Evaluation of Mehlich 3 as an agri-environmental soil phosphorus test for the Mid-Atlantic United States of America

Laws and guidelines limiting P applications to cropland based on soil P exist in the Mid-Atlantic USA because of water quality concerns. We evaluated Mehlich 3 (M3) as an environmental soil P test using 465 soils typical to the Mid-Atlantic region and found M3-P accurately predicted water soluble P (WSP), desorbable P (Fe oxide strip P [FeO-P]), and total sorbed P (oxalate P). The M3-P saturation ratio (M3 [P/(Al+Fe)]) was linearly related to the well-established oxalate P saturation method (DPSox) and a M3 [P/(Al+Fe)] range of 0.10 to 0.15 corresponded to reported environmental limits for DPSox (25–40%). Rainfall simulation and column leaching studies showed M3 [P/(Al+Fe)] predicted runoff and leachate P concentrations better than M3-P. We suggest consideration of the following approach now used in Delaware for agri-environmental interpretation of M3-P and M3 [P/(Al+Fe)]: (i) Below optimum (crop response likely; M3-P ≤ 50 mg kg\(^{-1}\); M3 [P/(Al+Fe)] < 0.06); (ii) Optimum (economic response to P unlikely, recommendations for P rarely made; M3-P = 51–100 mg kg\(^{-1}\); M3 [P/(Al+Fe)] = 0.06–0.11); (iii) Above Optimum (soil P will not limit crop yields, no P recommended; M3-P > 100 mg kg\(^{-1}\); M3 [P/(Al+Fe)] > 0.11); (iv) Environmental (implement improved P management to reduce potential for nonpoint P pollution—in Delaware M3-P > 150 mg kg\(^{-1}\); M3 [P/(Al+Fe)] > 0.15 is now used). (v) Natural Resource Conservation (no P applied even if the potential water quality impact is low to conserve P, a finite natural resource).

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Applied and Environmental Soil Science is a peer-reviewed, Open Access journal that publishes research and review articles in the field of soil science. Its coverage reflects the multidisciplinary nature of soil science, and focuses on studies that take account of the dynamics and spatial heterogeneity of processes in soil. Basic studies of the physical, chemical, biochemical, and biological properties of soil, innovations in soil analysis, and the development of statistical tools will be published. A. Mehlich, “Mehlich 3 soil test extractant: a modification of Mehlich 2 extractant,” Communications in Soil Science & Plant Analysis, vol. 15, no. 12, pp. 1409–1416, 1984. View at Google Scholar · View at Scopus. Characteristics of Agri-Environmental data. Problems of scale: environmental phenomena are site specific; statistics at the country level may be not very significant in some cases (e.g. “big countries” like Brazil, with a variety of landscapes). Different data sources: questionnaires, surveys, remote sensing, modeling, field measurements. Environmental Attributes Soil type, Slope, Location, Climate. Market Responses Prices-inputs, crops-Organizational set-up. An agri-environmental indicator is a summary measure, combining raw data, used to describe the state of the environment, a risk to the environment, a change in the environment, or a driving force behind such a change, that can be attributed wholly or in part to an agricultural activity or activities.