Role of plants in determining the soil response to either a single freeze-thaw or dry-wet event

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Table 1

Abundance of different soil microbial taxonomic groups (based on PLFA's normalized abundances) in soil at the end of either a single dry-wet cycle or freeze-thaw cycle (-5°C or -10°C). Stars and letters denote significant differences (*, ** and *** indicate $p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$, respectively) when compared with the control treatment. Values represent means ± SEM ($n = 4$).

	With plant									Without plant									Two-way ANOVA
	PControl		PDW		PFT -5		PFT -10			NControl		NDW		NFT -5		NFT -10			Plant effect
AM Fungi	6.74 ±	0.12	6.51 ±	0.21	6.60 ±	0.10	6.21 ±	0.07		4.76 ±	0.15	4.92 ±	0.08	4.66 ±	0.17	4.48 ±	0.24		***
Saprophytic Fungi	1.82 ±	0.04	1.63 ±	0.07	1.65 ±	0.09	**2.17 ±**	**0.10**	*	1.70 ±	0.15	1.57 ±	0.11	1.48 ±	0.04	1.42 ±	0.11		***
Gram Negative	60.9 ±	0.84	61.1 ±	0.48	61.4 ±	0.77	**63.8 ±**	**0.43**	*	54.3 ±	1.29	56.0 ±	0.51	53.8 ±	1.09	52.4 ±	1.78		***
Eukaryote	4.57 ±	0.30	4.06 ±	0.32	3.75 ±	0.19	3.81 ±	0.04		3.42 ±	0.22	3.68 ±	0.19	3.37 ±	0.32	2.97 ±	0.25		***
Gram Positive	50.1 ±	0.96	51.1 ±	0.37	50.1 ±	0.80	51.3 ±	0.40		47.8 ±	1.03	49.0 ±	0.40	46.9 ±	0.92	45.6 ±	1.37		***
Actinomycetes	19.2 ±	0.32	19.4 ±	0.19	19.6 ±	0.17	19.7 ±	0.13		18.4 ±	0.31	18.8 ±	0.28	18.1 ±	0.30	17.5 ±	0.41		***
all	143 ±	2.37	144 ±	1.50	143 ±	1.99	147 ±	0.89		130 ±	3.00	134 ±	1.42	128 ±	2.68	124 ±	4.10		***

Stars next to mean values represent significant difference of the values compared to control

