Quantifying the Integration of Olive Production and Inland Shrimp Farming

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ABSTRACT

By integrating aquaculture production into traditional agriculture, the impact of farming on already limited water resources and the reliance on chemical fertilizers can be reduced. Recent expansion of the aquaculture industry in Arizona has enabled us to study the integration of olive groves with marine shrimp culture. There are currently four aquaculture facilities in the state growing the pacific white shrimp, *Litopenaeus vannamei*. Each of these farms is using low-salinity (1.3-5.0 ppt) groundwater and in many instances, effluent generated at these farms is being used to irrigate field crops including wheat, sorghum, cotton, alfalfa and olives.

In order to quantify the effect of low-salinity shrimp farm effluent on olive trees, a field study utilizing a randomized block design was chosen. This trial examined three effluent/well water/fertilizer combinations: 100% well water (A); normal farm management/fertilizer (B); and 100% effluent. Treatments A and B were applied to three rows of twelve olive trees (*Olea europaea* var. Manzanillo), while treatment C was applied to four rows of twelve olive trees. Trees were flood-irrigated at a rate of 3785 L per row, every 7-10 days throughout the growing season. Duplicate water samples from each of the three treatment water sources were collected each time the trees were irrigated. Samples were analyzed for total nitrogen (TN), nitrate (NO3-N), nitrite (NO2-N), ammonia (NH3-N), total phosphorus (TP) and electrical conductivity (EC). In addition to the water analysis, tree growth was monitored monthly.

On average, trees grew 16.39 cm over the seven-month study ($F_{2,357}$ = 1.1099, P=0.3307). Average growth for individual treatments was: 14.61 cm for treatment A; 18.58 cm for treatment B; and 15.98 cm for treatment C. While growth of trees irrigated with low-salinity shrimp farm effluent (C), did not improve in respect to the other treatments (A or B), our results do indicate that irrigating with this low-salinity shrimp farm effluent had no noticeable negative effects.

This study shows relatively short term differences in tree growth due to treatment differences over the course of one growing season. However, to better understand the impacts of effluent treatment on olive trees, this trial must be extended to determine long-term sustainability of continued effluent applications. This aspect is especially relevant considering that olives grow and mature for approximately ten years before bearing fruit.