

Phosphorus Fractions under Planted *Pueraria phaseoloides* Crop-fallow System: A Comparison with Natural Regrowth

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Abstract

The potential of planted leguminous cover crop fallow in comparison to the natural regrowth fallow for sustaining P availability of low activity clay (LAC) soils in the tropics as the fallow period shortens was assessed at the International Institute of Tropical Agriculture, Ibadan, in the forest-savanna transition zone of southwestern Nigeria. Phosphorus availability and crop yields under the cover crop-fallow and a traditional system (natural fallow-NF) were compared in 1998 and 1999 in a long-term fallow management trial initiated in 1989. *Pueraria phaseoloides* was sown with a maize-cassava intercrop at the same season. In a 2-year cycle, 1 year of cropping was followed by 1-year fallow with *Pueraria* for the cover crop-fallow system or with natural regrowth (mainly *Chromolaena odorata*) for the natural fallow system. Maize-cassava intercropping without a fallow period (continuous cropping) was included as a control. No fertilizer was applied throughout the experimental period. *Pueraria* produced 3.9 t ha⁻¹ dry matter (DM) in 1998 and 8.3 t ha⁻¹ DM in 1999 after the fallow period. DM production from NF was 5.7 t ha⁻¹ in 1998 and 7.8 t ha⁻¹ in 1999. Phosphorus accumulation in *Pueraria* biomass was 4.3 kg ha⁻¹ in 1998 and 6.1 kg ha⁻¹ in 1999. Phosphorus accumulation in NF biomass was similar to that of *Pueraria* in 1998 but was significantly higher (8.9 kg ha⁻¹) than in *Pueraria* in 1999. In 1998, NF had significantly higher Olsen extractable P than *Pueraria* fallow. Biologically plant available P fractions (resin P, NaHCO₃ inorganic P (P_i), and easily mineralizable P fraction NaHCO₃ organic P (P_o) were higher under NF than under *Pueraria* fallow and continuous cropping. Although P availability was higher under NF than under *Pueraria* but crop yields under crop-fallow with *Pueraria* were comparable with those under NF. Continuous cropping without the use of chemical fertilizer produced over 200% less maize grain and about 40% lower cassava tuber yields compared with the crop-fallow systems.

Introduction

Throughout the tropics, the shifting cultivation method has been widely used by small-scale farmers as a means of maintaining soil fertility. The method involves manual clearing, burning, and cropping a relatively small

area of land for one or two years followed by a long period of natural fallow (10–30 years). The land is usually allowed to return to forest vegetation through a series of plant species successions to restore soil fertility (Nye and Greenland, 1960; Sanchez, 1976; Mokwunye