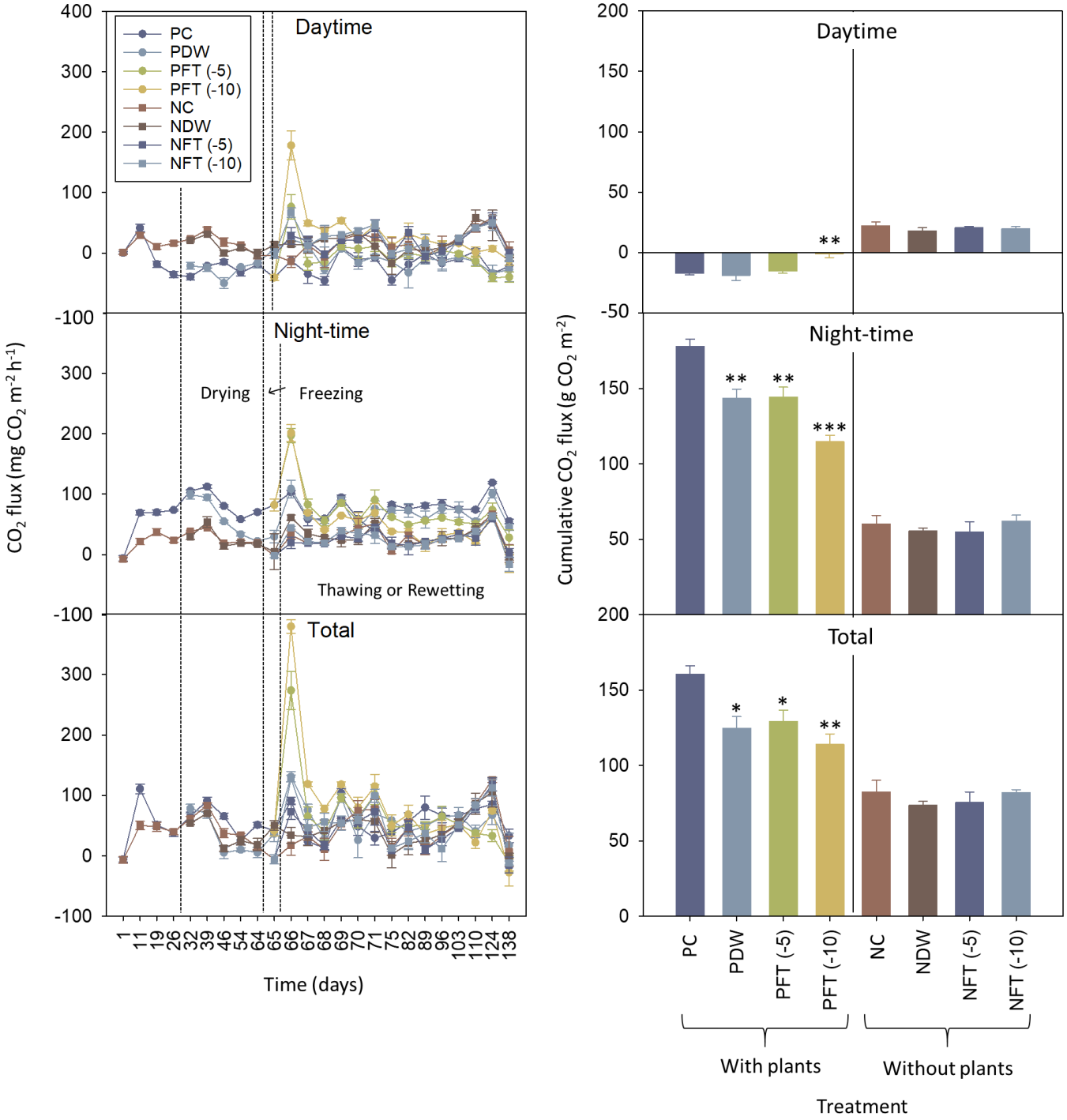

Fig. 1. CO_2 flux (left) and cumulative CO_2 flux (right) from soil expressed as daytime (8 h light condition), night-time (16 h dark condition), and total (24 h combined) before and after a single freeze-thaw (-5°C or -10°C) or dry-wet event. Stars above the plots denote significant differences from the control, where *, ** and *** denote $p \leq 0.05$, $p \leq 0.01$, and $p \leq 0.001$, respectively. Values represent means ± SEM (n = 16 for pre-treatments, n = 12 for pre-freeze-thaw treatments and n = 4 during drying and after thawing or rewetting). PC = Control with plants (+10°C), PDW = Dry-wet with plants, PFT (-5) = Freeze-thaw (-5°C/+10°C) with plants, PFT (-10) = Freeze-thaw (-10°C/+10°C) with plants, NC = Control without plants (+10°C), NDW = Dry-wet without plants (+10°C), NFT (-5) = Freeze-thaw (-5°C/+10°C) without plants, NFT (-10) = Freeze-thaw (-10°C/+10°C) without plants.

