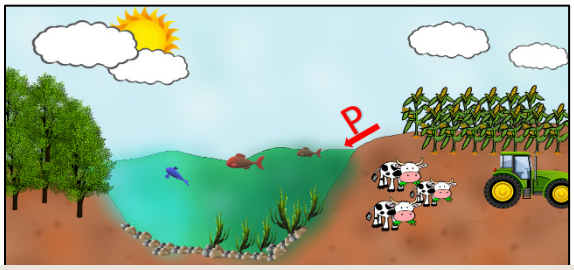

Evaluation and Development of Lime-Based Products to Reduce Phosphorus Loss from Agricultural Soils

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Abstract

Phosphorus loss from agricultural fields is one of the main contributors to the rapid eutrophication of lakes and rivers. Eutrophication is the over-enrichment in nutrients, and it is often accompanied by excessive algal growth and hypoxia, which will consequently endanger aquatic life and cause negative impacts to the ecosystem. The application of phosphorus-immobilizing soil amendments could be an effective measure to reduce phosphorus release into downstream water bodies. There exists a great need for cost-effective novel materials to reduce phosphorus loss. The main objective of this Ph.D. research was to evaluate the effectiveness of lime-based products on reducing phosphorus concentration in the leachate from common agricultural soils without interfering with crop growth as well as to develop a novel, cost-effective lime-based product to increase soil phosphorus adsorption capacity in the soil. Through laboratory and field lysimeter studies, this research demonstrated that lime application at the optimum dose of 1% by soil weight could significantly reduce soluble reactive phosphorus release from the soil by increasing soil P adsorption capacity up to 40% without disturbing soybean growth. However, the lime-phosphorus interactions in the soil were soil type-dependent. Lime kiln dust, as the by-product and less expensive alternative to high-quality lime, was able to exhibit similar performance in increasing soil phosphorus adsorption capacity, especially in the soil solution concentration ranges. Therefore, the lime kiln dust was modified to develop a novel iron-coated lime kiln dust with a neutral pH, iron loading of 16%, and improved efficiency. The new product was able to increase soil phosphorus adsorption capacity by 30% compared to the non-amended soil. The new iron-coated lime kiln dust could be a promising low-cost phosphorus-immobilizing soil amendment to help mitigate rapid

About the Candidate

Faezeh Eslamian holds a bachelor's and master's degree in Civil and Environmental Engineering from Isfahan University of Technology, Iran. She has been pursuing her PhD degree at McGill University under the supervision of Dr. Zhiming Qi. Faezeh's research mainly focused on the development of a novel lime-based product to mitigate eutrophication of the lakes and rivers and her project was conducted in collaboration with Graymont.