

## Potential of selected underutilized organic residues and *Azolla*, *Spirulina* grown in wastewater as plant nutrient sources

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### Abstract

Inorganic fertilizer usage leads to economic losses and environmental issues. Limited knowledge and availability of organic fertilizers is one of the reasons for excessive inorganic fertilizer usage. Though phosphorus and potassium are rich in plant residues, their nitrogen content is poor. *Azolla* (Az) and *Spirulina* (Sp) are nitrogen-rich sources grown in water, which is a scarce resource. In this background, a study was conducted aiming to formulate low-cost medium using wastewater to produce *Spirulina* and *Azolla* and analyze different organic nutrient sources, namely, Palmyrah leaf (Pl), Coconut leaf (Co), Banana pseudostem (Bp), Az and Sp. Biomass yield of *Spirulina* was assessed with different combinations of wastewater and standard Zarrouk's medium (Zm) with two replicates and six treatments, namely, T1- 100% Zm, T2- 50% Zm, T3 - 50% Zm + 50% Parboiled effluent, T4 - 50% Zm + 50% Reverse osmosis wastewater (ROw), T5- 50% Zm + 50% Seawater, T6 - 50% ROw. *Azolla* was assessed with different combinations of wastewater and freshwater with two replicates and nine treatments, namely, T1 - Kitchen wastewater (Kw) + Triple superphosphate (TSP), T2- Tap water (Tw) +TSP, T3- ROw + TSP, T4 - Kw + Cow dung (Cd), T5 - Tw +Cd, T6 - ROw + Cd, T7 -Kw, T8 - Tw, T9 - ROw in completely randomized design (CRD). Macronutrient (carbon, nitrogen, phosphorous, potassium, calcium, and magnesium) content of organic sources Az, Sp, Co, Pl, and Bp were analyzed with three replicates in CRD. The recorded data were statistically analyzed using ANOVA, and mean separation was done using Duncan Multiple Range Test. Results of nutrient analysis of organic sources indicated that significantly higher potassium (19.56 mg/kg), phosphorous (6.17 mg/kg), nitrogen (115.03 mg/kg), carbon (832.50 mg/kg), calcium (10861 mg/kg) and magnesium (1947.2 mg/kg) were found in Banana pseudostem, Banana pseudostem, *Spirulina*, Palmyra leaf, *Azolla*, and *Azolla*, respectively. By substituting 50% Zm with parboiled effluent (3.02 g/L) or ROw (2.8 g/L) gave significantly higher and comparable *Spirulina* dry biomass respectively to that of 100 % Zm (2.809 g/L). Significantly higher dry biomass yield was obtained in *Azolla* when Kw or ROw was used instead of freshwater. Results therefore indicated that the tested underutilized organic sources and nitrogen sources grown in wastewater are potential plant nutrient sources.

**Keywords:** *Azolla*, Banana pseudostem, Coconut leaf, Palmyra leaf, *Spirulina*

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