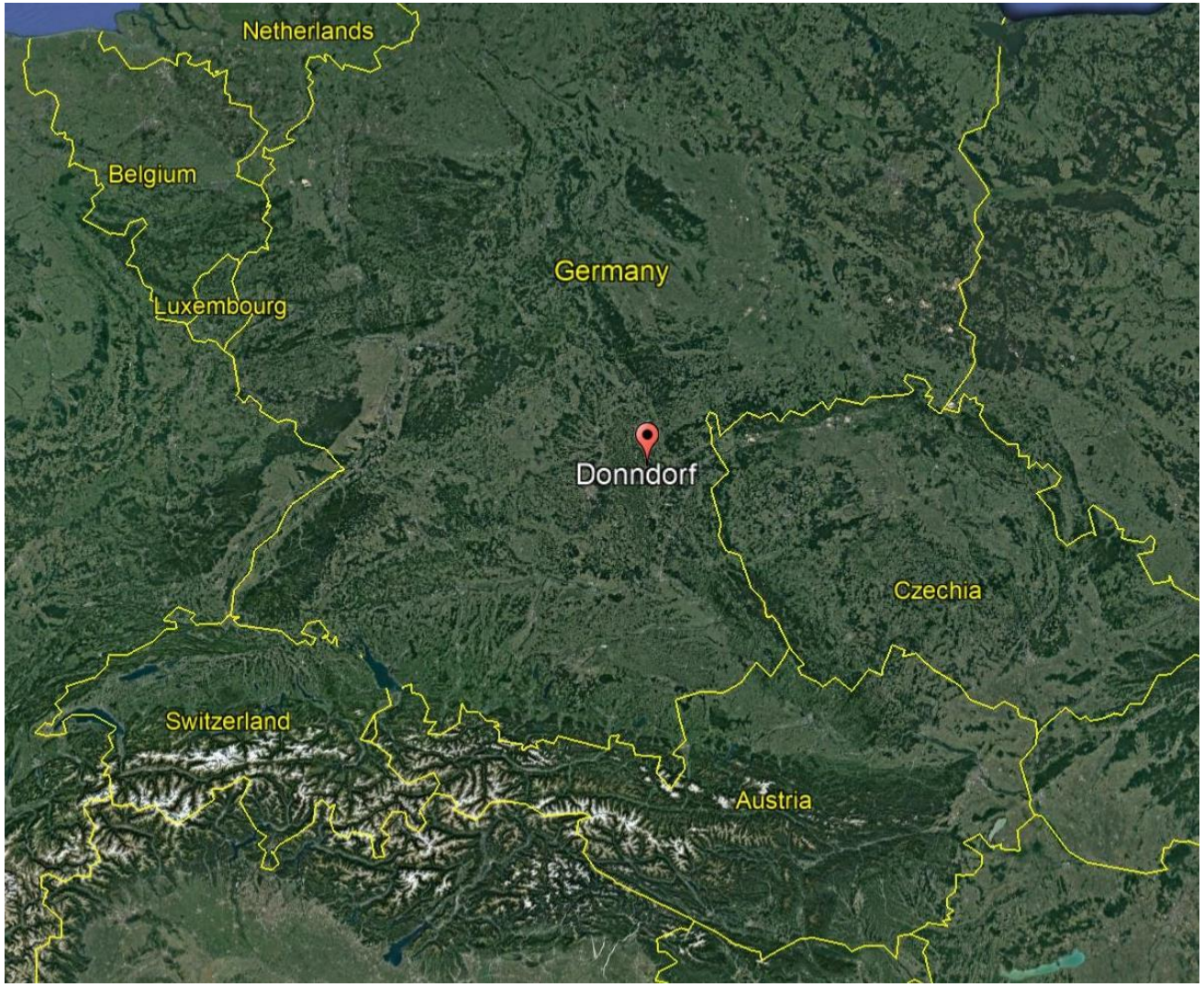
Donndorf-Eckersdorf (Germany)



EXPERIMENT GOALS

Fill the knowledge gaps on long-term (i.e.>5 years) effects of biochar in temperate soils. Proving the increase in aggregate formation and OC storage in soil receiving compost-biochar as compost is reactive and might act as an effective aggregate binding agent for biochar-derived organic carbon.

Six-year experiments

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SITE DESCRIPTION

The field experiment is located in Donndorf / Eckersdorf (near Bayreuth, Germany) in northeastern Bavaria. The climate is temperate, with temperature range of 5–13 °C, and a mean annual precipitation of 507 mm. The experimental site covers a total area of 3600 m² (30 m x 120 m) and consists of fifty individual plots of 72 m² (6 m x 12 m) each. The soil type is a Cambisol. With an average of 62 % sand, 12 % silt, and 26 % clay for bulk soil sampled at the 0−30 cm depth, the soil was classified as a sandy loam.

Nine treatments were arranged in plots according to a Latin rectangle in a row-column design so that each treatment was present in each row and each pair of columns in a grid across the field.

During the field experiment, the crops grown on all treatments were millet, ryegrass, corn, triticale, mustard and winter wheat.

BIOCHAR AND ITS APPLICATION IN THE FIELD

The commercially available biochar was derived from beech and pine wood chips (CarbonTerra, Wallerstein, Germany). Low-temperature pyrolysis (< 550 °C) lasted 36 h with short-duration high-temperature pyrolysis (700–800 °C) for 1–2 hours. Treatments included a control without any application of compost or biochar, application of 20 or 70 t ha^{-1} of compost (**C20** and **C70**), application of 9 or 31.5 t ha^{-1} of biochar (**B9** and **B31.5**), application of compost-biochar mixtures where biochar and compost were mixed on site directly before being applied (**C20B9** and **C70B31.5**), and application of compost-biochar mixtures where biochar and compost were mixed and co-composted for two months before application (**C20B9** comp and **C70B31.5** comp).

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Measured parameters

Soil analysis and interactions with biochar: soil analysis at T0, periodic soil analysis, pH, WHC, Cmic, CEC, SOC, bulk soil
Biochar dynamics and matrices: degradation of biochar, soil carbon contribution

Key findings

- Soil OC was significantly increased in the surface soil six years after a single addition of 9 or 31.5 t ha^{-1} of biochar, applied individually or in mixture with compost.
- Soil fractionation revealed significant increases in the amount of non-occluded organic particles (POM) in response to biochar application.
- Only the application of biochar promoted OC storage in aggregates in the surface soil, while both biochar and compost were drivers of aggregate formation in the subsurface soil.

Planned activities or potential experimental activities
Field experiment with control, compost only, biochar only, and a mixed compost-biochar application (co-composted and only mixed) at low and high application rates (9–70 t/ha) to derive microbial binding agents on long term studies (> five years).

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PRESENTATION OF THE WORKING GROUP

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector.

Bibliography and publications of the experiment, online information material, websites

Cooper, Jennifer, Isabel Greenberg, Bernard Ludwig, Laura Hippich, Daniel Fischer, Bruno Glaser, and Michael Kaiser. 2020. 'Effect of Biochar and Compost on Soil Properties and Organic Matter in Aggregate Size Fractions under Field Conditions'. *Agriculture, Ecosystems & Environment* 295 (June): 106882. https://doi.org/10.1016/j.agee.2020.106882.

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