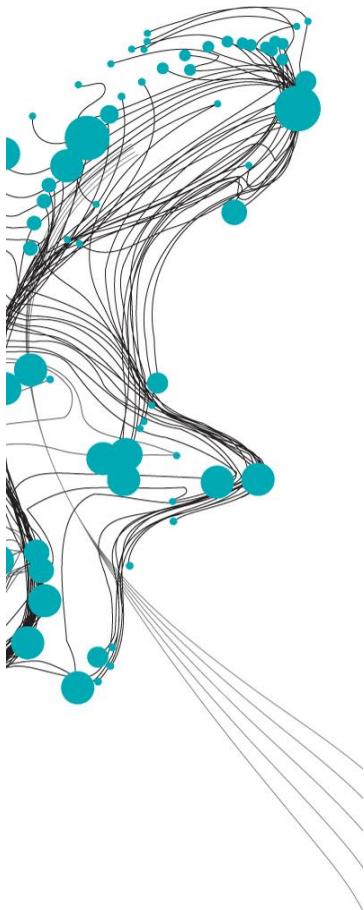


Increase in staple crop production and yield stability for sub-Saharan Africa through supplemental irrigation and associated water needs



The majority of sub-Saharan African (SSA) agriculture is rainfed and has low and variable yields. Supplemental irrigation (SI) might be a solution to increase yields and yield stability. The goal of this study is to quantify the potential effect of large-scale implementation of supplemental irrigation on crop yields throughout SSA as well as on the temporal variability of crop yields and the irrigation water volumes required.

In this study we defined SI strategies as having the highest marginal water productivity (MWP) ($\frac{\Delta Y}{\Delta ET}$). Strategies in this study consist of an separate irrigation threshold and amount for the vegetative, flowering and yield formation crop stage. We used the crop model AquaCrop to determine robust SI strategies for four staple crops: maize, sorghum, cassava and wheat. Potential SI strategies that have a high MWP in many locations and years were taken as being a robust SI strategy.

Implementation of these robust strategies without limitations increase average, currently rainfed, yields by 22, 54, 30 and 33% for maize, sorghum, cassava and wheat respectively and reduce the interannual coefficient of variation of yield of said crops by 73, 70, 74 and 72%. The water use associated with this is 33, 83, 70 and 97 mm of evapotranspiration of irrigation water for respectively maize, sorghum, cassava and wheat.

Limiting the implementation of SI to locations with sufficient amounts of available water changes the increase in yield to 15, 25, 28 and 19% for maize, sorghum, cassava and wheat respectively and reduce the interannual coefficient of variation of yield of said crops by 70, 43, 32 and 36%. The water use associated with this is 17, 31, 63 and 52 mm of evapotranspiration of irrigation water for respectively maize, sorghum, cassava and wheat.

Large scale implementation of SI has the potential to severely increase yields and yield stability for SSA staple crops and might be part of a solution for food security for SSA in the future.

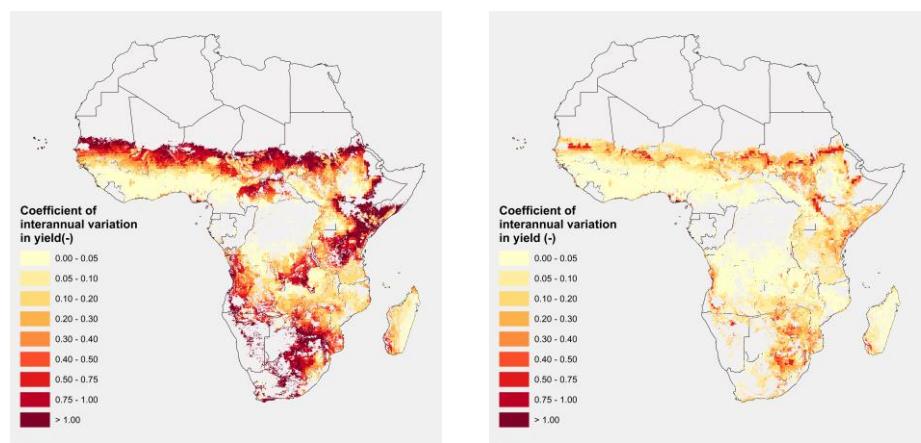


Figure 1: Coefficient of interannual variation in yield (-) for currently rainfed maize (left) and for not water availability limited supplemental irrigation on currently rainfed maize (right). Map of sub-Saharan Africa between the years 1986-2015 at a 5x5 arcminute resolution.

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26 September 2019

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