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著者	Ogura Shin-ichiro, Shishido Tetsuro, Tanaka Shigefumi, Tannai Masaki, Sato Shusuke, Yusa Kenji
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## Effect of Interannual Application of Cattle Manure Compost on Yield and Quality of Herbage and Soil Chemical Condition in a Temperate Grass Meadow

Shin-ichiro Ogura, Tetsuro Shishido, Shigefumi Tanaka, Masaki Tannai,  
Shusuke Sato and Kenji Yusa

Tohoku University, Japan

**Introduction** Application of animal manure compost to forage crop field has a profound significance in terms of resources recycling. However, there is scarce information on the effect of compost application on yield and quality of herbage under application to the surface of pasture as additional fertilizer. Thus, we conducted a three-year field experiment in a temperate grass meadow to assess the effects of interannual application of cattle manure compost on yield and quality of herbage and soil chemical condition. We also assessed residual effect of the cattle manure application.

**Materials and Methods** A mixed meadow of orchardgrass (*Dactylis glomerata*) and tall fescue (*Festuca arundinacea*) was established in the Field Science Center, Graduate School of Agricultural Science, Tohoku University, Japan (38° 44' N, 140° 45' E) in 2005. Soil type is non-allophanic andosol. Six plots (200 m × 14 m each) were fixed in the meadow and subjected to the following six treatments in 2006-2008: 1) no fertilizer, 2) split application of chemical fertilizer (conventional application; N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O = 231-120-200 kg/ha/yr), 3) split application of cattle manure compost (equivalent to the amount of K<sub>2</sub>O in treatment 2: 2,500-9,000 kg of compost/ha/yr) and chemical fertilizer to address N deficiencies 4) split application of cattle manure compost (equivalent to the amount of N in treatment 2: 27,000-81,000 kg of compost/ha/yr) 5) single application of cattle manure compost in spring (equivalent to the annual amount of manure in treatment 4), 6) split application of twice amount of the cattle manure in treatment 4. In 2009, we applied chemical fertilizer to all six plots, as in treatment 2, to assess residual effect of the cattle manure compost. In 2006-2009, herbage samples were collected at the height of 3cm from three locations (1 m × 1 m each) in each treatment in mid to late May (1st cut), late July to early August (2nd cut) and October (3rd cut), and the yield and chemical composition were measured. Four soil samples (0-10 cm in depth) were also collected from each treatment and their chemical composition were analyzed after the 3rd cut every year.

**Results and Discussions** There was no clear effect of compost application on forage yields during the experimental period. However, Ca content decreased and P content increased in 2007-2008 in three treatments (treatment 4-6) where only cattle manure compost was applied. The following residual effects were also observed in 2009 in those three treatments: low Ca content, low Ca/P ratios, high K content, high K/(Ca+Mg) ratio and high NO<sub>3</sub>-N content. In the three treatments, a large increase of exchangeable K and Mg concentrations, a modest increase of exchangeable Ca, and a large increase of Mg/K and Ca/Mg equivalent ratio were observed in the soil surface in 2007-2008. In contrast, there was no clear effect of compost application on N and available P concentration. The following residual effect in 2009 was not observed in K concentration, but observed in Mg concentration in the three treatments. Such deterioration of soil mineral condition was rarely observed in the treatment 3 where the amount equivalent to that of K<sub>2</sub>O in conventional treatments was applied.

**Conclusions** Interannual application of cattle manure compost reduces forage mineral balance in a few years due to deterioration of mineral condition of soil surface, if an amount equivalent to that of N in conventional treatments was applied. In contrast, application of the compost in the amount equivalent to that of K<sub>2</sub>O in conventional treatments enables to sustainable forage production with well-balanced minerals, by reusing animal wastes.