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Maintaining the Yield of Upland Rice under Intensified Land Use in Slash and Burn Systems of West Africa

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Abstract

Most upland rice in West Africa is produced in slash-and-burn systems of the humid forest zone. With increasing land shortages, the length of fallow between periods of cultivation has declined from 12 years in the 1980s to less than three years at present, with permanent cultivation emerging in some high population areas. Land use intensification in these low-input systems results in declining yield levels, which are associated with a reduced soil N supplying capacity, more weed pressure and widespread P deficiency on the predominant acid Udisols. Low-cost options potentially available to farmers may include (1) the use of weed-suppressing nitrogen-fixing legumes that replace the traditional weedy fallow, (2) application of locally available rock phosphate, and (3) the use of input-responsive weed-suppressing rice cultivars. These options, solely and in combination, were evaluated in a 3-year field experiment near the town of Gagnoa in the bimodal forest zone of Côte d'Ivoire.

Permanent cultivation of the same field reduced upland rice yields from 3.0 Mg ha⁻¹ in the first year after clearing a 12 year-old bush fallow, over 1.6 in year two to 0.7 Mg ha⁻¹ in the third year of cropping. Replacing the off-season weedy fallow by a planted fallow of pigeon pea (*Cajanus cajan* L.) was able to slow the yield decline and to reduce the weed biomass in rice. Rock phosphate at a rate of 30 kg P ha⁻¹ increased upland rice yield only, when applied to a legume fallow. Modern varieties responded to improved management (legumes+ P) but succumbed to the weed pressure under traditional management. Combining legume fallow with rock-P and the use of an interspecific cross of *Oryza sativa* × *O. glaberrima* maintained the yield of upland rice at more than 2 Mg ha⁻¹, even in the third year of cultivation.

Keywords: *Cajanus cajan*, Côte d'Ivoire, *Oryza sativa*, rock phosphate, weeds