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Development and characterization of a slow release fertilizer system using ammonium nitrate incorporated Gliricidia bark particles

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Best management practices for fertilizers in the application of plant nutrients should always aim to avoid a surplus of plant available nutrients in the soil. This will promote the efficient use of nutrients and minimize unfavorable effects on the environment. These conditions could be achieved by using slow release fertilizer systems. Experiments were conducted to determine the nitrogen (N), phosphorous (P) and potassium (K) contents in leaf, mid rib, root, bark and stem of gliricidia (*Gliricidia sepium)* plant and to develop a new slow release fertilizer system using ammonium nitrate (NH_4NO_3) incorporated gliricidia bark particles. Gliricidia plants were obtained from Rathmalagara estate, Madampe in Coconut Research Institute (CRI), Sri Lanka. New slow release fertilizer system was prepared from gliricidia bark particles (< 5 mm) after treating with a saturated solution of ammonium nitrate (NH_4NO_3). The morphology and physicochemical parameters of treated gliricidia bark particles were investigated. The release patterns of nitrogen from ammonium nitrate incorporated gliricidia bark particles (10 g) in a soil matrix (200 g) were investigated using columns with deionized water (pH 6.7). Parallel studies were carried out to evaluate the leaching patters of commercially available three nitrogen fertilizers sold in Sri Lanka in the soil matrix using the columns. Control reactions were carried out with ammonium nitrate in a soil matrix alone. Each experiment was carried in triplicate.

Experimental results indicated that the level of nitrogen content in different parts of the gliricidia plants varied from 4599 mg kg^{-1} to 24381 mg kg^{-1}. It was found that phosphorous content in gliricidia plant varied from 1367 mg kg^{-1} to 3143 mg kg^{-1}. Potassium in different parts of the gliricidia plants varied from 140 mg kg^{-1} to 2600 mg kg^{-1}. Therefore, gliricidia plant can potentially be used as a fertilizer source of nitrogen, phosphorous and potassium. After treating gliricidia bark particles with saturated ammonium nitrate, the total nitrogen content in gliricidia bark particles increased by more than six times with a maximum value of 67830 mg kg^{-1} after 6 hours. The initial nitrogen content in the bark was 10080 mg kg^{-1}. According to the experimental results, within 24 hours more than 80% of the nitrogen was eluted from ammonium nitrate and commercially available fertilizers in the soil matrix given. However, only 24% of nitrogen was eluted from NH_4NO_3 incorporated gliricidia bark particles within 24 hours. After 15 days eluted nitrogen amount was recorded as only 43% from treated gliricidia bark particles. Therefore, it could be inferred that nitrogen was released from NH_4NO_3 impregnated gliricidia wood chips in a slow-release pattern. According to research data, it could be concluded that gliricidia bark particles have a great potential as a fertilizer carrier for the development of a nitrogen rich new slow release biomass fertilizer system.

Keywords: Ammonium nitrate, Gliricidia, Nitrogen, Slow release fertilizers