

SWAT model application for Irrigation development project in Kenya
– Case study of MWEA Irrigation Scheme, KIRINYAGA County, KENYA –
 ケニアにおける灌漑計画に対する SWAT モデルの適用

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1. Introduction

Kenya has a land area of around 580000km². Of this area, only about 20% is suitable for agriculture. Agriculture is of great importance to Kenya as it contributes about 27% to the country's GDP. The main staple foods consumed in Kenya are maize, wheat and rice respectively. However, in terms of increasing consumption, the annual increase rate of consumption of rice is the highest at 12% as compared to 4% for wheat and 1% for maize. Most of the rice grown in Kenya (about 89%) is grown in irrigation schemes that have been set up by the government across the country, and also from smallholder farmer groups. (Kenya National Rice Development Strategy 2008-2018 report).



Fig. 1 Mwea Irrigation Scheme (MIS) location in Kenya

The largest rice production scheme in Kenya is known as Mwea Irrigation Scheme located in Kirinyaga county in Kenya. It was started in mid 1950s as an irrigation scheme that predominantly cultivates rice and is currently managed by the National Irrigation Board (NIB). It is broadly divided into 5 main sections; Wamumu, Karaba, Thiba, Mwea and Wamumu. Of the total gazetted area of about 1,200 ha, about 8,000 ha has been developed for paddy production. Irrigation water is obtained from the schemes two main rivers; R. Thiba and R. Nyamindi. The water abstracted via fixed weir intakes is conveyed and distributed to the paddy fields through open lined and unlined canals. Approximately, 2,000 ha has been developed by out growers who also use the irrigation water. The scheme main challenges include inadequate water supply and poor state of infrastructure. To address the water inadequacy challenges, NIB has proposed for the development of a dam along R. Thiba and has already committed considerable amounts of funds and resources into infrastructural

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development. Also, the scheme targets expansion by another 3000 Ha in a project currently underway in tandem with the development of Thiba Dam.

The objectives of this research are;
 1) To analyse water supply amount for new irrigation district and existing area by hydrological model, and 2) To estimate increase of irrigable area and rice production based on different modelled scenarios. In hydrological model analysis, SWAT model was applied.

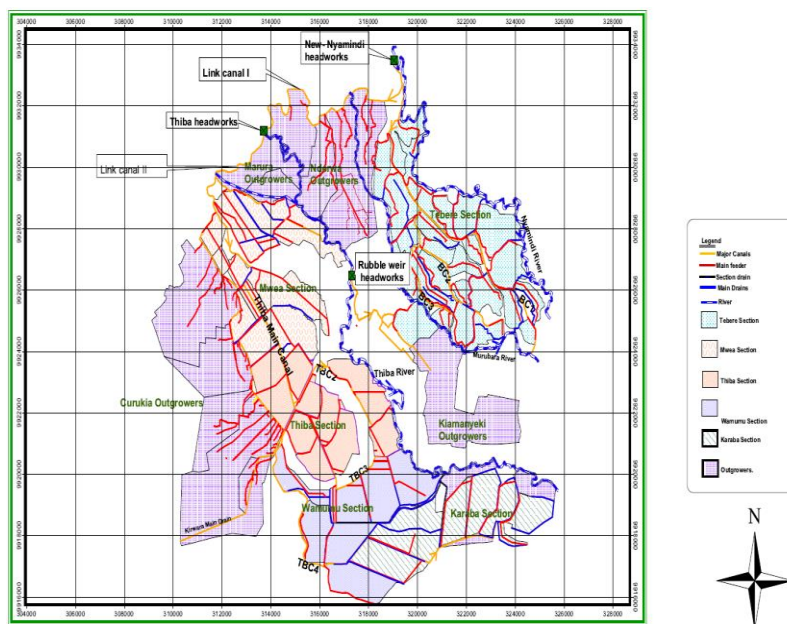


Fig. 2 Mwea Irrigation Scheme layout

2. Methodology

2-1. SWAT Model Approach

SWAT (Soil Water Assessment Tool) is a river basin scale model developed by Dr Jeff Arnold for the USDA Agricultural Research Services (ARS) It's a physically based model that incorporated data such as weather, soil properties, topography, vegetation and land management practices to continuously simulate watersheds. SWAT model will be used in assessing the water balance in the scheme based on several scenarios; without the dam and convectional paddy flooding irrigation, without the dam and water saving technologies such as intermittent irrigation, with the dam and convectional paddy flooding irrigation and with the dam and applying water saving technologies

2-2. Model Development

Various water saving technologies trials have been applied at plot scale within Mwea Irrigation Scheme. Notably, Water Saving Rice Culture (WSRC) has had several trials at this scheme and has proven that water saving technologies such as intermittent irrigation can be applied and the rice productivity and turnover can be increased as compared to conventional paddy flooding irrigation

Currently, several data such as climatological data, river discharge data, DEMs, scheme layouts etc. are being used to model the aforementioned scenarios to give insight into how more irrigation water can be saved while still achieving the same or even higher turnover from rice crop within the scheme.

3. Conclusion

This research is expected to highlight how water saving methods can be applied at scheme level to improve water productivity and while also increasing the overall turnover from rice. From the data analysis of the various scenarios modelled, this research will give recommendations on water management in order to contribute to improving the overall irrigation planning and water management within Mwea Irrigation Scheme.