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## Can Intercropping Food Crops into Perennial Pasture Improve Water Use Efficiency, Risk Profile and Sustainability of Degraded Dryland Systems?

ROHAN ORFORD<sup>1</sup>, JOHN ANNANDALE<sup>2</sup>, MICHAEL VAN DER LAAN<sup>2</sup>, FOLKARD ASCH<sup>1</sup>

<sup>1</sup>University of Hohenheim, Institute of Plant Production and Agroecology in the Tropics and Subtropics, Germany

<sup>2</sup>University of Pretoria, The Department of Plant Production and Soil Science, South Africa

### Abstract

Population growth in sub-Saharan Africa (SSA) and drought demands an increased agricultural productivity and precipitation use efficiency (PUE). Till recently increased productivity has been achieved through the expansion of cropping areas into rangelands and overstocking. This has degraded 65 % of the arable and 30 % of the grazing land thus reducing PUE. Rainfed semi-arid agropastoral communities are particularly vulnerable. Climate change further threatens the PUE and risk of such systems. In response to these challenges a food crop-perennial pasture intercropping (PI) approach was tested under dryland field conditions at the University of Pretoria, South Africa. The primary objective was to assess the PUE and risk reduction qualities of such a system. Various crops (*Sorghum bicolor* = S, *Vigna unguiculata* = C, *Vigna radiata* = M, *Lablab purpureus* = L) and established *Eragrostis cervula* (P) were assessed as a monocrop (MC) and intercrop (PI) within the established P. PI with C (PIC) was tested over two seasons (2013, 2014). All treatments were rain-fed nutrient non-limiting trials. Crop growth parameters, soil texture and moisture measurements and meteorological data were measured for MC and PIC. Season 1 and 2 received 685 mm and 211 mm of rain respectively. When comparing PI between legumes and cereals, only PIC (3.5 t ha<sup>-1</sup>) was advantageous with an LER = 1.4. Legume screening for PI found L (1.2 t ha<sup>-1</sup>) suffered the lowest yield penalty. Overall PIC showed an 81 % (4.23 t ha<sup>-1</sup>) and 279 % (3.86 t ha<sup>-1</sup>) total DM yield advantage in season 1 and 2 respectively. Conversely C showed a higher yield penalty in the drier season 2 of 72 % (1 t ha<sup>-1</sup>) versus 34 % (1.79 t ha<sup>-1</sup>). There was a 81 % (6.24 kg mm<sup>-1</sup> ha<sup>-1</sup>) and 306 % (15.46 kg mm<sup>-1</sup> ha<sup>-1</sup>) PUE advantage with PI over season 1 and 2. Adding the P forage before planting, the total DM yield advantage was 138 % (7.23 t ha<sup>-1</sup>) and 519 % (6.86 t ha<sup>-1</sup>) higher than their respective C monocrops single harvest. PI is ideal for livestock oriented system with significant PUE and forage advantages in a dry season, however the food crop suffers severe yield penalties under drier conditions.

**Keywords:** Dryland, pasture cropping, precipitation use efficiency