Assessment of Rice Production System and Water Productivity
in Sumani Watershed, West Sumatra, Indonesia

インドネシア国西スマトラスマニ流域におけるコメ生産システムと水生産性に関する評価

農業環境工学専攻　　農業環境工学大講座

Nova Anika

Indonesia is a major rice consumer and producer in the world. Sumatra Island is economically less developing compare to Java Island that make yield also relatively lower. In order to increase rice production, the government of Indonesia has done several investment programs such as development adequate irrigation system, agriculture machinery, fertilizer subsidies, etc. However, they need to prioritize the implementation due to budget limitation. Since rice production is controlled by several interrelated factors: climate, hydrological regime, agricultural input, agricultural practice, management and technology, and socioeconomic conditions, fully comprehending rice production system is necessary for decision making for rural development. The objectives of this study are to identify the various factors that affect rice production and to estimate water demand, supply and productivity for sustainable rice production. Sumani watershed, Solok Regency, is a primary rice-producing region with a high demand for agricultural development and investment, to better inform policymakers.

In this study, Structural Equation Modelling analysis on agricultural system (natural condition, agricultural input and socio-economic condition) in major rice production area. In addition, water supply, demand and productivity analysis under current irrigation facilities and the improvement of irrigation efficiency scenarios for future investment of irrigation system. Artificial Neural Networks (ANN), a biologically inspired computer programs designed to simulate the way in which the human brain processes information was used to analysis of hydrology and water resources condition and F.J. Mock tank model was used to analyze water balance in the study area. The Water Evaluation and

Planning System (WEAP) a forecasting tool for maintaining water demand and supply information was applied to analyze future condition of water demand and supply base on several scenarios.

SEM analysis of various factors that affect cropping intensity and land productivity in the central rice production region of Solok Regency showed that not only the development of adequate irrigated area such as semi-technical and simple irrigation systems was the only government subsidy that contributed to rice production, increased evaporation also significantly affected the cropping intensity, while an increase in farmer's income through increased rice exports mediated by the presence of rice milling units and farmers' organizations affected both the cropping intensity and the average yield.

Available water supply in the Sumani watershed is approximately 40 % of rainfall. Since the study area is rice production region, irrigation water requirement is much higher than domestic water requirement. Based on the current condition of irrigation system, net irrigation requirement approximately 50 % of the total irrigation requirement. Annual available water supply can cover the annual water demand. However, insufficient water availability occurred in the dry season. Water productivity in the study area are influence by yield and irrigated area.

Further analysis regarding supply and demand is conducted based on several scenarios of population growth, improvement on irrigation efficiency and development of irrigation system. The findings of the scenario simulation are if there is no increase in the population growth rate and there is no improvement on irrigation efficiency Sumani watershed will require 37 % more water in 2050. On the other side, irrigation water requirement will decrease approximately 35% if all of rice field in the area only occupy by technical irrigation system with 80% of irrigation efficiency. However, the annual water requirement coverage is 100% only occurred in the very wet season with monthly unmet water requirement in the dry season.