DATA-DRIVEN SLOW-RELEASE FERTILIZATION REGIME

In oil palm (OP) cultivation, fertilization is a mandatory practice to yield and productivity. The standard fertilizer has high solubility and thus, multiple applications are required to support effective plant nutrient use. At any single dose of administration, only 30-40% of the total fertilizer is absorbed by OP, while the balance settles into the soil system causing residual effects, pollution, soil degradation, pest and disease resurgence and greenhouse gas emission. In Malaysia, the acid-tolerant oil palm is cultivated over a range of soil types which includes sandy clay, silty clay and acidic Ultisols and Oxisols. Since the latter has inherent poor fertility, massive amendment strategies are required to enhance the soil nutrient status. Nanomaterials are bestowed with ideal physical properties for loading and unloading agrochemicals. They can act as adsorbents, improving the retention period of agrochemicals in a soil system. However, the physical interactions may differ with the various soil systems *per se.* My innovation, the Z-generation fertilizer (Z-genF) addresses the leaching behaviour of the conventional and improves soil health via an informed-sustainable fertilization regime. A machine learning approach will be used as a decision-making tool in estimating OP nutrient requirements based on soil and meteorological data assessment. Both the soil and meteorological information of various OP plantations across Malaysia will be collected and subjected to neural networks and supervised modelling for site-specific OP nutrient requirement prediction. Currently, I have established a green synthesis protocol for mesoporous nanosilica production from rice husk agro-waste. The protocol is devoid of any surfactant modifications and the pore size is favourable for surfactant-free incorporation of agrochemicals. The mesoporous nanosilica will be encapsulated with conventional fertilizer to form a slow-release nanosilica-agrochemical composite (NaC). A molecular dynamic simulation of NaC under different soil systems will be carried out to predict the leaching activity and the results will be further validated via *ex situ* soil leaching test. The success rate of the Z-genF formulation will be measured through field experiments (fertilizer application and plant nutrient assessment) carried out on OP plantations at various locations (healthy and acidic soils) in Malaysia. The Sustainable OP Dialogue is seeking Z-genF, a change-driving innovation embracing sustainability. The slow nutrient-release property coupled with informed nutrient application are amongst the key sustainable features of Z-genF which aims at preserving soil health, sustain yield and positively impact climate change.

Nisha T. Govender
Malaysia