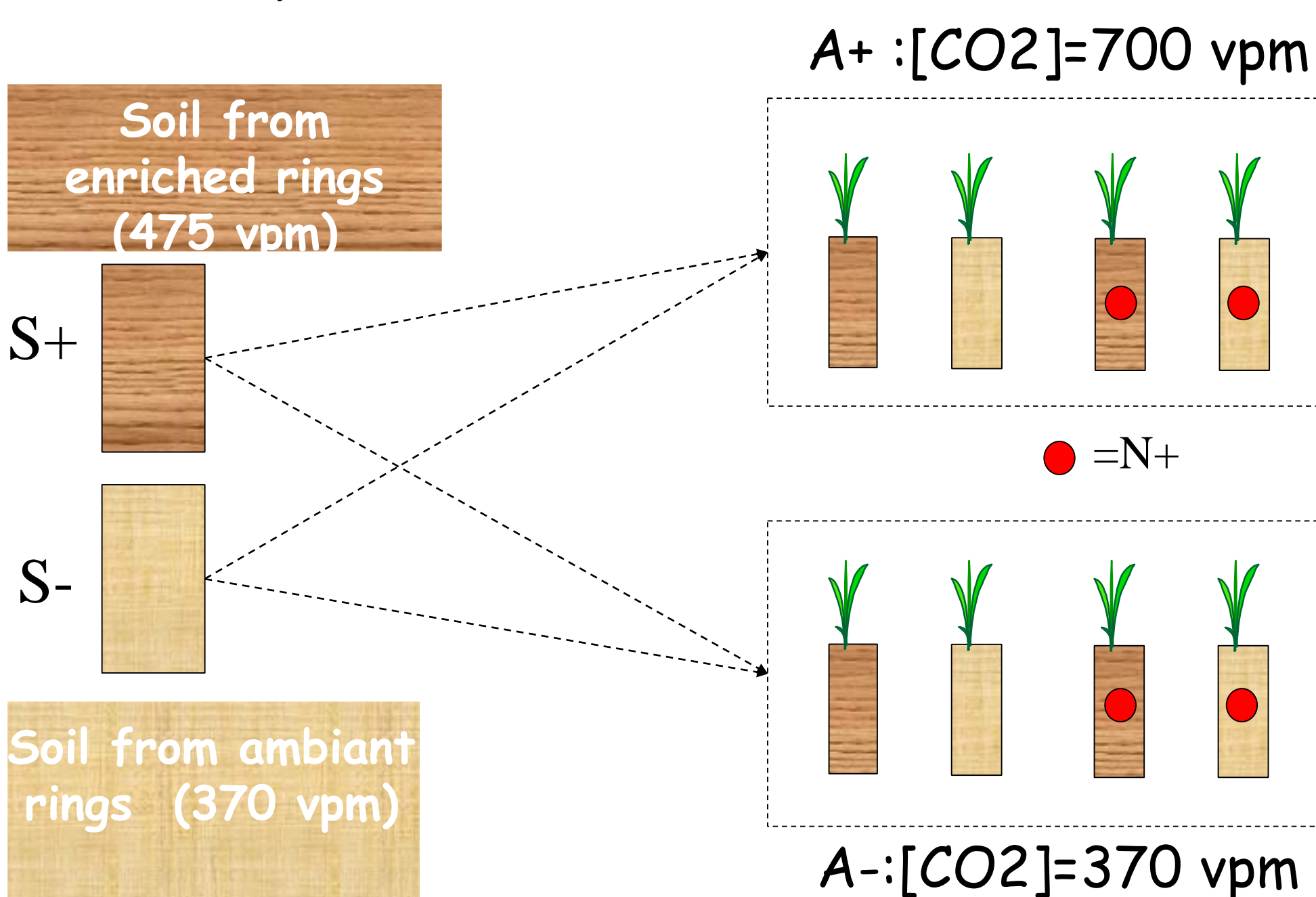
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Objectives

The poster summarizes the main results of two distinct experiments, both aiming to assess the effects of enriched atmospheric CO₂ on carbon partitioning to rhizosphere compartments and to determine the consequences of elevated CO₂ on mineralization activity of soil micro-organisms towards soil organic matter and rhizodeposits.

