

Abstract

Micro-field rain-harvesting farming system (MRFS) has demonstrated great potentials to enhance field productivity and profitability of dryland wheat (*Triticum aestivum* L.) in semiarid eastern Asia, yet little is known whether this system results in desired effects in semiarid Africa such as Kenya. A two-year field experiment was conducted during 2012 and 2013 growing seasons to evaluate the effects of introduced MRFS on water availability, field productivity and economic benefits using a local wheat (*T. aestivum* L.) cultivar *DUMA* in a semiarid site of Kenya. Five treatments were designed as: 1) ridge and furrow with transparent plastic mulching (RFT); 2) ridge and furrow with black plastic mulching (RFB); 3) ridge and furrow with grass straw mulching (RFS); 4) ridge and furrow without mulching (RF); and 5) traditional flat planting (CK). The results showed that mulching treatments (RFT, RFB and RFS) significantly decreased the evapotranspiration (ET) by 11.4–88.5 mm, increased wheat grain yield by 60%–163%, above-ground biomass by 58%–104% and water use efficiency for grain by 68%–271%, compared with CK over two growing seasons. RFT and RFB treatments resulted in maximal soil water storage at 1-m depth and the greatest harvest index among all treatments. Linkage analyses indicated that grain yield showed significantly positive correlation with plant height, leaf area and major spike components ($P \leq 0.05$), suggesting that plant type of wheat was altered for better yield production as a result of MRFS operation. More importantly, economic ratios of output to input were also calculated and compared. The average ratio of output to input for CK was 3.86, slightly lower than 4.28, 4.06, 5.86 and 5.34 for RFT, RFB, RFS and RF, respectively across two growing seasons. In particular, net incomes in MRFS (RFT, RFB, RFS and RF) were increased by 145%, 128%, 117% and 82% respectively, compared with that of CK. In conclusion, on-field rain-harvesting farming system provides an innovative management to boost the productivity and profitability of dryland wheat, and a potential solution to cope with food security in semiarid Kenya.