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Resilience and Economic Benefits of Water Harvesting and Changing Planting Date in Maize Systems of Semi-arid Tanzania

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Abstract

In sub-Saharan Africa (SSA), climate variability and poorly adapted farming practices threaten food security, economic growth and development among rural households. Unpredictable rainfall challenge smallholder farmers to determine the appropriate timing for planting and result in crop failure and declining crop yields. There is inadequate information on the resilience and economic benefits of improved technologies to inform farmers in semi-arid conditions. This study adopted a split plot experimental design in 2017/18 and 2018/19 cropping seasons to test the resilience and economic benefits of select management practices (ox-cultivation/control, tied ridges, Chololo pits and intercropping) and planting dates (early, normal and late) with three replications. Long-term annual rainfall recorded was below average by 40 % which lead to declined yield at 6 % in 2019 cropping season due to droughts. Chololo pits at early and tied-ridges at late planting dates significantly ($p = 0.047$ and $p = 0.001$) increased maize grain yield (3.1 and 3.6 t ha^{-1}) respectively in both cropping seasons as compared with ox-cultivation at normal planting dates. Similar practices had higher biomass yield (ranging from 4.6 to 4.7 t ha^{-1}) and economic benefits of average margin rate of return of 89.82 % and 83.64 % also marginal net return of 426.05 USD/ha and 460.92 USD/ha in two cropping seasons. In both cropping seasons, Chololo pits and tied ridges demonstrated the highest resilience on soil moisture retention at 10.8 % and 13 % that influenced maize growth and yield. Chololo pits and tied ridges at early and late planting dates can be recommended as climate-smart because they yield resilience and economic productivity benefits that smallholder farmers in semi-arid areas of central Tanzania can capitalize on.

Keywords: Climate change, climate-smart agriculture, climate change, economics, planting date, resilience, water harvesting

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