Abstract

This study attempts to explain food shortage in a water scarce Muooni catchment using operational research inventory models. It seeks specifically to evaluate farmers" water economic order quantity (EOQ), limit average cost (LAC) and minimum efficient scale (MES) of water use in farming, for rationalization and optimization of crops water requirement and crops yields under rainfall fluctuation. Such an approach helps integrating spatially distributed and descriptive mathematical variables of water storage with economic performance and environmental sustainability. Results show that Muooni dam siltation and subsequent water stress threatens the economic viability of smallholder farms in the catchment. Both endogenous on-farm management factors and exogenous environmental agents hamper the rate of fertile soil loss and water stress under rainfall fluctuation. They increase significantly the costs of costs water saving and shortage costs in farming, threatening agriculture economic viability and food security. For efficiency, farmers need to define a water demand EOQ under ANOR, or a quantity well-matched with the LAC under NOR, or a MES quantity under BNOR in order to optimize their crops water requirement. This means that they need to implement rational methods of water use in farming and appropriate farming technologies to foster allocative and technological efficiencies within the production possibility frontier. Also, the government should implement a catchment management strategy (CMS) in Athi catchment in general, and Muooni in particular, to mitigate the risk of food shortage and water conflicts under unexpected drought.