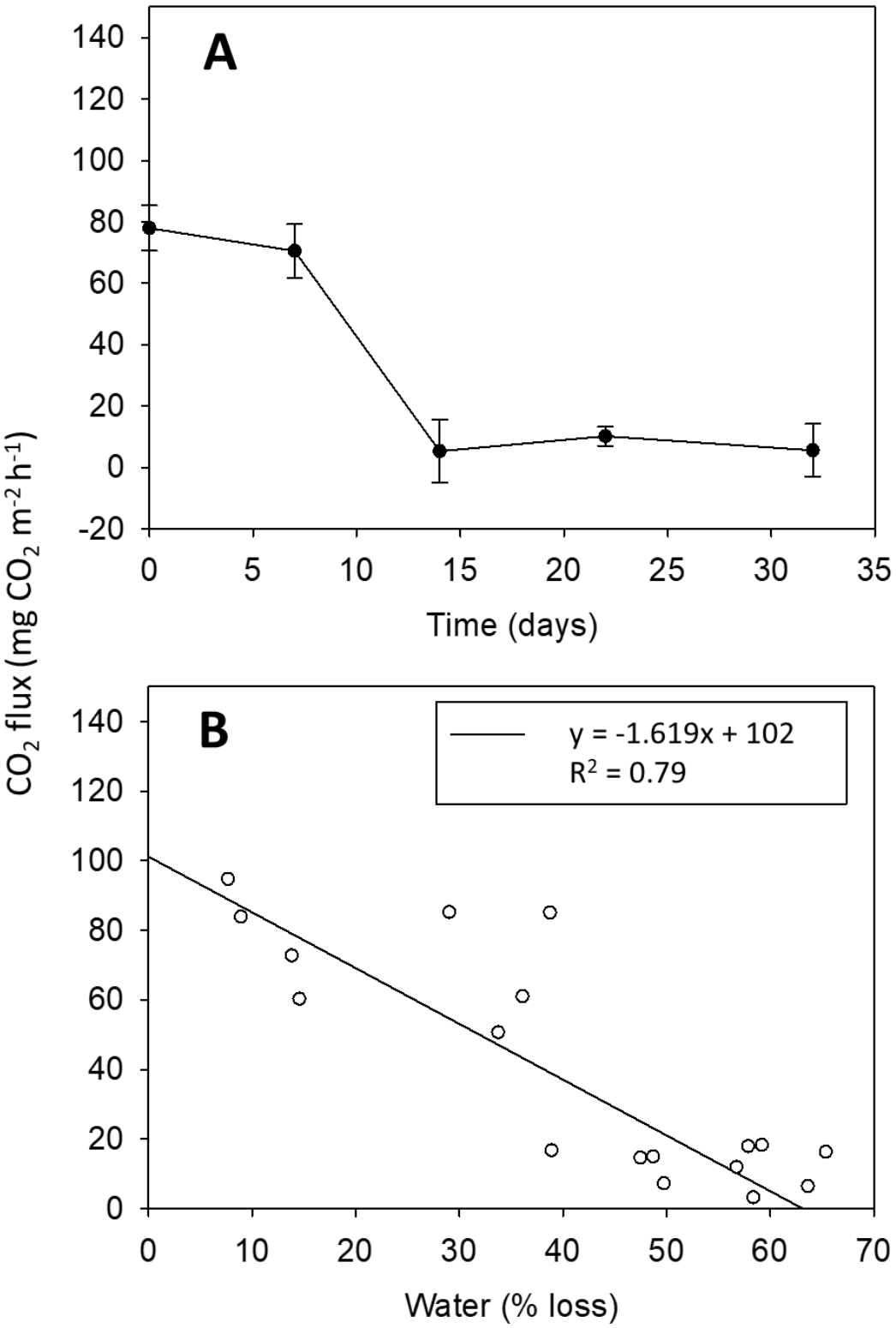

Fig. 2. Effect of drought on total CO_2 flux. (A) Total CO_2 flux from planted soil during the drought period, (B) Relationship between total CO_2 flux and water loss in the planted soil (Pearson's product-moment correlation. In Panel A, values represent means ± SEM (n = 4).

