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“Development on the margin”

## Assessment of Supply of Soil Nutrients in Different Land Use Types using Plant Root Simulator Probes

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### Abstract

The study was conducted in 2009 in Tara Gedam and Ambober watersheds of Northwest Ethiopian highlands to assess the plant available soil nutrients for different land use types. The plant root simulator (PRSTM) probes which consists of an ion extraction membrane encapsulated in a plastic probe were buried in the soil at a depth of 10 cm in a root exclusion cylinder in agriculture, forest (community protected and church forests at Tara Gedam and community protected forest at Ambober) and grazing lands in three or more replicates. After an exposure of six weeks, the probes were sent to Western Ag Innovations, Canada for laboratory analysis ( $\text{NH}_4^+$ -N, Ca, K, Mg,  $\text{NO}_3\text{N}$ , P, S, Al, Fe, Mn, Cu, Zn, and B). ANOVA and subsequent multiple comparison using Scheffe test ( $p < 0.05$ ) showed that total nitrogen, nitrate nitrogen, iron, manganese, copper, zinc, and boron supply in church forests was significantly higher than in community protected forests, grazing and agriculture lands. No significant difference for ammonium nitrogen, magnesium, potassium, phosphorus, sulphur and aluminum was found among the land use types at Tara Gedam. The maximum nitrate nitrogen supply was recorded for soils under church forest ( $682.7 \pm 85.8 \mu\text{g } 10 \text{ cm}^{-2}/6 \text{ weeks}$ ) followed by community protected forest ( $149.4 \pm 70 \mu\text{g } 10 \text{ cm}^{-2}/6 \text{ weeks}$ ), grazing land ( $137.9 \pm 54.3 \mu\text{g } 10 \text{ cm}^{-2}/6 \text{ weeks}$ ) and the lowest value for agriculture land ( $69.9 \pm 40.4 \mu\text{g } 10 \text{ cm}^{-2}/6 \text{ weeks}$ ) at Tara Gedam. At Ambober, nitrate nitrogen supply was significantly different only between community protected forest ( $215 \pm 45.2 \mu\text{g } 10 \text{ cm}^{-2}/6 \text{ weeks}$ ) and grazing land ( $33.2 \pm 45.2$ ) and no significant differences among the other land use types and other nutrients. The supply rate of potassium, boron and aluminum was significantly higher at Tara Gedam compared to Ambober while, the reverse is true for sulphur and magnesium. The interaction of watershed and land use types showed significant difference for the supply of total nitrogen, nitrate nitrogen, calcium, and boron. The study indicated that in a well managed church forest the supply of most soil nutrients was significantly different from the exhaustively used land use types indicating the need for sustainable nutrient management.

**Keywords:** Land use, nutrient, PRSTM probes, supply, watershed