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EFFECT OF PROLONGED DROUGHT FOLLOWED BY REWETTING ON SOIL NUTRIENT DYNAMICS

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Abstract

Soil nutrient dynamics are closely linked to soil moisture availability, particularly in dryland ecosystems where water is a limiting factor influencing microbial and biochemical processes. This study investigated how prolonged drought followed by rewetting affects soil nutrient availability in the dry zone of Sri Lanka. Soil was collected (0-10 cm) from Kalaththewa Grama Niladhari Division, Anuradhapura District. The soil is a reddish-brown earth with a water holding capacity (WHC) of 0.36 g/g. A laboratory incubation experiment subjected soils to three drought (~10% WHC) durations (2 weeks, 2 months, and 6 months), followed by rewetting to 50%WHC. Soils were kept at drought (~10% WHC) by maintaining them at a constant weight. The sampling was done at 2, 14, and 30 days after rewetting. There were three (03) replicates for each treatment. Soil pH, electrical conductivity (EC), available phosphorus (P), and organic matter (OM) were measured. Soil pH remained stable without significant changes between the treatments, whereas EC, P, and OM showed significant increases after rewetting, particularly following the 2-month drought period. Results showed soil pH remained stable (pH ~7.0) with no significant change across treatments. Electrical conductivity (EC) peaked at 0.19 dS/m two days after rewetting following the 2-month drought, then declined. Available phosphorus (P) reached a maximum of 55.5 mg/kg and organic matter (OM) peaked at 4.81% at 14 days after-rewetting in the 2-month drought. The 6-month drought had lower P (28.3 mg/kg) and OM (3.2%) levels, indicating reduced microbial activity and nutrient cycling. These findings highlight drought duration's critical role in soil nutrient dynamics. Rewetting dry soil activates dormant microbes, enhancing short term nutrient release like phosphorus, which supports plant growth and soil health. However, this sudden flush can lead to nutrient leaching, especially after rain, reducing soil fertility. Nutrient flushes after moderate droughts can temporarily enhance soil fertility, benefiting Sri Lanka's rainfed agriculture. However, prolonged drought diminishes microbial activity and nutrient availability, affecting long-term soil health and crop yields. These results show the need for adaptive land management practices to sustain the productivity of the soil under climate change.

Keywords*: Drought, Rewetting, Soil Nutrients, Phosphorus Flush, Organic Matter, Dry Zone,*

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