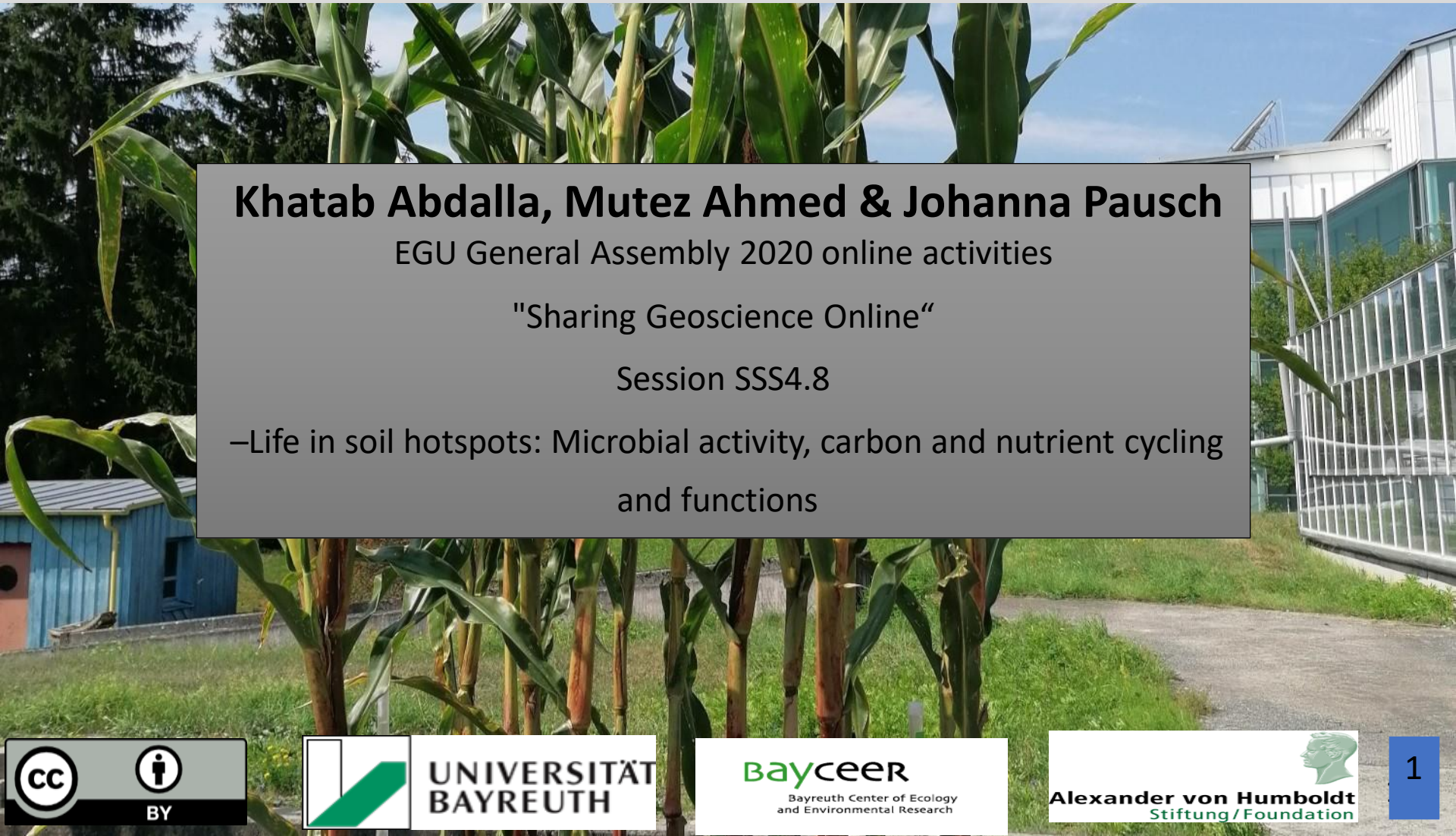
Does rhizosphere priming effect explain the greater soil respiration in well-watered and drought-stressed maize?



