

Effect of Fanya Juu Terraces With Varying Ditch Dimensions on Selected Soil Properties and Crop Yields in Semi-arid Eastern Kenya

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Abstract

Fanya juu terracing is a soil and water conservation practice used to control erosion and increase agricultural productivity in sloppy and hilly areas. The practice involves digging ditches and throwing the soil uphill to form embankments that obstruct runoff flow. Scanty information exists on their temporal and spatial effects on soil moisture, nutrients variability and crop yields especially on different types of soils. An on-farm study was, therefore, conducted in both the long rain (LR) and short rain (SR) seasons of 2014 and 2015 on the Luvisols in Mua location in Machakos County in semi-arid Eastern Kenya, to help generate this information. The objectives were to (i) determine the effect of Fanya juu terraces with varying ditch dimensions on soil moisture variability along the slope on hard-setting soils (ii) determine the effect of terraces on the spatial variability of selected soil nutrients along the slope and (iii) assess the effect of terraces on maize and bean grain yields on the hard-setting soils of semi-arid Eastern Kenya. A split-split plot design with four replicates was used. Treatments consisted of terraces with 60, 30 and 0 (Control) cm ditch depths and three cropping systems (sole maize, sole beans and maize/bean intercrop). Soil moisture content (SMC), quantities of selected nutrients (nitrogen, phosphorous, potassium, organic carbon) and maize and bean grain yields were monitored at the upper (US), middle (MS) and lower (LS) slope positions of the terraces. Data was subjected to analysis of variance (ANOVA) and means compared across seasons at a 95% level of confidence using the least significant difference of means (LSD). Results showed that SMC and its variability in the different terraces were influenced by the distribution and amount of rainfall. Significant difference ($p \leq 0.001$) was found in the interactions of season, ditch depth and slope position. Treatments with ditches had higher SMC than the control in all seasons. Soil moisture content was higher in terraces with 30 cm ditch depth compared to those with 60 cm in low and poorly distributed rainfall seasons but lower in the high and well-distributed rainfall season. Significantly higher SMC was recorded in the LS position of the terraces compared to the US and MS positions except when seasonal rainfall was high and well distributed. Total nitrogen and available phosphorous were both significantly ($p < 0.001$) higher in the LS than in the US positions. Maize and beans grain yields were significantly ($p \leq 0.05$) higher in terraced than non-terraced treatments and at the LS position compared to the MS and US positions. Terraces with 30 cm ditch depth produced higher grain yields than those with 60 cm in low and sparsely distributed rainfall seasons. The findings implied that the construction of Fanya juu terraces with 30 cm ditch depths was favourable for the conservation of soil moisture, nitrogen and phosphorous contents on hard-setting soils in the marginal rainfall areas of semi-arid Eastern Kenya. Farmers can therefore, save on labour and still achieve better yields by constructing terraces with 30 cm ditch depth. The results also implied that spatial variations in contents of N and P caused by Fanya juu terraces can be utilized more efficiently through increased intensification of the lower slope position to improve crop production. The study recommends the construction of Fanya juu terraces with a ditch depth of 30 cm and intensification of the lower slope position for increased utilization of the available nutrients and

moisture in low and poorly distributed rainfall environments. It further recommends more studies on different soil types, development of technologies that favour efficient utilization of resources without causing degradation at the lower slope, and practices that will increase productivity at the upper position of the slope for improved food security.

Key words.

[Fanya Juu Terraces, Selected Soil Properties, Crop Yields, Semi-arid Eastern Kenya](#)