



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 \pm 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 \pm	0.12	6.51 \pm	0.21	6.60 \pm	0.10	6.21 \pm	0.07	4.76 \pm	0.15	4.92 \pm	0.08	4.66 \pm	0.17	4.48 \pm	0.24	***
Saprophytic Fungi	1.82 \pm	0.04	1.63 \pm	0.07	1.65 \pm	0.09	2.17 \pm	0.10 *	1.70 \pm	0.15	1.57 \pm	0.11	1.48 \pm	0.04	1.42 \pm	0.11	***
Gram Negative	60.9 \pm	0.84	61.1 \pm	0.48	61.4 \pm	0.77	63.8 \pm	0.43 *	54.3 \pm	1.29	56.0 \pm	0.51	53.8 \pm	1.09	52.4 \pm	1.78	***
Eukaryote	4.57 \pm	0.30	4.06 \pm	0.32	3.75 \pm	0.19	3.81 \pm	0.04	3.42 \pm	0.22	3.68 \pm	0.19	3.37 \pm	0.32	2.97 \pm	0.25	***
Gram Positive	50.1 \pm	0.96	51.1 \pm	0.37	50.1 \pm	0.80	51.3 \pm	0.40	47.8 \pm	1.03	49.0 \pm	0.40	46.9 \pm	0.92	45.6 \pm	1.37	***
Actinomycetes	19.2 \pm	0.32	19.4 \pm	0.19	19.6 \pm	0.17	19.7 \pm	0.13	18.4 \pm	0.31	18.8 \pm	0.28	18.1 \pm	0.30	17.5 \pm	0.41	***
all	143 \pm	2.37	144 \pm	1.50	143 \pm	1.99	147 \pm	0.89	130 \pm	3.00	134 \pm	1.42	128 \pm	2.68	124 \pm	4.10	***