Khatab Abdalla, Mutez Ahmed & Johanna Pausch

EGU General Assembly 2020 online activities

"Sharing Geoscience Online“

Session SSS4.8

–Life in soil hotspots: Microbial activity, carbon and nutrient cycling and functions

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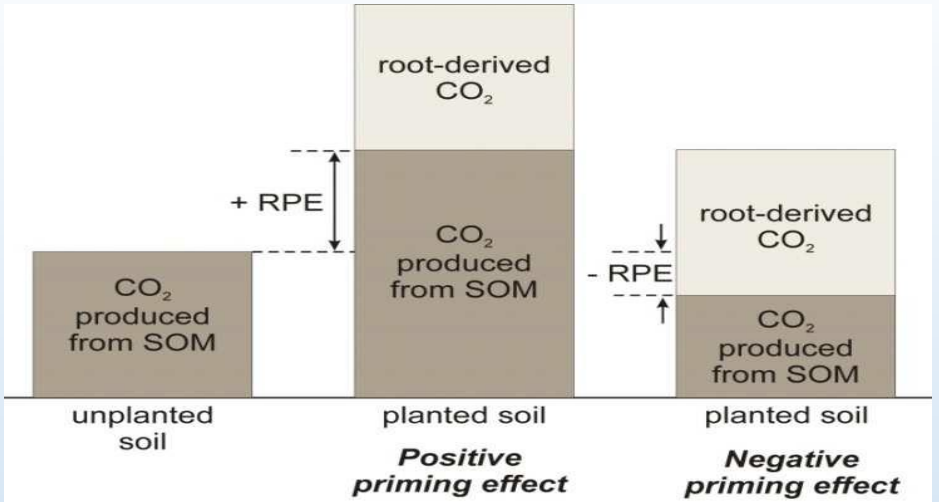
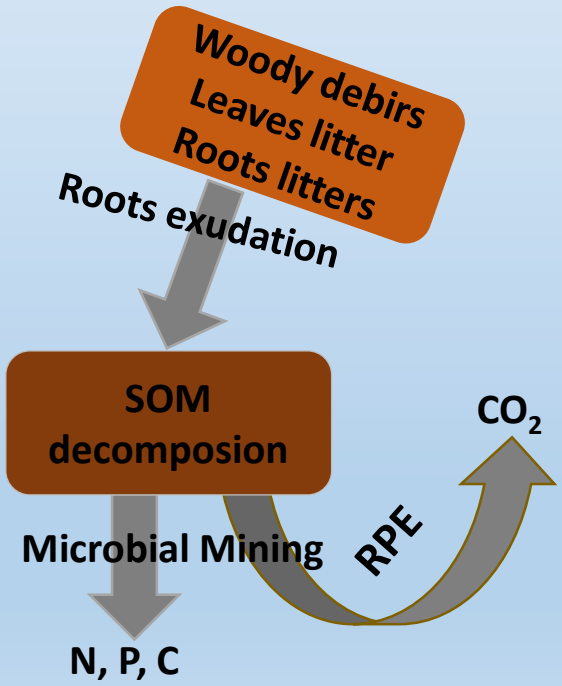
Background;

❖ What is the Rihzosphere priming effects (RPEs)?

- RPEs are changes in the rate of SOM decomposition (SOM-derived CO_2) in the presence of living roots (Kuzyakov et al., 2000).



Kuzyakov et al., (2000)



❖ Research hypothesis;

- it's well accepted that soil moisture directly affects microbial activity, whereas, drought stress was recently postulated to increase root exudates, which in turn will accelerate SOM mineralization "priming effects".

❖ Research Objective;

- To investigate the interplay between soil moisture (well-watered and drought stressed) and maize (*Zea mays* L.) root exudates on soil CO_2 efflux.

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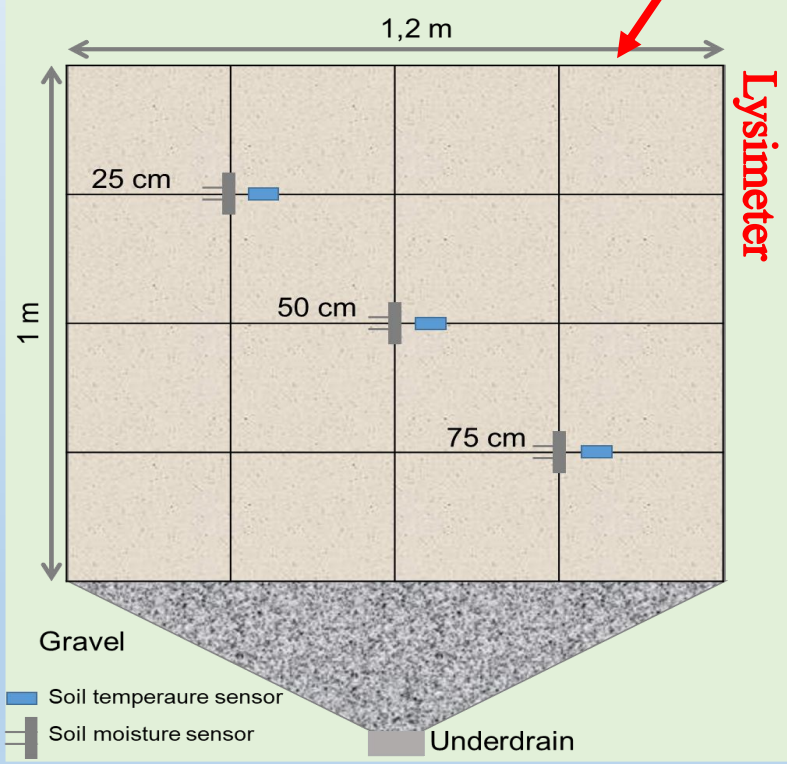
- Three treatments; well-watered, drought-stressed maize plus a control.
- Drip irrigation systems to adjusted water flow based on the treatments.
- Soil CO_2 efflux, soil temperature and moisture content measured twice and once a month for growing season and fallow period, respectively.



