Analysis of Paddy Water Use through Irrigation Reservoir Management – Case Study of Tasal Reservoir, Kampong Speu Province, Cambodia –

灌漑用ため池の水利用解析－カンボジア国カンポンスプ州タサル池の事例－

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1. Introduction

Cambodia is located in South-East Asia and its economy strongly depends on agriculture sector and potential of domestic agriculture productivity. The primary agricultural commodity is rice and other major crops are cassava, maize, sugarcane, pepper, and soy bean. Agricultural sector is accounting for 31.4 % of Cambodian GDP in 2005 (MOWRAM, 2012). Cambodia is one of the most water-abundant countries with total amount of water of 289.4 billion m^3. The maximum quantity of water use each year is estimated to be 750 million m^3, and 95% of water consumption is used for irrigated agriculture (MOWRAM, 2012).

Kampong Speu province is located to the west of Phnom Penh, the capital city of Cambodia, with 7,017 km^2 (JICA, 2013). This province is one of the most affected by heavy rainfall in wet season, especially in lowland areas, also drought is occurred in the dry season in upland areas under monsoon climatology. Mostly existing irrigation systems are poor functions then they aren't able to distribute well to irrigated area in dry season. Tasal dam is installed to mitigate the situation but the reservoir operation is quite difficult in this tough condition.

Therefore, to improve water management in the reservoir, water balance analysis is conducted for irrigation demand and supply, and efficient water use plan in irrigation district would be proposed at the Tasal reservoir.

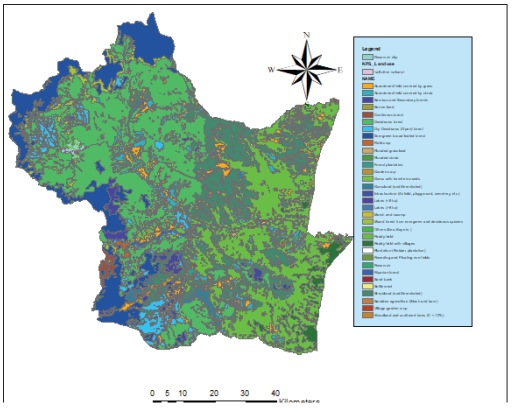

Fig 1. Tasal Reservoir locates in Kampong Speu

2. Materials and Methods

Water balance in the reservoir is estimated by equation $\Delta Vs = V(Qin) - V(Qout)$, where ΔVs is change in volume of water storage in the reservoir (m^3), $V(Qin)$ is volume of inflow into the reservoir (m^3), and $V(Qout)$ is volume of outflow of the reservoir (m^3). On the other hand, water supply is volume of outflow from reservoir minus volume of evaporation and infiltration due to the supply period is no spilling out of the reservoir. For water demand, the irrigation water requirement is applied as $IWR = (ETo \times Kc + PR + Lp - ER) / IE$, where IWR is irrigation water requirement for diversion unit, ETo is reference evapotranspiration, Kc is crop coefficient, PR is percolation rate, Lp is land preparation requirement, ER is effective rainfall, and IE is irrigation efficiency. Hydrological data is collected from Kampong Speu Provincial Department of Water

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Resources and Meteorology and weather station on the dam as well as water level is recorded by gate keeper at the reservoir.

3. Ongoing Result and Discussion

In Fig.2, it shows that it was quite low precipitation from Jan to Apr in 2019 and 2020 which can't meet to crop water requirement in command area. During dry season crop water requirement was quite high if comparing with wet season. Then, this area needed water supply from the reservoir in the dry season.

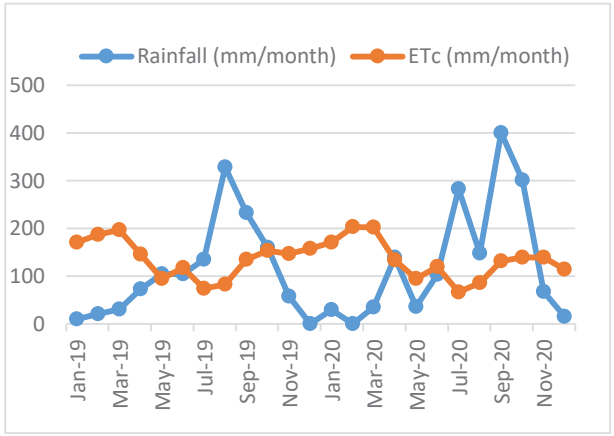

Fig 2. Rainfall and Crop Water Requirement

Water supply and demand was shown in Fig.3. Water supply wasn't enough in the early of dry season in Jan and Feb in 2019 and 2020, these gaps were fulfilled by Tasal reservoir water supply. However, there is no data to show mitigation of drought. And there are still farmers complain for lack of water supply.

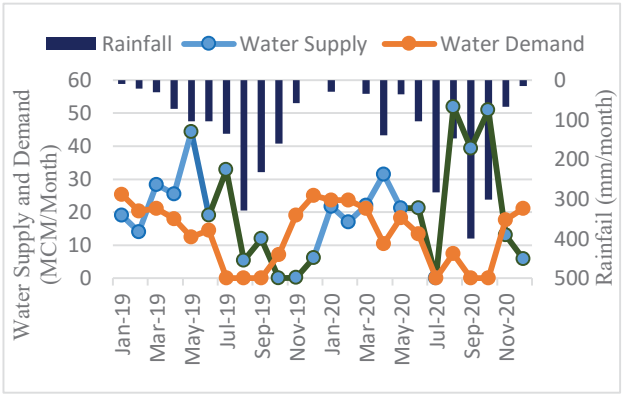

Fig 3. Water Supply and Demand in Research Area

Withdrawal amount from Tasal reservoir was shown in Fig.4. This shows gate keeper try to discharge reservoir water in Jan to Jun in 2019 and 2020. Some farmers would like to start irrigation from Oct, because small amount water was restored concaved area in irrigation block. Though it is not reliable resources, farmers can get a chance. Also water is available to use from Jan by irrigation supply from Tasal reservoir. This water use is not secured, but as farmers always would like to maximize their profit, it is not avoidable. If water supply could start from Dec, dry season products could be more reliable. The normally reservoir operation is focused on irrigation in dry season and evacuation in rainy season in order to control flood occurred at downstream during wet season. Water release for irrigation depends on Provincial Department of Water Resource policy and farmers requesting while evacuation release relies on real situation of inflow in the reservoir. Then, further analysis of reservoir operation will be conducted.

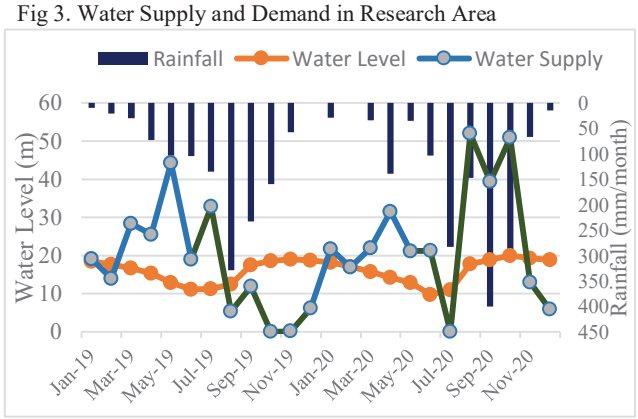

Fig 4. Water Supply and Water Fluctuation in Tasal Reservoir