ENHANCING FARMERS' AGRICULTURAL PRODUCTIVITY THROUGH IMPROVED FIELD MANAGEMENT PRACTICES IN THE CENTRAL HIGHLANDS OF KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or any other award.

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DECLARATION BY SUPERVISORS

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

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ABSTRACT

Farmers in central highlands of Kenya have been experiencing declining crop yields in the recent past. Low water availability caused by low and unreliable rainfall, and poor water harvesting techniques coupled with low soil fertility are key constraints to crop production in these regions. To increase crop yields, and reduce production risks, better use of available rainfall is required. The broad objective of the research was to enhance farmers’ agricultural productivity through improved field management practices in the central Highlands of Kenya. The research was carried out in Maara, Meru South both in Tharaka Nithi County and Mbeere South district in Embu County. The study used both sociological and experimentation approaches. Long term rainfall and other meteorological data were utilized in the modeling exercise. A socio-economic survey was conducted to explore how farmers make crop production decisions and adapt their field practices in response to seasonal rainfall distribution patterns. Tillage and surface management, timing of split nitrogen application and temporal staggered planting trials were conducted to assess their effect on maize yields and also to collect data for AquaCrop model parameterization, calibration and validation. The field trials were complemented with a runoff study. The rainfall analysis study established the most probable onset, cessation and the length of growing season. Rainfall analysis resulted in establishment of spatial rainfall onset and cessation dates of the study area. Based on farmer’s survey, key findings were on how the farmers adapted and also cope with not only rainfall variability but also climate variability. From the staggered planting trial results, dry planting led to 28%, and 37% higher grain yields in Kiamaogo and Machang’a, respectively, compared to normal (wet) planting. Hence, it was observed that decision on the planting date, roughly going along with the start of the rains, is of utmost importance especially in low potential regions like Mbeere. Tillage methods and surface management study highlighted the impact of integrated approach in in-situ water conservation. For instance, even though there was significant \( p=0.05 \) influence of minimum tillage on soil water conservation with ift, surface management strategies were more apparent within a short time and their influence on maize yields was significant. Split application of 70N proved to be the best application method leading to 18% grain yield increase compared to single application. The findings also underscored the potential use of calibrated AquaCrop model with a high degree of reliability; \( R^2=0.87 \) to 0.96 for combined observed and estimated grain and stover yields in Machang’a and Kiamaogo. AquaCrop model was recommended for use in practical management, strategic planning, and estimation of yield production under varying climatic and agro-ecological conditions. The runoff study clearly showed that under water limiting conditions, tied ridging was a very efficient technique in reducing sediment yield by 94% followed by mulching (73.5) compared to conventional practise (Bare surface). It was observed that conventional tillage accelerates soil loss as signified by high sediment yields irrespective of the rainfall pattern. The output of this study would be invaluable to extension service providers, governments, bureaucrats and people in regional natural resource management groups in planning, designing and evaluating effective and efficient soil and water conservation strategies at local, regional and national scales. This would in turn result in positive spin-offs in farmers’ adoption of soil and water conservation practices.