TropSOC Database

3.4.1. Cropland – Soil experiments – Incubation experiments

When using these data, please cite the database and the key publication in ESSD:

Doetterl, S.; Bukombe, B.; Cooper, M.; Kidinda, L.; Muhindo, D.; Reichenbach, M.; Stegmann, A.; Summerauer, L.; Wilken, F.; Fiener, P. (2021): TropSOC Database. V. 1.0. GFZ Data Services.
https://doi.org/10.5880/fidgeo.2021.009

Doetterl S., Asifiwe R.K., Baert G., Bamba F., Bauters M., Boeckx P., Bukombe B., Cadisch G., Cizungu L.N., Cooper M., Hoyt A., Kabaseke C., Kalbitz K., Kidinda L., Maier A., Mainka M., Mayrock J., Muhindo D., Mujinya B.B., Mukotanyi, S.M., Nabahungu L., Reichenbach M., Rewald B., Six J., Stegmann A., Summerauer L., Unseld R., Vanlauwe B., Van Oost K., Verheyen K. Vogel C., Wilken F., Fiener P. Organic matter cycling along geochemical, geomorphic and disturbance gradients in forests and cropland of the African Tropics - Project TropSOC Database Version 1.0. *Earth System Science Data*. https://doi.org/10.5194/essd-2021-73, 2021.

Introduction

The data set comprises a unique sample identifier and 7 additional variables that provide information regarding soil incubations conducted for selected TropSOC tropical cropland soils. Missing data is indicated by -9999.

Data structure

No.	Variable	Explanation	Unit
1	sampleID	unique identifier of any soil or vegetation sample taken in the field	-
2	sample_weight	weight of samples	g
3	no	number of measurements during the incubation	-
4	incubation	duration of the incubation in days	dd
5	pre-incubation	duration of the pre-incubation phase in days	dd
6	C-CO2_SOC	weighted mean CO_2-efflux over the entire incubation period per SOC mass	µg CO_2-C g SOC^{-1} h^{-1}
7	C-CO2_soil	weighted mean CO_2-efflux over the entire incubation period per soil mass	µg CO_2-C g $soil^{-1}$ h^{-1}
8	RSD	weighted average of the relative standard deviation for the whole incubation period	-

Methods

Heterotrophic respiration was assessed in a laboratory incubation experiment using bulk soil samples from forest site soils across all geochemistry, topographic and depth gradients. 50 g of 12 mm sieved soil were weighed in a 100 ml beaker with soil moisture adjusted to 60 % of the water holding capacity, considering this to be the optimum water content level for microorganism activities (Rey et al., 2005). Each sample was put in a 955.5 ± 1.3 ml sealed mason jar with no further additives. Samples were then incubated at 20 °C, a temperature closest to the mean temperature of the study sites. Following a pre-incubation period of 4 days to allow for equilibration after rewetting, we incubated all samples for 67 days and sampled periodically every 1 to 10 days throughout the experiment with longer intervals towards the end of the experiment as respiration levelled out. This amounted to an average of

twelve observations per incubated sample. 20% of the samples were incubated in triplicate to assess the average deviation between samples. Gas was sampled using a syringe, transferred with pre-evacuated vials and analysed for its CO_2 concentration using a gas chromatograph (Trace 1300, Thermo Scientific, MA USA). The gas chromatograph was calibrated with five CO_2 standard gas mixtures (0, 500, 1000, 5000, and 10000 ppm CO_2) and measurements were corrected for ambient air CO_2 respiration. Generally, gas samples were taken after accumulating between 1000-3000 ppm CO_2. Before sealing to accumulate C, jars were flushed with fresh air before. After each measurement, jars were opened and covered with parafilm allowing for gas diffusion to avoid CO_2 saturation effects that could inhibit microbial activity, and to retain moisture between CO_2 accumulation periods. The resulting data average standard error of the mean replicate values was 9.6%. Incubation data was used to derive the specific potential heterotrophic respiration (SPR), expressed as CO_2-C per unit soil C, and CO_2-C per gram soil to derive total potential heterotrophic respiration (TPR). Data was analysed as the weighted average of SPR and TPR over the respective length of the experiment. For a scientific interpretation of these results see Bukombe et al. (2021).

Acknowledgment

TropSOC was funded via the Emmy-Noether-Program of the German Research Foundation (project ID 387472333).

References

Rey, A., Petsikos, C., Jarvis, P. G., and Grace, J.: Effect of temperature and moisture on rates of carbon mineralization in a Mediterranean oak forest soil under controlled and field conditions. In Eur. J. Soil Sci.,56, 1365-2389, https://doi.org/10.1111/j.1365-2389.2004.00699.x, 2005.