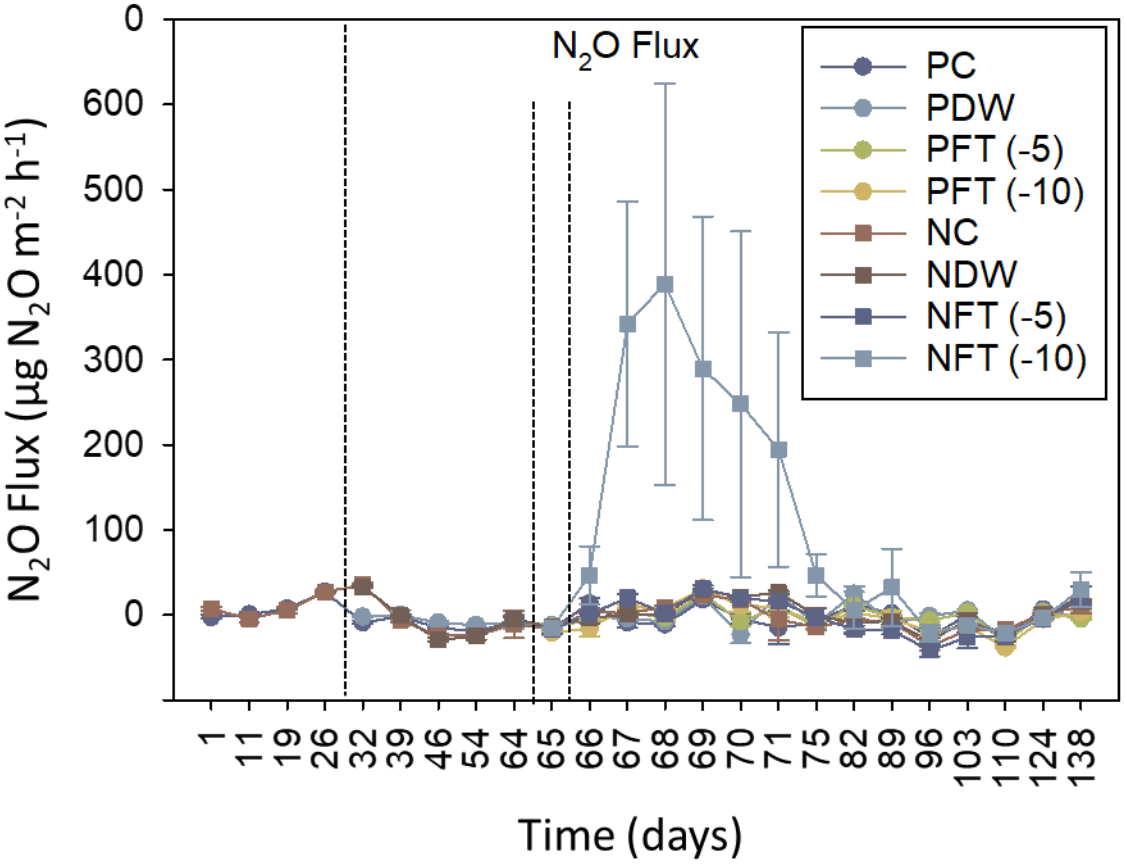

Fig. 3. N_2O flux from soil chemistry before and after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. Values represent means ± SEM (n = 16 for pre-treatments, n = 12 for pre-freeze-thaw treatments and n = 4 during drying and after thawing or rewetting). PC = Control with plants (+10°C), PDW = Dry-wet with plants, PFT (-5) = Freeze-thaw (-5°C/+10°C) with plants, PFT (-10) = Freeze-thaw (-10°C/+10°C) with plants, NC = Control without plants (+10°C), NDW = Dry-wet without plants (+10°C), NFT (-5) = Freeze-thaw (-5°C/+10°C) without plants, NFT (-10) = Freeze-thaw (-10°C/+10°C) without plants.

