



The effect of different soil health management and cropping system options on yield of drought tolerant bush bean varieties in two agro-ecologies in central Malawi

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Abstract

In Malawi the common bean (*Phaseolus vulgaris* L.) is mostly produced under smallholder farming systems, where little or no manure or fertilizer are applied, leading to a low national average yield of 600 kg ha⁻¹. A participatory evaluation study, was conducted to assess the influence of various soil fertility management options (organic and inorganic fertilizer application), and cropping systems (maize-bean intercrop and bean sole crop) on the yield of 2 drought tolerant bush bean varieties (SER45 and SER83) in Dedza and Ntcheu districts, in central Malawi during 2013/14 and 2014/15 crop seasons. The trials were laid out in split-plot design with the bean varieties as main plots and the soil fertility management options and cropping systems as sub-plots, replicated three times. Under both cropping systems the soil fertility management options included: i) control (no soil fertility amendment) ii) 7.0 ton ha⁻¹ of chicken manure (98 kg N, 112 kg P₂O₅ and 70 kg K₂O ha⁻¹) on bean and maize bean intercrop, iii) 23 kg N and 21 kg P₂O₅ ha⁻¹ fertilizer on bean sole crop, iv) 115 kg N and 21 kg P₂O₅ ha⁻¹ fertilizer on maize and maize-bean intercrop and v) a combination of 7.0 ton ha⁻¹ of chicken manure and 23 kg N and 21 kg P₂O₅ ha⁻¹ fertilizer on bean sole crop or 115 kg N and 21 kg P₂O₅ ha⁻¹ fertilizer on maize and maize-bean intercrop. Both bean genotypes performed significantly better ($P < 0.01$) in sole crop than intercrop, with yield differences of 620 kg ha⁻¹ (SER45) and 340 kg ha⁻¹ (SER83), maintain the same bean plant density under both cropping systems. The land equivalent ratios were 1.49 (SER45) and 1.29 (SER83). The application of inorganic fertiliser to bean in both sole intercrop systems had insignificant ($p > 0.05$) effects on the bean yield increase for both varieties. The bean varieties however responded differently to application of manure and a combination of manure and fertilizer. SER45 was responsive to manure application in a sole crop which led to a 79% yield increase, while SER83 was responsive to a combination of manure and fertilizer leading to 76% yield increase. Both bean genotypes showed superior performance across the two seasons, despite the 2014-15 crop season being exceptionally dry, posing terminal drought conditions for other crops. The study demonstrated the potential of increasing bean productivity through promotion of improved drought tolerant bean genotypes and appropriate soil fertility management options, which are variable depending on the bean variety.

Key words: Cereal-legume cropping systems, drought tolerant bush bean, soil fertility management options

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