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Continuous simulation of groundwater use and effluent discharge in catfish (Ictalurus punctatus) ponds at five locations in the Southeast U.S

Sugeng Triyono

CONTINUOUS SIMULATION OF GROUNDWATER USE AND EFFLUENT DISCHARGE IN CATFISH (*ICTALURUS PUNCTATUS*) PONDS AT FIVE LOCATIONS IN THE SOUTHEAST U.S.

By

Sugeng Triyono

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Long-term climatological data were used to evaluate the effectiveness of a drop/add management strategy to reduce groundwater use and effluent discharge in catfish ponds in the southeast U.S.. A drop/add approach is based on the creation of a storage volume in the pond for rainfall collection. The storage volume is created by allowing water level in the pond to decrease until some minimum level is reached. When the minimum level is reached, the pond is partly refilled, leaving the remaining volume available to capture incident precipitation. In this way, the role of precipitation in the water budget is increased. In the process, groundwater use and effluent release both become smaller.

The data consisted of 45 year precipitation and evaporation records from Fairhope, AL; Clemson, SC; Stoneville, MS, Stuttgart, AR; and Thomsons, TX. The data were used in a water balance levee pond model that included precipitation, evaporation, infiltration, overflow, groundwater pumping, and draining. The model appeared to indicate that the drop/add management scheme is an effective strategy to reduce groundwater use and effluent discharge.

The simulated results showed that variation of climate in the southeast U.S. was an important determinant of performance of the drop/add management scheme. At locations with positive P-0.8E, zero groundwater use could be achieved with low drop depths. At location with negative P-0.8E, zero groundwater use could be achieved for about 50% of the 45 simulated years. The model also indicated that effluent discharge cannot be avoided at most locations except at location with very low (negative) P-0.8E. The model also indicated that 65 to 100% of annual precipitation (depending on the P-0.8E's of the locations) can be captured and used in the ponds. Rainwater contribution to the total water budget ranged from 90 to 100%.

The sensitivity analysis showed that model sensitivity to pan coefficient and infiltration rate was affected by infiltration rate and pond water storage capacity (drop depth). The model was more sensitive to pan coefficient rather than to infiltration rate at lower infiltration rates and *vice-versa*. Both sensitivities of the model, however, increased when pond water deeper storage capacity was used.

Key words: aquaculture, pond, model, drop/add scheme

DEDICATION

I would like to dedicate this research to my parents Harinto Samad and Seruni, and my wife Sri hartatik, my son Afid Fitro Setiawan, and my daughter Vina Dwiayu Wardhani.

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