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

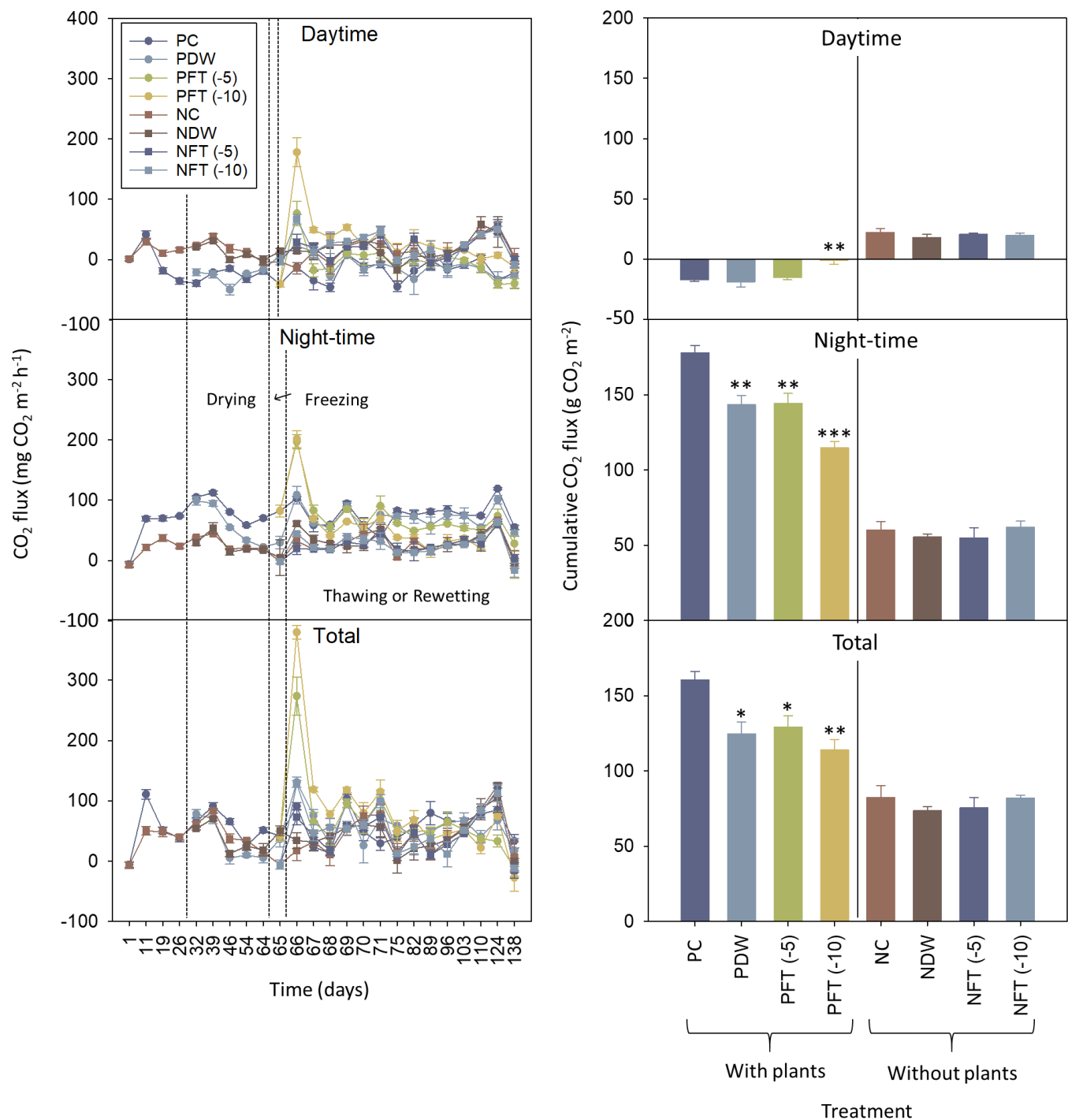


Fig. 1. CO₂ flux (left) and cumulative CO₂ flux (right) from soil expressed as daytime (8 h light condition), night-time (16 h dark condition), and total (24 h combined) before and after a single freeze-thaw (-5°C or -10°C) or dry-wet event. Stars above the plots denote significant differences from the control, where *, ** and *** denote $p \leq 0.05$, $p \leq 0.01$, and $p \leq 0.001$, respectively. Values represent means \pm 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.

