

**INTEGRATED SOIL FERTILITY AND
WATER MANAGEMENT PRACTICES FOR
ENHANCED SORGHUM PRODUCTIVITY IN
THE DRYLANDS OF THARAKA-NITHI
COUNTY, KENYA**

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ABSTRACT

The low yields of cereal crops such as sorghum in dryland areas such as in Tharaka Nithi County of Kenya, is predominantly attributed to low nutrients and inadequate soil moisture content. These challenges can be managed by integrating soil fertility and water management (ISFWM) practices. This study sought to evaluate the effect of integrated soil fertility and water management practices on soil chemical and physical properties for enhanced sorghum productivity in the drylands of Tharaka-Nithi County, Kenya. The experiment was conducted over 2 seasons employing a randomized complete block design (RCBD) consisting of seven treatments replicated eight (8) times. The first five treatments consisted of high (120 kg N ha⁻¹) or moderate (60 kg N ha⁻¹) nitrogen applied from decomposed goat manure and NPK inorganic fertilizer combined with tied ridging, conventional tillage as well as minimum tillage + mulch, the sixth treatment was beneficial legume intercrop while the seventh one was the control treatment. One and two-way ANOVA were used to analyze the data, and the significant means were separated using the post-hoc honest significant difference (HSD) tests at 5% significance level. Pairwise mean comparison of soil physico chemical properties before and after the experiment was implemented using Students paired T-test at $p < 0.05$. There was a significant increase in soil pH in all high-input treatments, where there was significant increase in soil carbon within all treatments than the control. Soil P and K increased in all the treatments while soil Na reduced significantly, with the highest decline in the high manure and fertilizer with minimum tillage and mulch treatment. Soil aggregate stability was lowest in the control and highest in Beneficial Legume Intercrops treatment. The soil moisture trend in both seasons recorded highest values in high-input treatments during all the sampling times. The highest stover yields were recorded in high manure and fertilizer with tied ridging, while the least was observed in the control treatment in all seasons. Combined analysis of both seasons showed that the highest aggregate stover yields (7.1 t/ha) were observed in the high manure + fertilizer with conventional tillage and high manure + fertilizer with tied-ridging treatments, while stover yields was lowest in the control (2.6 t/ha). Moreover, the yield of sorghum grains was highest (1.2 t/ha) in the high manure + fertilizer with minimum tillage with mulch and high manure + fertilizer with conventional tillage treatments and lowest in the control (0.5 t/ha). These findings indicate the potential of ISFWM practices in improving chemical and physical properties and enhancing soil fertility, moisture retention and water use efficiency thus promoting sustainable production in drylands agro-ecozones. Therefore, the findings point out the need to adopt ISFWM in dryland soils to increase the potential productivity of sorghum crops. These practices should therefore be promoted among the farmers to ensure the nutrients mined from the soils after every harvest are replenished in a sustainable manner.