Methods

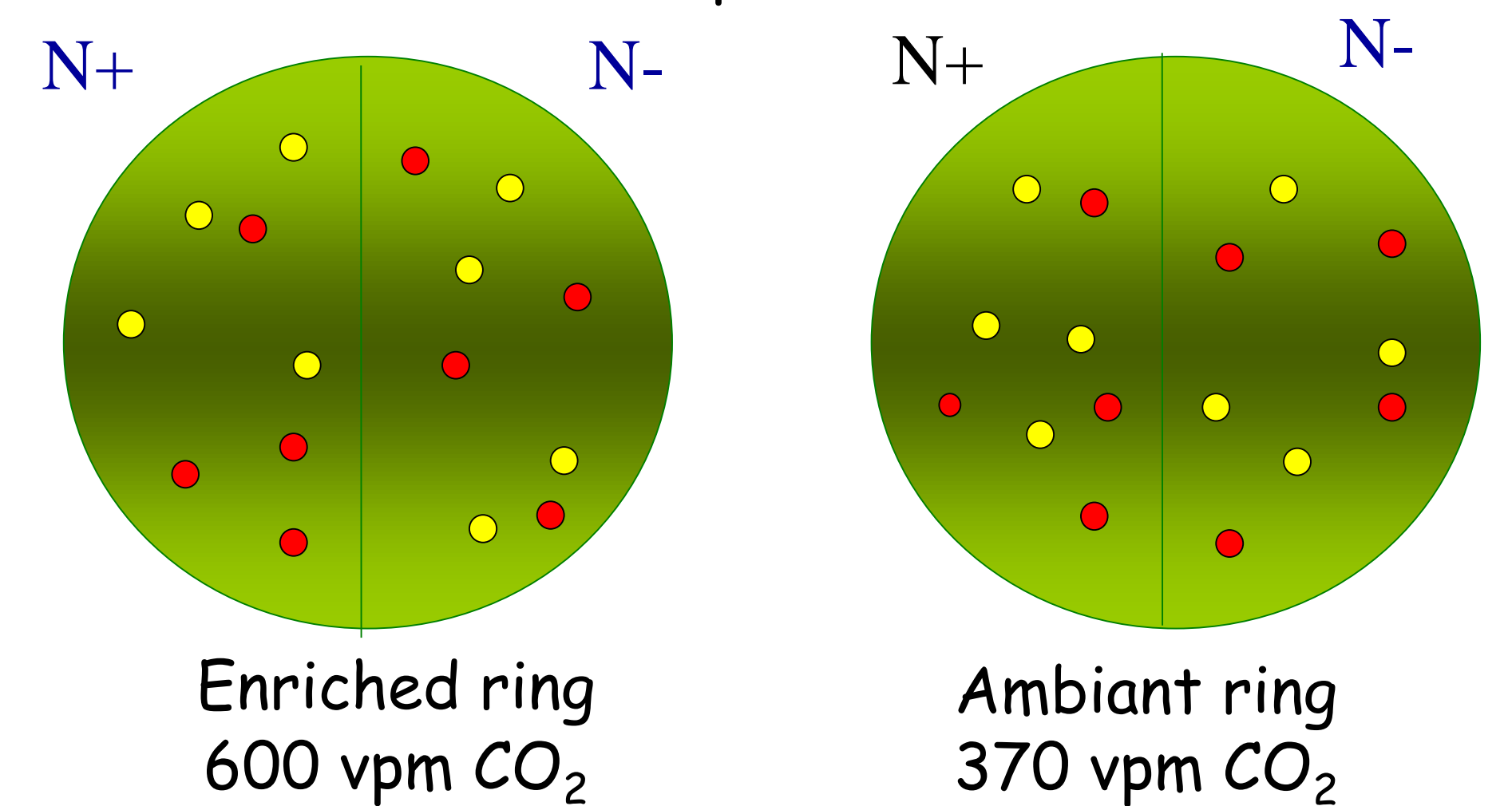
The effects of elevated atmospheric CO₂ on C allocation were evaluated on ryegrass planted on soil monoliths sampled from the New Zealand FACE experiment after 5 years enrichment. Ryegrass and soil monoliths were subjected to elevated CO₂ in a greenhouse for 3 months (Allard et al., 2006)



The effects of elevated atmospheric CO₂ on C allocation were evaluated on ryegrass planted on soil monoliths from the Swiss FACE experiment (9 years enrichment). See Bazot et al. (2006).