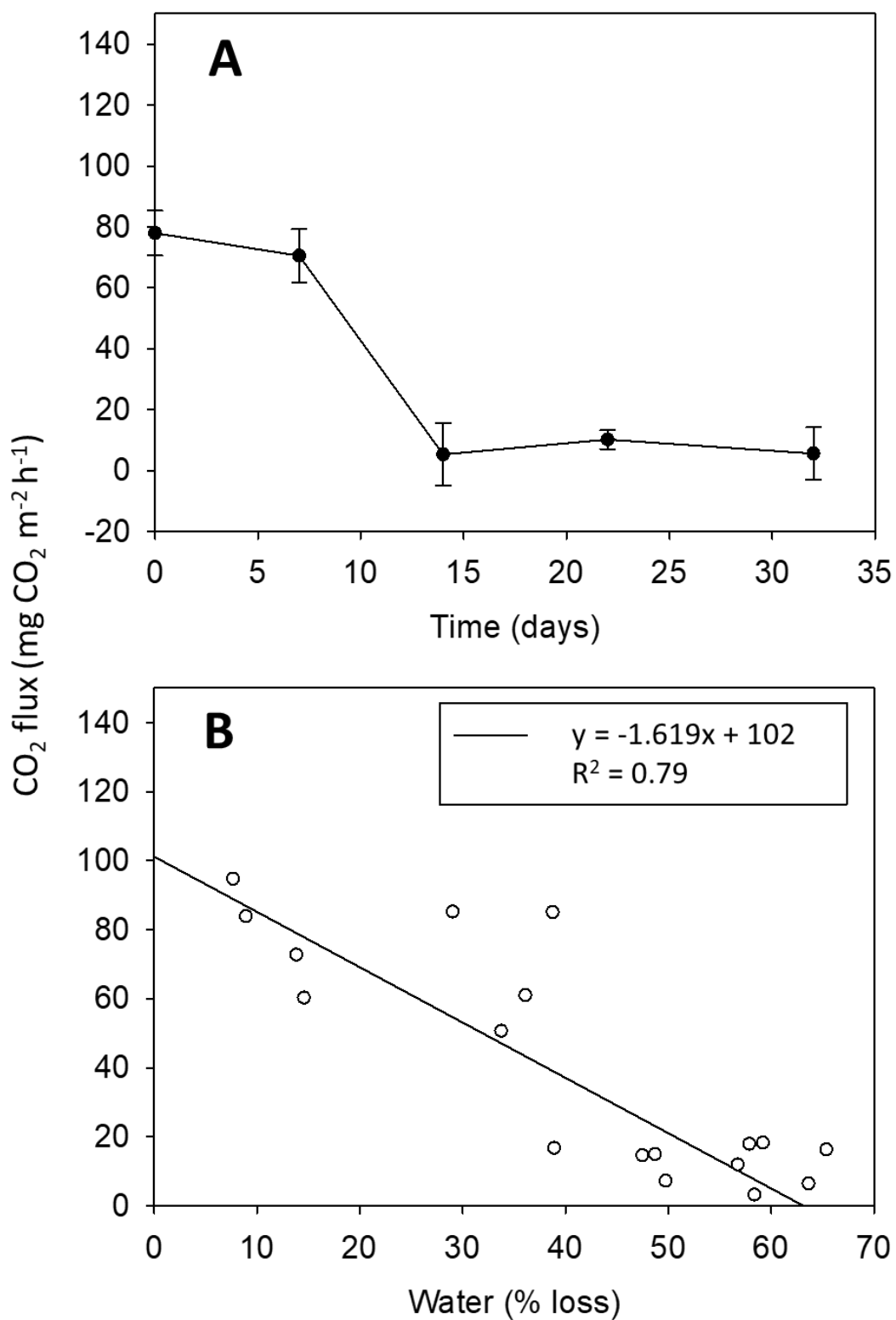


Fig. 2. Effect of drought on total CO₂ flux. (A) Total CO₂ flux from planted soil during the drought period, (B) Relationship between total CO₂ flux and water loss in the planted soil (Pearson's product-moment correlation. In Panel A, values represent means \pm SEM ($n = 4$).

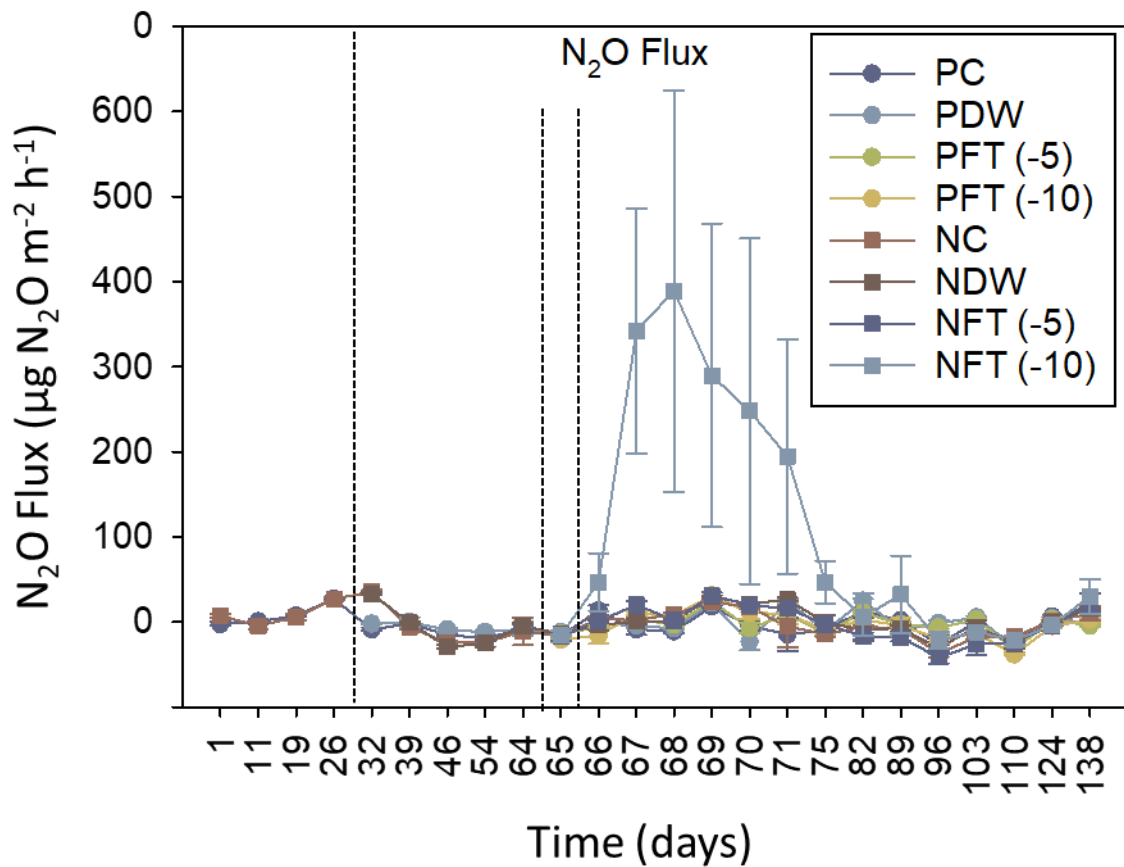


Fig. 3. N₂O flux from soil chemistry before and after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. Values represent means ± SEM ($n = 16$ for pre-treatments, $n = 12$ for pre-freeze-thaw treatments and $n = 4$ during drying and after thawing 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.

