UNIVERSITY OF HOHENHEIM

DeliSoil
Delivering soil improvers from circular food production processes to boost soil health

IMPACT OF SOIL AMENDMENTS FROM FOOD INDUSTRY BY-PRODUCTS ON CROP DEVELOPMENT AND SELECTED SOIL QUALITY PARAMETERS

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AIM: This study investigates the potential of using currently under-utilized food industry by-products as soil improvers by means of a 3-year field experiment with silage maize and winter wheat and evaluates their impact on soil quality and crop productivity.

APPROACH

Field experiment at Hohenheim, Southwest Germany (28°42'54" N, 9°12'52" E)

Plots: 60 m^2; 16 treatments; 4 replicates; 64 plots in total

Crops: silage maize (2024), winter wheat (2024/25), faba bean (2026)

5 regional soil improvers: processed anaerobic digestates from mixed food waste (nutrient-depleted, NG; nutrient-enriched, NB); insect frass (INS); bio-compost (BK); coffee silverskins (CSS, only 2025)

2 application rates: 1 and 2 t ha^{-1}, incorporated before maize sowing, surface-applied to wheat

References: commercial reference (CREF); mineral fertilizer calcium ammonium nitrate, CAN (MREF); control

Soil samples: 3x during growing season; 0-20 cm; N_{min}, CAL-P, pH, organic and reactive carbon, cation exchange capacity (CEC), soil texture, bulk density.

Plants: bi-weekly monitoring of growth stage (BBCH), height, SPAD chlorophyll index; maize biomass yield at anthesis and dough maturity; wheat biomass yield at milk stage and grain yield at senescence; N concentration

RESULTS & DISCUSSION

Maize: Highest yields at anthesis in treatments NG1, NB1, NB2, MREF; lowest yields in CON, BK2, CREF750 and CREF1000 (Figure 1). Higher application rate resulted in increased yield for treatments NG, NB and CREF at dough maturity.

Winter wheat: highest yields in treatments NB1, NG1, BK1 (Figure 2). Higher application rate did not increase yield except for CSS. Plots treated with soil improvers generally resulted in higher yields than with MREF, suggesting that they improved water supply during the main growing season. The drought set in very early in 2025, with only 58% of average rainfall from February to June. Evaluation of soil sample results and logger data ongoing.

Both years: differences are probably mainly an effect of mineral N, as N differences in soil improvers were applied as CAN. Moreover, N in soil improvers is mineralized more slowly.

OUTLOOK

Some soil improvers resulted in significantly higher yield effects than others, suggesting that the choice of soil improver can strongly influence crop productivity already in the first two years. The field experiment is going to be continued for another year.

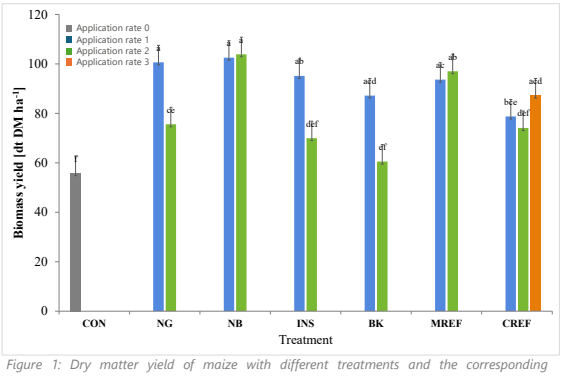

Figure 1: Dry matter yield of maize with different treatments and the corresponding application rates at the time of anthesis on 05.08.2024. The error bars represent the standard error. Dry matter yields with different letters differ significantly from each other ($p \leq 0.05$).

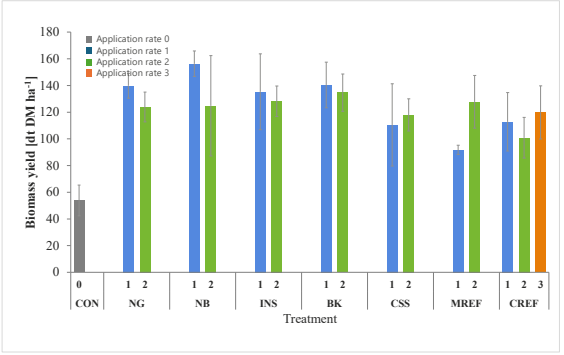

Figure 2: Dry matter yield of winter wheat whole plants with different treatments and the corresponding application rates at milk stage on 17.06.2025. The error bars represent the standard error.

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