

Soil acidification processes and indicators

Michael J. Webb¹, Paul N. Nelson², Murom Banabas³, Steven Nake⁴

Abstract

Acidification of soil occurs in most environments, including unmodified natural environments. However, under agricultural conditions, the acidification rate is often increased because of nitrogen (N) fertiliser use and export of the agricultural product. This acidification can be mitigated with the use of liming materials but these are not often used under oil palm. Acidification due to N-fertiliser use is a result of one or both of two processes: conversion of ammonium to nitrate; and incomplete uptake (leaching) of the resultant nitrate. Some fertilisers (e.g. ammonium sulfate) are acidifying even if all resultant nitrate is taken up. Acidification due to product export is a result of the imbalance between the export of cations and anions. This cannot be avoided unless all the by-products of milling are returned to the oil palm blocks—which is impractical. Acidification of soil affects many processes that can be detrimental to growth of the current crop and may limit options for future crops. It also may cause irreversible damage to the soil. Acidification rates depend on the amount of acid being added (net acid addition rate; NAAR) and the ability of the soil to resist pH change (pH buffering capacity; pHBC). Some researchers have used the concept of ‘time to critical pH’ as an indicator of sustainability. However, such an approach assumes that pHBC is linear across the pH range of interest—which is mostly not true. We have chosen to use just the NAAR as an indicator as this reflects the effect of current practice and it is clear from the calculations what remedial actions can be taken depending on the soil condition.

¹ CSIRO Agriculture Flagship, Townsville, Queensland, Australia. Email: michael.webb@csiro.au

² Centre for Tropical Environmental and Sustainability Science, James Cook University, Cairns, Queensland, Australia. Email: paul.nelson@jcu.edu.au

³ PNGOPRA, Kimbe, West New Britain Province, Papua New Guinea.
Email: murom.banabas@pngopra.org.pg

⁴ PNGOPRA, Kimbe, West New Britain Province, Papua New Guinea.
Email: steven.nake@pngopra.org.pg