JOURNAL OF ENVIRONMENTAL QUALITY

Plants Need No Phosphorus Fertilizer above Environmentally Critical Values

Optimizing phosphorus (P) application to agricultural soils is fundamental to crop production and water quality protection. Soil P tests and P sorption characteristics describing crop yield response to P application can also be used in predicting environmentally critical soil P status.

In an article recently published in the *Journal of Environmental Quality*, Norwegian researchers report on P response to P application in barley grown in pot experiments with 45 soils of different P status. The soil P status was measured by four soil P analyses, and the P sorption properties were determined by three methods.

All soil P analyses and two of the P sorption characteristics showed a nonlinear and significant relationship with yield response to P application and manifested a threshold value above which no P response was observed. Readily releasable P in soil reflects the risk of P loss to runoff and also had a nonlinear relationship to soil P analyses and P sorption characteristics. The threshold for yield response coincided with the environmentally critical values determined from the degree of P saturation.

The results support the conclusion that soil P levels for which no P application is needed also have an elevated risk of P loss to runoff.

Annbjørg Øverli Kristoffersen, first author of the article in the *Journal of Environmental Quality*. Photo by Unni Abrahamsen.

Adapted from Kristoffersen, A.Ø., Krogstad, T., & Øgaard, A.F. (2020). Prediction of available phosphorus in soil: Combined use for crop production and water quality protection. *Journal of Environmental Quality, 49,* 1575–1584. https://doi.org/10.1002/jeq2.20165

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VADOSE ZONE JOURNAL

Soil Moisture Dynamics in an Amazonian Tropical Forest

Soil moisture plays a key role in hydrological, biogeochemical, and energy budgets of terrestrial ecosystems. Therefore, accurate soil moisture measurements are important, especially in the Amazon, the largest continuous tropical forest in the world. Time domain reflectometry (TDR) sensors are widely used to measure soil moisture and require site calibration to convert the TDR's dielectric permittivity measurement (K_a) to volumetric water content (ϑ_v).

In a recently published *Vadose Zone Journal* article, researchers developed a site-specific calibration of TDR sensors in an old-growth upland forest in the central Amazon, evaluated the performance of the calibration, and then applied it to determine the dynamics of soil moisture content within a 14.2-m-deep vertical soil profile.

They found that the widely used K_a–ϑ_v relationship (Topp model) underestimated the calibrated water content (ϑ_v) by 22–42%, indicating significant error in the Topp model when applied to well-structured, clay-rich tropical forest soils. The calibrated ϑ_v data showed a variety of depth and temporal variations, highlighting the importance of soil textural differentiation, root uptake depths, as well as event to seasonal precipitation effects.

Master's student Regison de Oliveira inspecting sensors in a 17-m-deep pit in an old-growth forest at the Tropical Silviculture Experimental Station north of the City of Manaus, Amazonas State, Brazil. Photo by Dr. Marcelo Mota.

Data like this can help improve our understanding of ecohydrological processes within tropical forests as well as models of these systems in the face of changing environmental conditions.

Adapted from Negrón-Juárez, R., Ferreira, S.J.F., Mota, M.C., Faybishenko, B., Monteiro, M.T.F., … & Chambers, J.Q. (2020). Calibration, measurement, and characterization of soil moisture dynamics in a central Amazonian tropical forest. *Vadose Zone Journal, 19*, e20070. https://doi.org/10.1002/vzj2.20070

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