MAKERERE UNIVERSITY

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

SCHOOL OF FOOD TECHNOLOGY, NUTRITION AND BIO-ENGINEERING

HYDROLOGICAL MODELLING OF RIVER MANAFWA BASIN FOR IRRIGATED AGRICULTURAL DEVELOPMENT

BY

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Agricultural production is carried out in most parts of Uganda for both domestic and commercial purposes. In most regions of Uganda, the population depends on this rain fed agricultural production throughout the year. The changes in the climate have greatly hindered the production leading to a decline of 10% in agricultural produce. Therefore there is a need of supplementary production in order to increase production within the regions of Uganda. One of the methods to improve production within Uganda is carrying out irrigated agriculture. Eastern region of Uganda is one of the targeted areas for the irrigated agriculture due to presence of major permanent rivers such as Manafwa and Mpologoma. Presence of the permanent rivers in the region has made available potential water sources for irrigated agriculture to supplement food production during dry periods of the year. The change in climate has led to uncertainties in the river flows hindering irrigation planning in the region. Therefore there was a need to determine the available water for irrigation from the river flows that can sustain irrigation within the region. In this study, a hydrological model was conducted for river Manafwa flows to determine the potential acreage that they can sustain for surface irrigation. Using ArcGIS, a digital elevation model was used to clip out the catchment which was then delineated to establish drainage area of about 8410 km^2 and the watershed. Annual runoff estimates were computed using the SCS CURVENUMBER method in GIS. The catchment curve numbers were determined using soil and land use data layers from FAO website, where the layers were reclassified, superimposed and merged. The annual runoff estimates were computed using spreadsheets and rainfall data. The river flows were then characterized from daily historical flow measurements from 1946 to 1946 at Busiu gauging station where hydrograph and flow duration curves were plotted. The dependable flow was determined at 75% probability of exceedance (5.29 m^3/s). Water balance analysis was done to determine the portion of water is available for agricultural use. Maize crop having the highest water requirement was used as the base crop to determine the minimum acreage that can be irrigated from the available water. Using CropWat software, the irrigation requirement for maize crop for both growing seasons was determined. Two crop growing seasons were considered for the river water shed. For April - August season, an irrigation requirement of 0.62 l/s/ha and the potential irrigation acreage of 2810 ha was determined. . For September - March season, an irrigation requirement of 0.89 l/s/ha and the potential irrigation acreage of 1958 ha was determined. The results suggest that within the river Manafwa basin, the agricultural water can be utilized for irrigation for a particular acreage as this will increase agricultural production within the region.