

Abstract

Planting of trees in rows is common on farms in western Kenya where phosphorus deficiency is also a major constraint to maize production. The influences of soil P status and simultaneous agroforestry systems on water use have, however, not been reported for the region. Effects of line-planted *Grevillea robusta* (upperstorey trees), *Calliandra calothyrsus* and *Senna spectabilis* (both managed as hedges) and P application on water use efficiency were investigated in maize. The experiment was laid out as split-plot with tree species forming main plots while 250 kg P ha and no P applications formed subplots. Seasonal evapotranspiration, was greater under grevillea by 40.8 mm (5.2%) in long rains and by 49.3 mm (10.2%) in short rains. Application of P significantly increased seasonal evapotranspiration (ET) by 1.7% in long rains and 2.4% in short rains. Maize water use efficiency was higher with P (6.9 kg ha⁻¹ mm⁻¹ in long rains and 9.5 kg ha⁻¹ mm⁻¹ in short rains) than without P (0.8 kg ha⁻¹ mm⁻¹ in long rains and 2.1 kg ha⁻¹ mm⁻¹ in short rains). The results revealed enormous potential for increasing maize WUE in these soils by overcoming P-deficiency. Combining grevillea trees with P application enhanced use of seasonally available water.