● : Monoliths sampled in June
● : Monoliths sampled in September



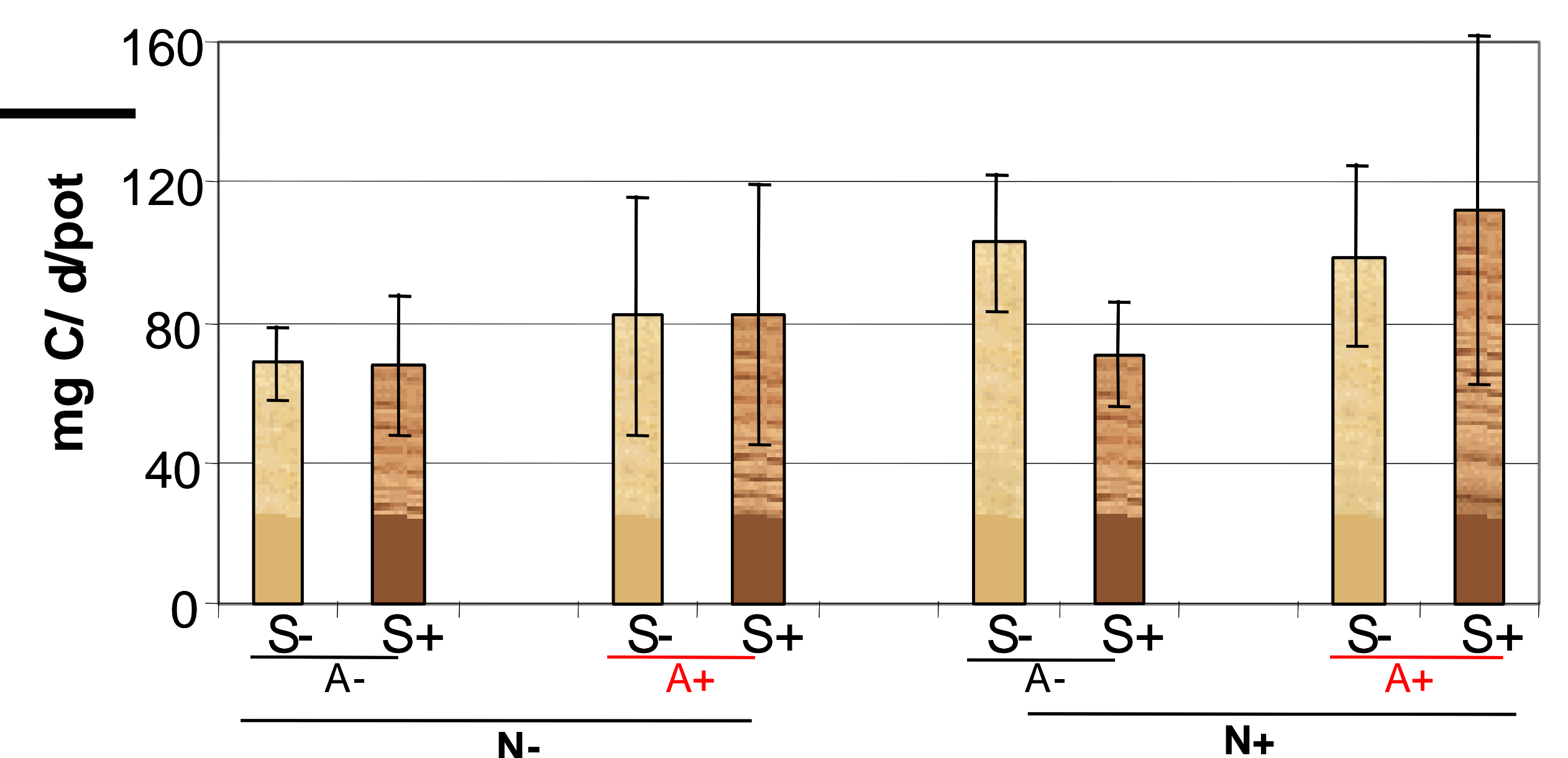
Results

¹⁴C-carbon allocation

Treatment			¹⁴ C (in % of total recovered)			
N	Atm	Soil	Plant	Rhizosph respiration	Soil	MB
N-	A-	S-	85	11	4	0.4
		S+	83	12	5	0.6
	A+	S-	84	11	5	0.7
		S+	80	14	6	0.8
N+	A-	S-	85	12	3	0.3
		S+	85	11	3	0.3
	A+	S-	87	10	3	0.5
		S+	84	11	5	0.6
Treatment effects		N	+	n.s.	**	*
		A	n.s.	n.s.	+	***
		S	n.s.	n.s.	n.s.	+

