Tittle: Opportunities for increasing productive water use from dam water: a case study from semi-arid Zimbabwe

Author: F.T.Mugabe, M.G. Hodnett, A.Senzanje

Abstract

Communities in the semi-arid areas of Zimbabwe rely on dryland farming, but do not get adequate yields in many years because of the low and erratic rainfall. Surface water from small reservoirs and groundwater is used for water supply and to irrigate community gardens. These gardens provide an additional source of nutrition and income from produce sold. These limited water sources are a buffer during dry seasons and dry years and should be managed appropriately, but management often is hindered by inadequate knowledge of the relationships among rainfall, run-in, evaporation, seepage and productive water use. A study was carried out within the catchment of the Mutangi dam, a small reservoir (surface area, 8.7 ha; capacity, 111,000 m_3; maximum depth, 2.5 m) in a semi-arid area in southern Zimbabwe during the 1999/2000 and 2000/2001 seasons. In these seasons, the Mutangi catchment received 755 and 615 mm of rainfall of which 13% (102 mm) and 10% (62 mm) resulted in runoff, respectively. Of this runoff, 79 and 45 mm spilled over the dam and 24 and 19 mm was caught by the reservoir in 1999/2000 and 2000/2001 seasons, respectively. Monthly rates of water loss/use from the dam varied between 3.8 mm day^{-1} in June and 8.6 mm day^{-1} in November. In volume terms, the highest rate of loss occurs when the dam is full and its surface area is at its maximum. Almost 97% of the loss was through surface evaporation with only 3% used productively, split approximately as 2% garden irrigation and 1% animal watering. Scenarios on how much water to use for irrigation in years with different rainfall were run. Water usage could be safely increased by a factor of 5 in years when the dam last spilled between February and May. The later the last spill occurs, the more water is available for productive use. It is better to use water earlier in the dry season when volumetric loss rates are highest, to “compete” with this loss. The study highlights that a management approach that matches the quantity of water used to the amount of water in the reservoir is required for sustainable use of surface water resources. The volume of water in the reservoir should be monitored by the communities using a staff gauge and a stage–volume curve for the reservoir, to allow rational decisions on setting permissible rates of water use through the dry season to ensure that a “buffer” reserve of water will be maintained in the event of late arrival of the rains. If critical levels

are reached, water use can then be reduced, and non-essential use stopped.