

# **Potential use of dairy digestate as a biofertilizer: Effects on growth and yield of lettuce in hydroponics**

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## **Abstract**

Hydroponic vegetable production using anaerobic digestate liquid waste as a sole nutrient source is a pragmatic approach to integrate food production and liquid waste management. In this study, we investigated the effects of anaerobic dairy digestate (DD), inorganic nutrient solution (NS) alone and their combine application (NS+DD) on the growth and yield of lettuce in hydroponic greenhouse. Experiment was laid out in a completely randomized design with factorial arrangements in three replicates. Results showed that NS and Romaine lettuce produced significantly higher leaf area (LA), total chlorophyll contents, root dry weight and yield whereas, DD and Newham lettuce exhibited lower LA, chlorophyll contents and yield. The results indicated 136% and 52% higher  $\text{NH}_4^+\text{-N}$  uptake in lettuce cultivated in DD compared to NS and NS+DD treatments, whereas, lettuce grown in NS showed 30% and 50% higher  $\text{NO}_3^-\text{-N}$  concentration compared to NS+DD and DD grown lettuce. Lower LA, chlorophyll contents, root growth and yield in DD solution might be due to the presence of high  $\text{NH}_4^+/\text{NO}_3^-$  which inhibited root growth due to  $\text{NH}_4^+$  toxicity. Romaine variety showed superior agronomic performance and displayed higher growth and yield than Newham irrespective of mineral feed solution. It can be concluded that DD could be used as a sustainable organic fertilizer for lettuce production in hydroponic system. Additionally, DD can reduce substantial environmental burden and rationale approach for waste management. Further research is required to reduce  $\text{NH}_4^+/\text{NO}_3^-$  in DD without dilution to

establish the utilization of DD as a sole source of mineral nutrients in hydroponics; further DD dilution could possibly reduce macro and micronutrients result in low growth and yield.

**Keywords:** Ammonium toxicity, chlorophyll contents, dairy digestate, liquid waste, waste management, hydroponics, leaf area, root growth, yield