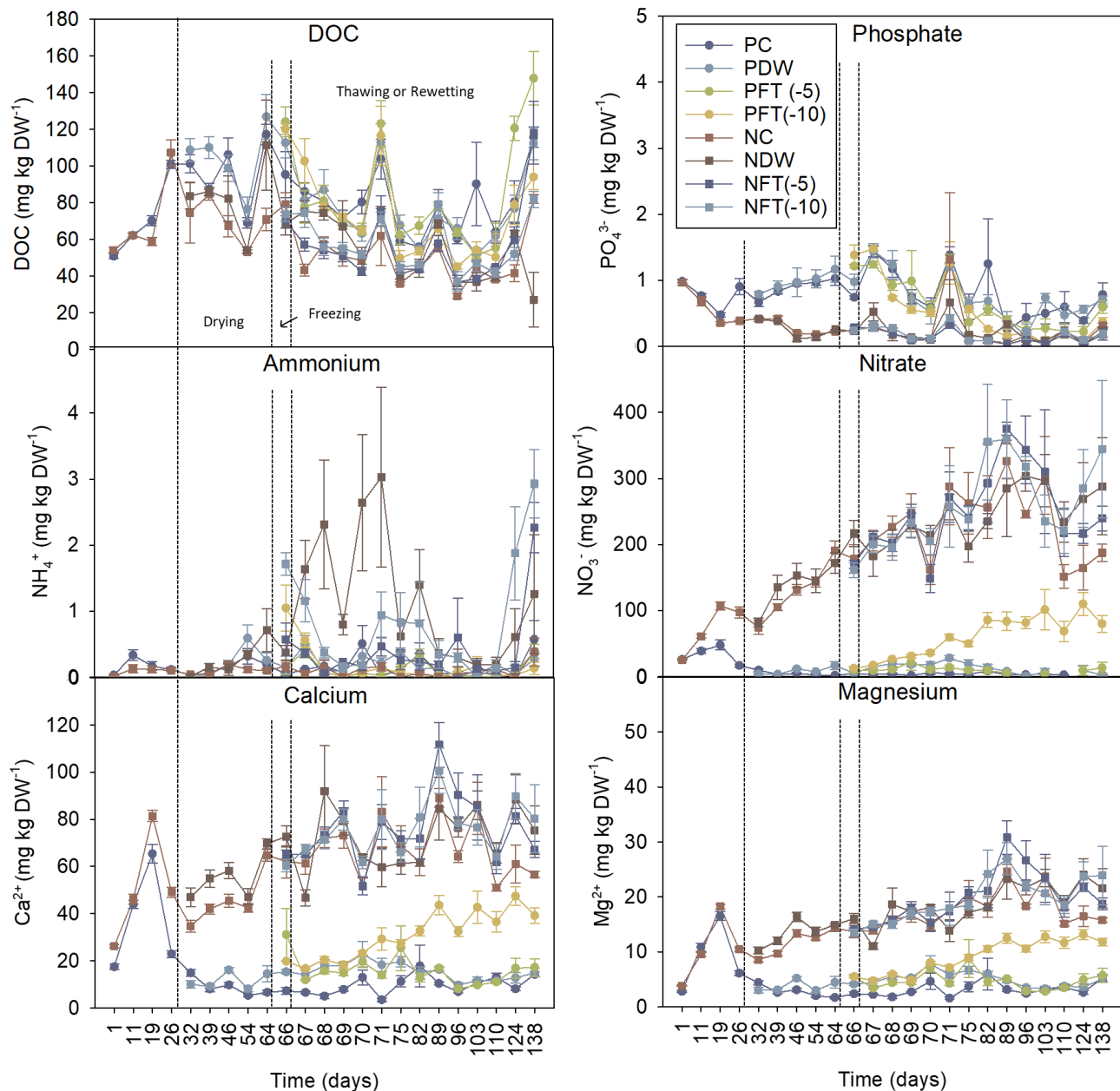


Fig. 4. Soil solute concentrations before and after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. Values represent means \pm SEM ($n = 16$ for pre-treatments, $n = 12$ for pre-freeze-thaw treatments and $n = 4$ during drying and after thawing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