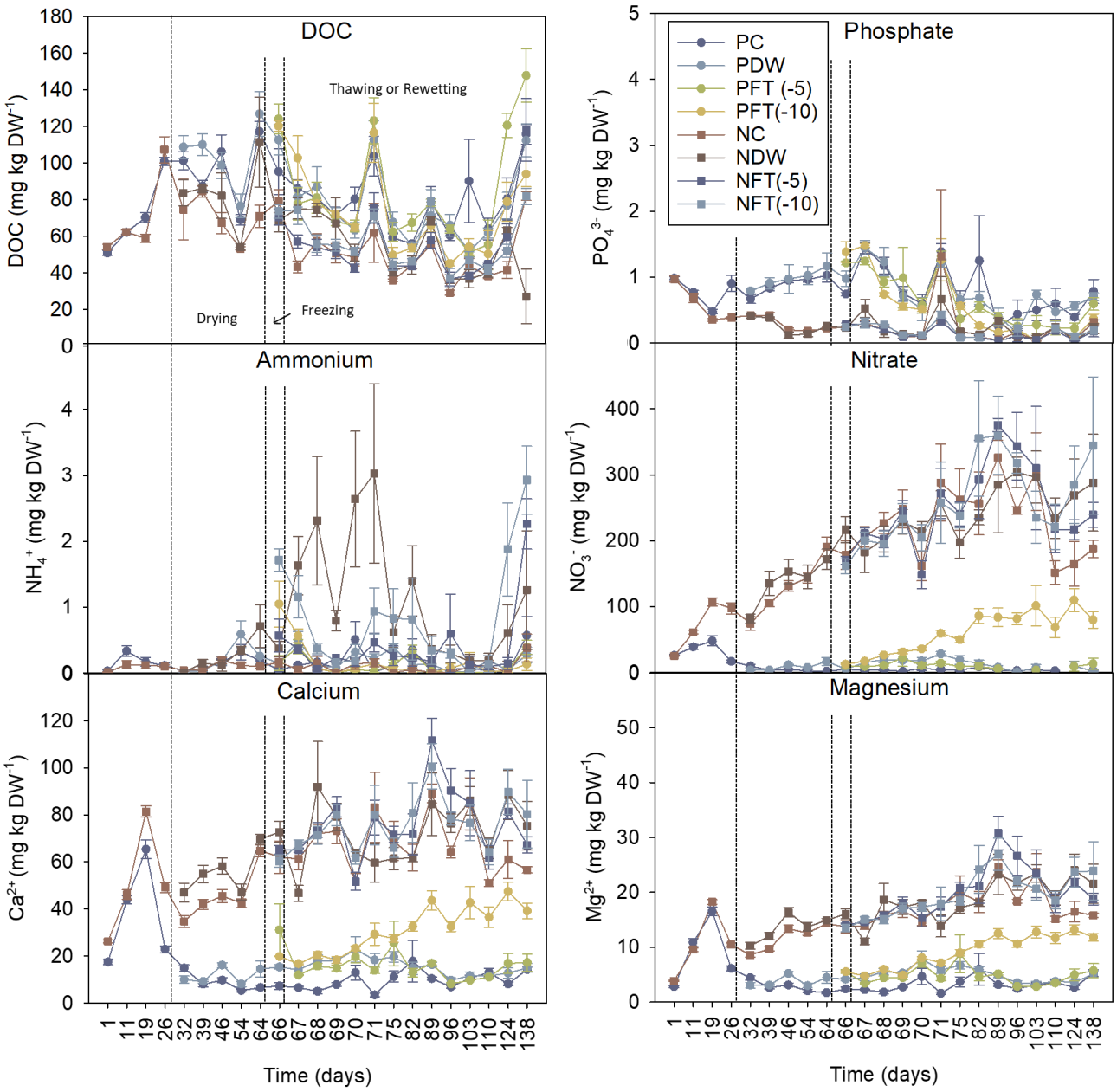

Fig. 4. Soil solute concentrations before and after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. Values represent means ± SEM (n = 16 for pre-treatments, n = 12 for pre-freeze-thaw treatments and n = 4 during drying and after thawing or rewetting). PC = Control with plants (+10°C), PDW = Dry-wet with plants, PFT (-5) = Freeze-thaw (-5°C/+10°C) with plants, PFT (-10) = Freeze-thaw (-10°C/+10°C) with plants, NC = Control without plants (+10°C), NDW = Dry-wet without plants (+10°C), NFT (-5) = Freeze-thaw (-5°C/+10°C) without plants, NFT (-10) = Freeze-thaw (-10°C/+10°C) without plants.

