



Tropentag, September 20-22, 2017, Bonn

“Future Agriculture:  
Socio-ecological transitions and bio-cultural shifts”

## Run-off, Soil Moisture, and Weed Management Strategies to Increase Water Productivity in Rain-fed Crops in Tanzania

ALEXANDRA SCHAPPERT<sup>1</sup>, ANGELA SCHAFFERT<sup>2</sup>, JÖRN GERMER<sup>3</sup>, FOLKARD ASCH<sup>4</sup>

<sup>1</sup> *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*

<sup>2</sup> *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*

<sup>3</sup> *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*

<sup>4</sup> *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*

### Abstract

Smallholder crop production systems in the semi-arid Dodoma region frequently suffer from drought-induced yield losses due to inadequate rainfall distribution and erratic rainfall events. The 30 year average rainfall amount of 500 mm during the rainy-season indicates that in general precipitation is sufficient for the crops to mature. Run-off management could reduce the effects of intra-season variability in precipitation and in combination with improved weed management is likely to improve overall soil moisture availability which in turn may result in more stable yields.

The aim of this study was to analyse the potential of i) run-off management through tied-ridges, ii) minimal irrigation to keep the soil moisture above the permanent wilting point and iii) weed management to stabilise yields in pearl millet, sorghum, maize, and sunflower by improving water productivity.

Due to soil surface modification, tied-ridges (i) collect water during rainfall events and thus increase the infiltration. Minimal irrigation requirements were set to 50 % of the crop water requirements following the FAO-56 methodology and supplied via drip irrigation (ii). The weeding treatments (iii) comprised clean weeding (4–5 times weeding) and farmer’s weeding practice (once after emergence and once after canopy closure).

The experiments were conducted at the Agricultural Research Institute Makutupora, Tanzania, during the wet season from January until May 2015 and 2016. Soil moisture was measured frequently using a PR<sup>2</sup> Profile Probe. Leaf area, crop development stages, and biomass accumulation and partitioning were determined at regular intervals, and yield components were determined at harvest.

The gained dataset helped to explore the influence of differing soil moisture levels on biomass production and crop development stages. Furthermore, ANOVA with post hoc Tukey-Test ( $P \leq 0.05$ ) was analysed to evaluate the impact of run-off, soil moisture management and lower weeding frequencies on crop productivity. Tied-ridges and minimal irrigation generally increased grain yields by 80 — 99 % in 2015 and by 16 — 37 % in 2016. The yield-increasing effects were more pronounced in 2015 due to the very low yielding

flat, rain-fed plots caused through insufficient rainfall amount (2015: 321 mm and 2016: 799 mm from January until May).

**Keywords:** Deficit irrigation, soil water, tied-ridges, water use efficiency