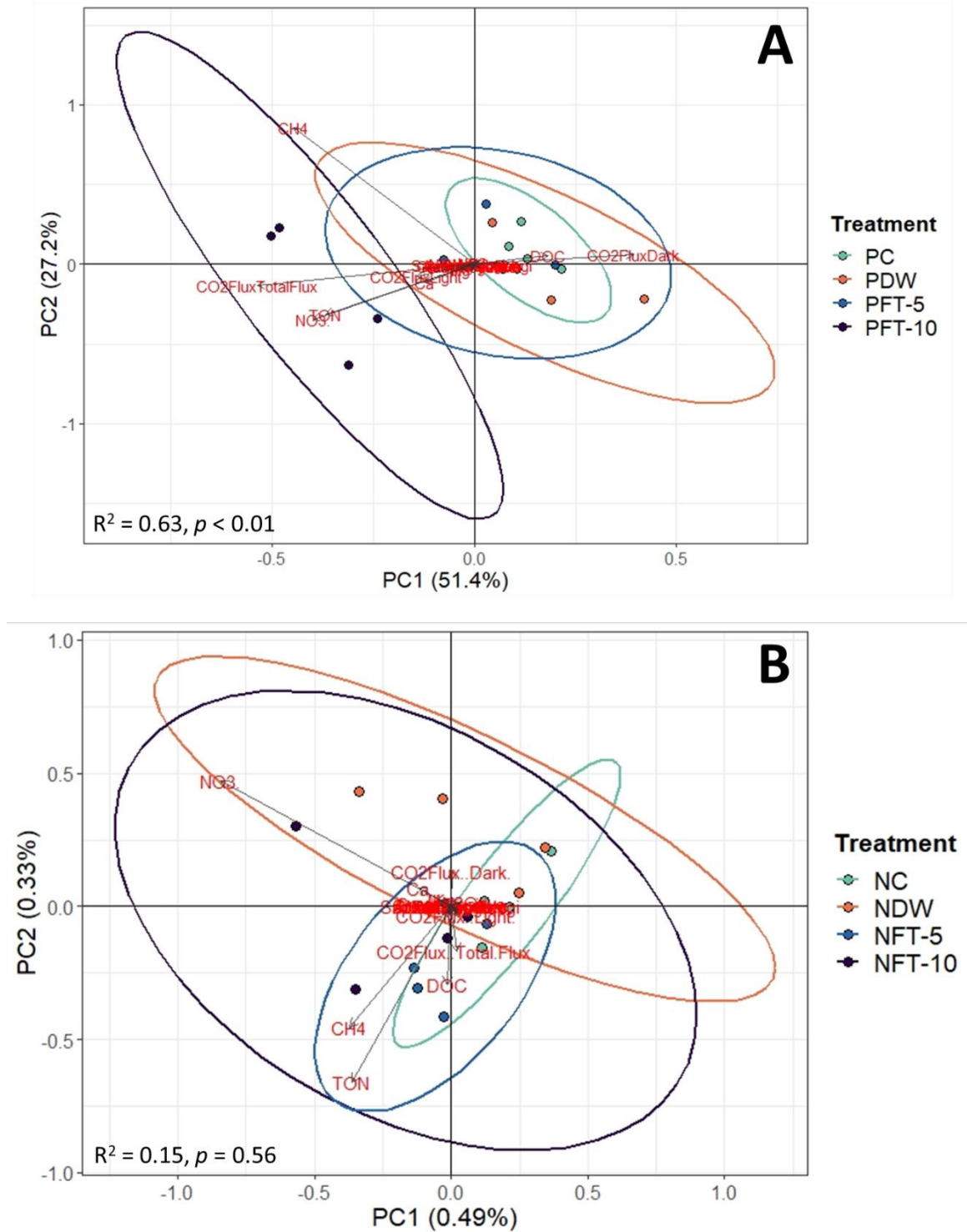


Fig. 5. Principal component analysis of abundance of different soil microbial taxonomic groups (PLFAs) at the end of the experiment after applying a single freeze-thaw (-5°C or -10°C) or dry-wet treatment in either planted or unplanted soil. A: Planted treatments and B: non-plant treatments. Ellipses delineate a 95% confidence interval. Values represent means \pm SEM ($n = 4$). PC = Control with plants ($+10^{\circ}\text{C}$), PDW = Dry-wet with plants, PFT (-5) = Freeze-thaw ($-5^{\circ}\text{C}/+10^{\circ}\text{C}$) with plants, PFT (-10) = Freeze-thaw ($-10^{\circ}\text{C}/+10^{\circ}\text{C}$) with plants, NC = Control without plants ($+10^{\circ}\text{C}$), NDW = Dry-wet without plants ($+10^{\circ}\text{C}$), NFT (-5) = Freeze-thaw ($-5^{\circ}\text{C}/+10^{\circ}\text{C}$) without plants, NFT (-10) = Freeze-thaw ($-10^{\circ}\text{C}/+10^{\circ}\text{C}$) 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.