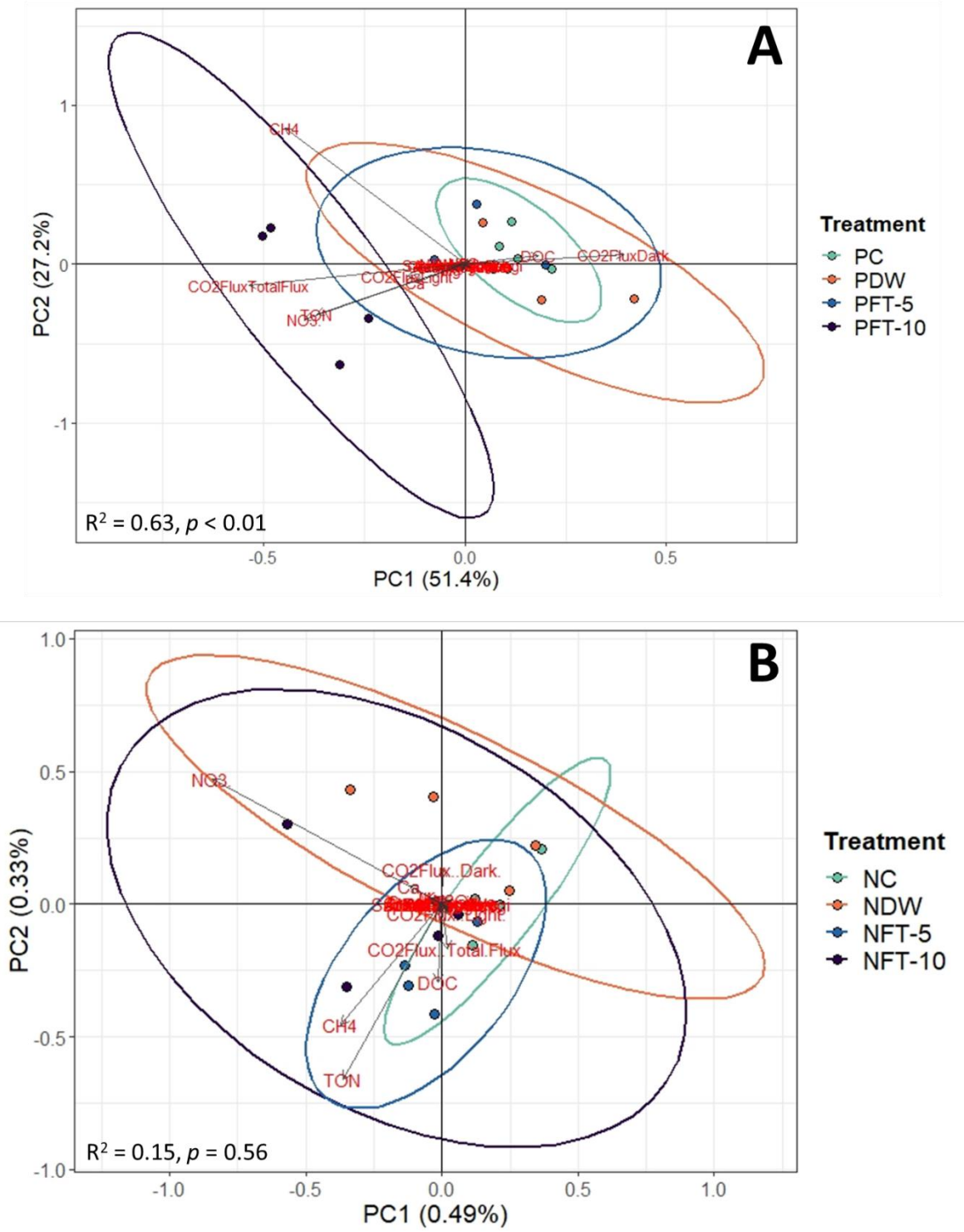

Fig. 5. Principal component analysis of abundance of different soil microbial taxonomic groups (PLFAs) at the end of the experiment after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. A: Planted treatments and B: non-plant treatments. Ellipses delineate a 95% confidence interval. Values represent means ± SEM (n = 4). PC = Control with plants (+10°C), PDW = Dry-wet with plants, PFT (-5) = Freeze-thaw (-5°C/+10°C) with plants, PFT (-10) = Freeze-thaw (-10°C/+10°C) with plants, NC = Control without plants (+10°C), NDW = Dry-wet without plants (+10°C), NFT (-5) = Freeze-thaw (-5°C/+10°C) without plants, NFT (-10) = Freeze-thaw (-10°C/+10°C) without plants. DOC (Dissolved Organic Carbon), CH_4 flux and N_2O flux are clustered around the centre point so are partially obscured from view.