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Abstract

Field experiments were conducted for six seasons (2007 and 2009) in Makueni County to evaluate the effects of three tillage systems (tied-ridging, subsoiling-ripping and ox-plouging) in conserving water for the production of maize and cowpea under smallholder farming conditions. Four cropping systems which included maize, cowpea, maize-cowpea intercrop and maize with 5 t ha-1 manure were compared in each tillage method. Data on soil water storage, crop yields and profitability were collected every season. Farmers' preference and acceptability to water conservation technologies was determined from a survey conducted during a farmers' field day.

Results showed that soil profile (0-110 cm) water storage averaged highest (221.0 mm) in tied ridges tillage followed by ox-plouging (203.2 mm) and then subsoiling-ripping tillage (196.3 mm) with ox-plouging and subsoiling-ripping tillage systems having no significant differences. Soil water balance components (soil bulk density, infiltration, porosity, crust strengths) were better in

ox-ploughed treatments than in subsoiling and ripping. Maize and cowpea yields and water use efficiency were generally higher under tied-ridging than under subsoiling-ripping and ox-plouging tillage. Subsoiling-ripping resulted in lower cowpea grain production and water use efficiency relative to ox-plouging tillage. When averaged across the seasons and tillage, manure increased (P≤0.05) maize grain by 36% to 1.23 Mg ha-1 compared to 0.89 Mg ha-1 while intercropping reduced the yields by 40% to 0.53 t ha-1. Tied ridging increased land preparation labour costs by 190% while subsoiling-ripping reduced labour cost by 53% relative to ploughing. Production costs were highest in tied-ridging and lowest in subsoiling-ripping. Maize production resulted in economic losses in two out of four seasons. Compared with maize, cowpea was more economically productive especially in ox-ploughing.

Key words: Tillage; cropping systems; water use efficiency; grain yields; gross margins; technology adoption; sandy loam soil