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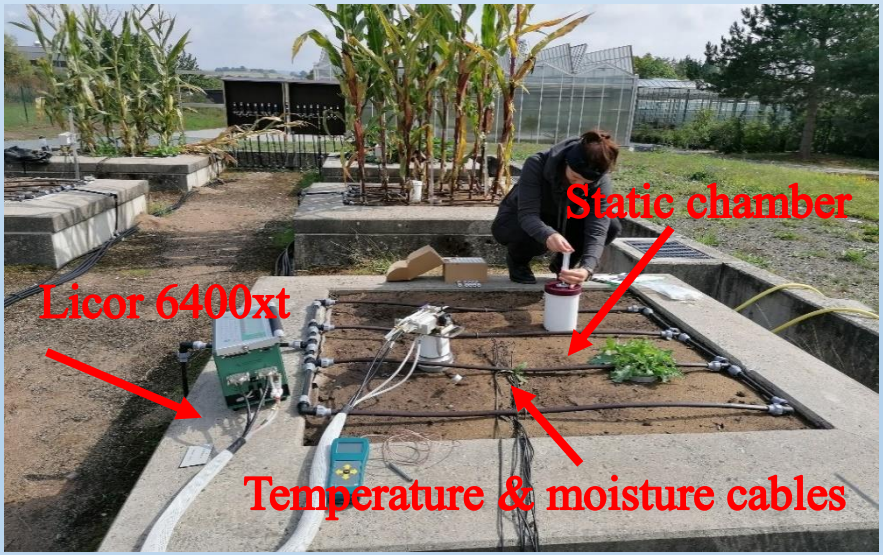
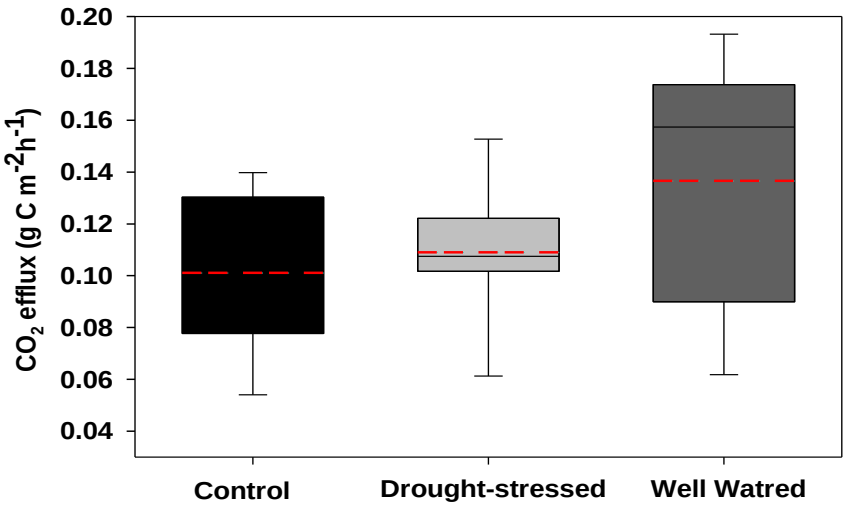
- CO_2 emissions were continuously measured twice a month in wet seasons and once a month in the dry season using LICOR 6400xt.
- CO_2 Conc for carbon isotopes were sampled using the static chamber.
- Soil temperature and soil moisture measured continuously at 10, 25, 50 and 75 cm depth.



Results;



- Greatest CO_2 effluxes variations under well-watered treatment.
- Overall average, CO_2 efflux was significantly greater in well-watered by 24.4 and 20% than the drought-stressed and the control, respectively.
- Lower 25th and 75th range being observed in drought-stressed treatment.