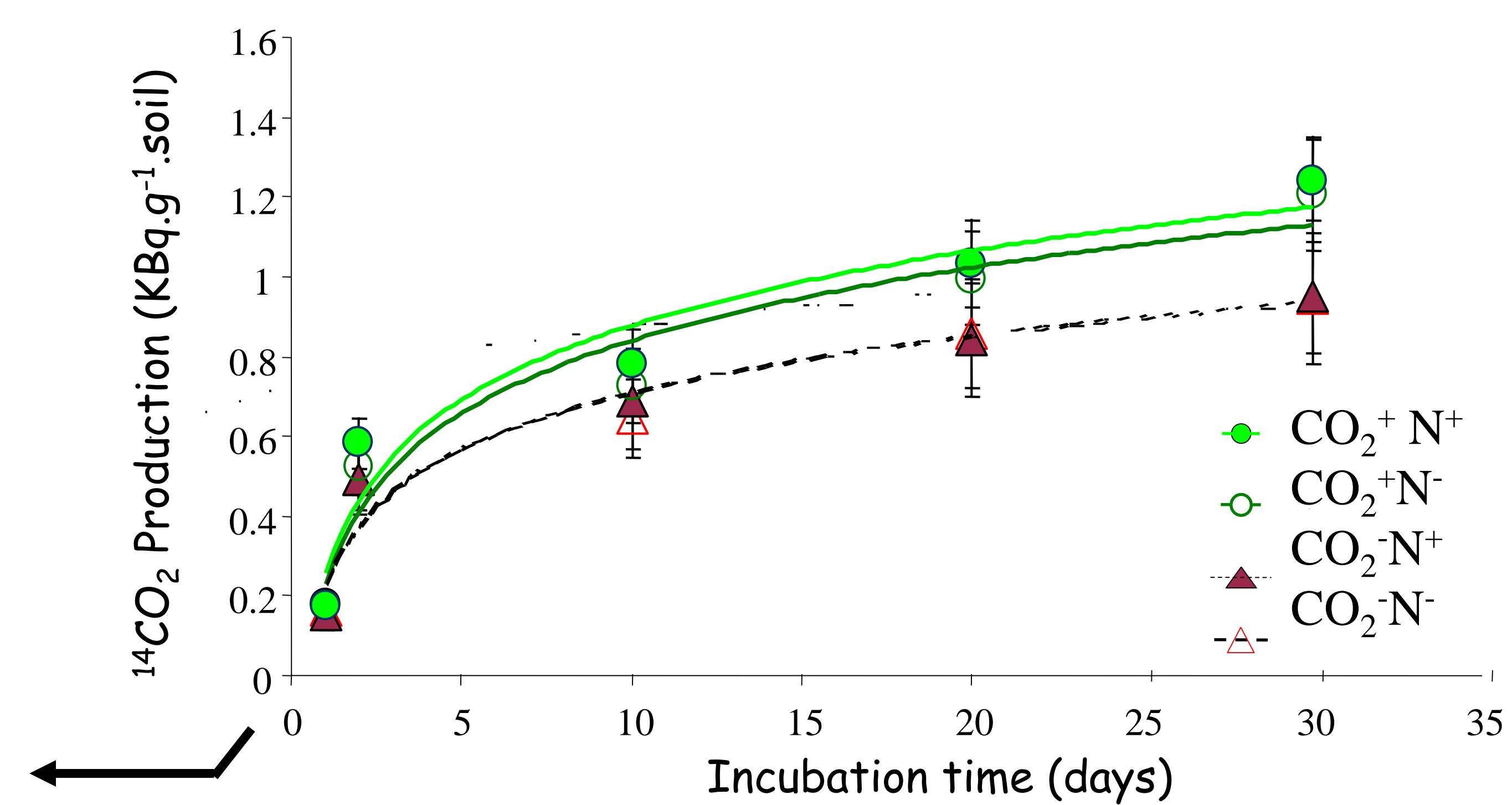
Under elevated CO₂, the belowground respiration was stimulated because the size of the MB was significantly increased (data not shown). This surplus of heterotrophic respiration is provided by the mineralisation the soil organic matter (non labelled), indicating a priming effect of rhizodeposits on SOM.

Belowground Respiration



For the NZ experiment, the C allocation was proportionally increased in the soil and within the microbial biomass (MB) under elevated CO₂, suggesting strongly that rhizodeposition was stimulated.

For the Swiss experiment, C allocation to rhizosphere compartment was not modified by elevated CO₂ at the spring sampling. At the autumn sampling, the C allocation to belowground compartments was depressed (data not shown). Mineralization rates and amounts of ¹⁴C and total C mineralized by MB during the incubation of adhering soil are higher for soils from enriched rings. This result suggests that the MB was more active in the soils from enriched ring and/or the root-released organic compounds (rhizodeposits) were more easily available for degradation by the MB.



Mineralisation of ¹⁴C-organic compounds in the adhering soil (incubated for 30 d.).

Conclusion

The amount of total soil C was not modified after 5 or 9 years of continuous CO₂ atmospheric enrichment of plant canopies. Moreover, when more C is allocated to the soil, the increase in size and activity of the MB stimulates the C mineralization of easy decomposable compounds. The two independent experiments strongly suggest that the rhizodeposition fluxes under elevated CO₂ are context dependent because they are driven by a combination of factors including the management of the plots and pedo-climat.