

Effects of tied ridges and different cattle manure application rates on soil moisture and rainfall use efficiency on maize growth and yield in semi-arid regions of Zimbabwe

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Abstract

A 3-year rainfed field experiment was carried out to determine effects of combined tied ridges and cattle manure application rates on maize productivity. The experiment was laid as a 2×4 factorial in a completely randomized block design (CRBD) with 3 replicates. Treatment combinations were tied ridges + 7.5 t ha^{-1} low cattle manure (TLM), tied ridges + 15 t ha^{-1} standard cattle manure (TSM), and tied ridges + 22.5 t ha^{-1} high cattle manure (THM) application rates. No-tied ridges + low, medium, and high quantities of cattle manure were used as positive controls. Early maturing maize variety (SC537) was then planted at 52000 plants ha^{-1} in each plot. Soil water storage, soil bulk density, rainfall, dry matter accumulation (DMA), and grain yield were measured. Rainfall use efficiency (RUE) was then calculated. Analysis of variance was done to determine effects of tied ridging and cattle manure on soil moisture content, RUE, and grain yield. Addition of cattle manure in tied ridges increased the soil moisture content, RUE, DMA, and grain yield. The measured parameters were significantly ($p < 0.05$) increasing with an increase in quantity of cattle manure applied. The THM had 40% higher soil moisture content, 20% more RUE and > 50% DMA compared to TLM. Grain yields significantly ($p < 0.05$) increased with an increase in application rates of cattle manure with highest (3.2 t ha^{-1}) recorded in 2022 season under the THM treatment. The THM had significantly ($p < 0.05$) higher grain yield compared to no-tied ridges combined with corresponding cattle manure application rates. Farmers can practice tied ridges and 22.5 t ha^{-1} cattle manure to improve RUE and maize grain yields in the semi-arid areas of Zimbabwe.

Keywords: Arid conditions, Drought, Maize production, Organic manure, Soil water