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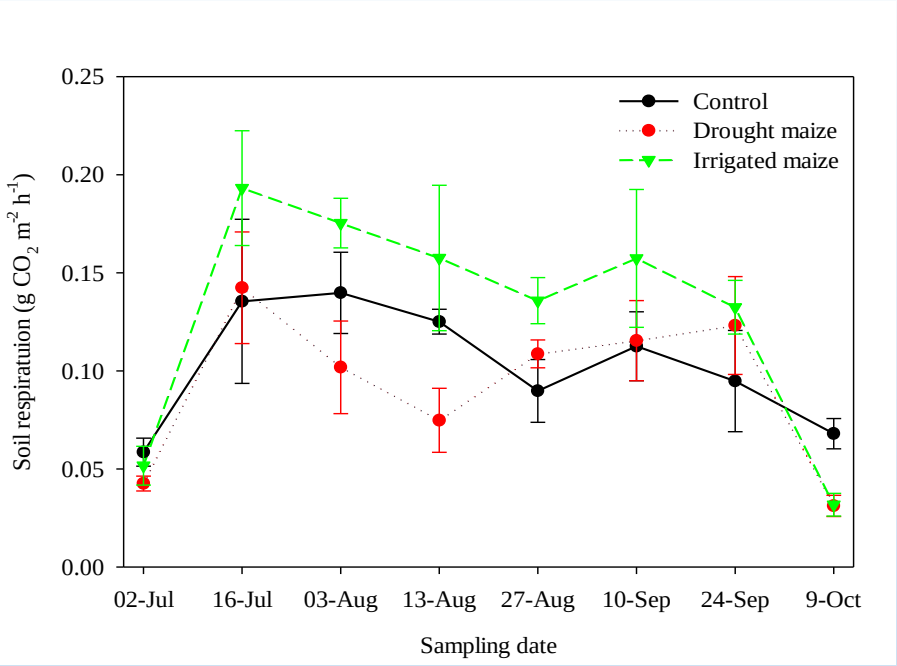

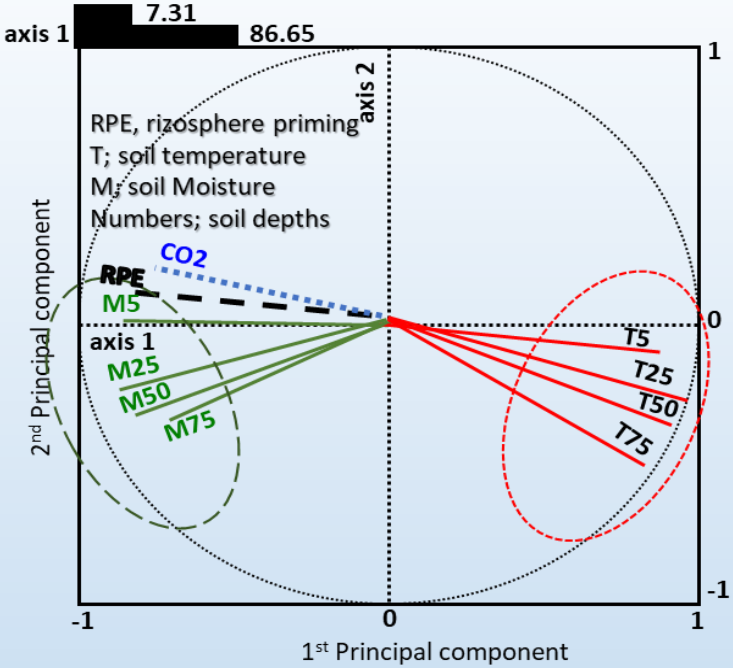

- CO_2 efflux, changed greatly over time, with high variations between the treatments in the rainy season.
- CO_2 effluxes were significantly greater in 5 events in well-watered compared to drought-stressed and the control.
- CO_2 efflux decreased with soil temperature and increased with soil moisture content.

- CO_2 efflux correlated positively to soil moisture and negatively to soil temperature.
- The strongest correlations were found at the top-soil and then decreased with the soil depth.
- Rhizosphere priming effect (RPE) seems to be the strongest factor controlling CO_2 efflux in the optimum soil conditions.

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Discussion and conclusion;

- Changes in soil CO_2 effluxes over time were attributed to the changes in soil microclimate, particularly the changes in soil temperature and moisture content.
- Optimum soil moisture in well-watered treatment enhanced maize growth, thus alter soil microorganism leading to high rhizosphere priming effect compared to the other treatments.
- The higher rhizosphere priming effect explained the greatest CO_2 efflux under well-watered treatment in comparison to the drought-stressed and the control.
- Greater soil microbial biomass carbon and nitrogen in well-watered treatment than drought-stressed and the control observed in the top-soil (data not shown).
- More factors such as soil factors i.e. C and N content, microbial biomass and activities and soil below and above-ground biomass will be included in later stages to confirm this preliminary findings.