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# The effect of the compost and anaerobic digestate application on microbial activities and community structures in soils from different depths
# （堆肥とバイオガス由来消化液の施肥が、異なる土層の微生物活性とコミュニティ構造に与える影響）

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## 1. Introduction

The anaerobic digestion (biogas plant) system is developed as one of the sustainable energy production systems from animal manure. The residue produced from this system (the substrate after an anaerobic fermentation) can be used as an organic fertilizer (called as “anaerobic digestates (AD)”). Here, we evaluated the effects of AD on the soils from different layer (the top/subsoil), focusing on the N cycle and soil microbial communities, compared to the composts which were produced by an aerobic fermentation of animal manure.

## 2. Materials and Methods

We conducted a pot incubation experiment. Four treatments were applied to a pasture soil from different depth (0–30 cm, the topsoil and 30–60 cm, the subsoil), namely, no amendment (*Soil*), compost (*Compost*), AD (*Digestate*), and compost+AD (*Mix*) amendment. The application rate for each treatment was adjusted to 100 kg inorganic-N $ha^{-1}$. Bacterial community structures (based on 16S rRNA gene) were analyzed at 3 and 30 days after the compost/AD amendment. Bacterial community structures were analyzed by a detrended correspondence analysis (DCA)

## 3. Results and Discussion

The DCA results showed that the application of composts and/or AD caused a larger change in community structures of the subsoil compared to those of the topsoil. In both soils, the change of community structures caused by the composts continued until day 30. Although the community structures were stable in the *Mix* treatment, the community structures in the *Soil* and *Digestate* treatments were easily changed during the incubation. The effects of AD on the community structures were disappeared within the same period, and on day 30, the *Digestate* treatment showed resemble structures to the *Soil* treatment. Thus, the composts application changed the microbial communities in the soils for an extensive period, but the AD application did not (or the effects were temporal). This composts effect may contribute the robustness against the stress during the incubation, such as heat and/or drying. Based on the response to the organic matter application and the incubation time, the bacterial phyla were classified into some groups. For example, one group including phylum *Bacteroidetes* and phylum *Chloroflexi* increased in the *Compost* treatment, and another group including phylum *Firmicutes* increased in the *Digestate* treatment.

## 4. Conclusion

As a conclusion, the effect of the compost on the soil microbial community structures was stronger and more continuous than that of the digestates. Thus, when AD are used, a combined application with compost can contribute to the stable soil communities against the stress, compared to a solely use of AD.