



## Purpose of study

# Combined Ultrafiltration and Reverse Osmosis Technologies to Increase Soy Protein Use in Aquaculture Feeds

Prairie AquaTech LLC

## Purpose / Goals

The central goal of this project is to quantify the benefits of commercially available ultrafiltration (UF) and reverse osmosis (RO) water treatment technologies in rainbow trout fed either fishmeal or soy-based diets in recirculating aquaculture systems (RAS). The study will evaluate if combined ultrafiltration and reverse osmosis technologies increase soy protein use in aquaculture feeds.

## Study Design

Two separate feeding trials were conducted using two matched tank-based RAS. One RAS system was used to rear fish at increasing stocking densities utilizing conventional water filtration technology while the other

system utilized an identical rearing configuration but possessed a UF/RO system to treat rearing water.

In trial #1, juvenile rainbow trout with an average weight of 40 +/- 0.5 gm, were stocked in tanks at increasing densities, 25-125 fish, in replicates of 4 tanks/stocking densities for 49 days on an extruded diet which contained 13% fishmeal and no soybean meal.

In trial #2, juvenile rainbow trout with an average weight of 20 +/- 1.2 gm, were stocked in the same two RAS system tanks and fed a 40% soybean meal diet for 42 days.

Fish characteristics (growth, survival, feed utilization), water quality and biological parameters were periodically measured.



Soybean efficiency



Increased soybean use

# Results

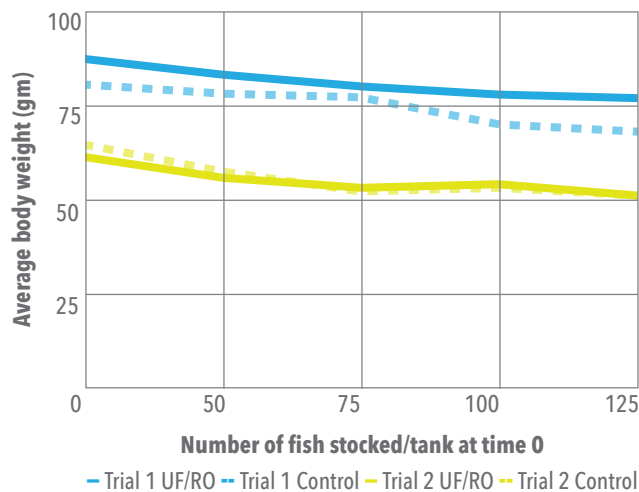
## Trial #1

- UF/RO technology increased production of RAS systems by 25 kg/m<sup>3</sup> of biomass as compared to rearing of fish in the same system under control conditions
- Productivity corresponds to 333 fish/m<sup>3</sup>
  - 333 fish/m<sup>3</sup> = \$1.50/fish = \$500/m<sup>3</sup>
  - \$500/m<sup>3</sup> = return of \$38,879 or \$151,515/year
- The UF/RO system used 35-40% less makeup water, decreasing operation costs

## Trial #2

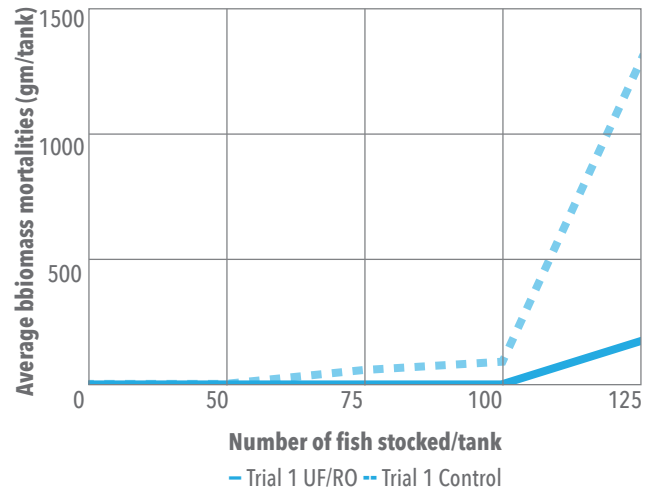
- UF/RO technology showed benefits when applied to trout reared on high soybean meal inclusion diets
- Trout fed a very high (40%) soybean meal diet grew less than fish fed a fishmeal diet under the same control condition
- Benefits of UF/RO technology were most apparent at higher stocking densities

## Average Body Weight



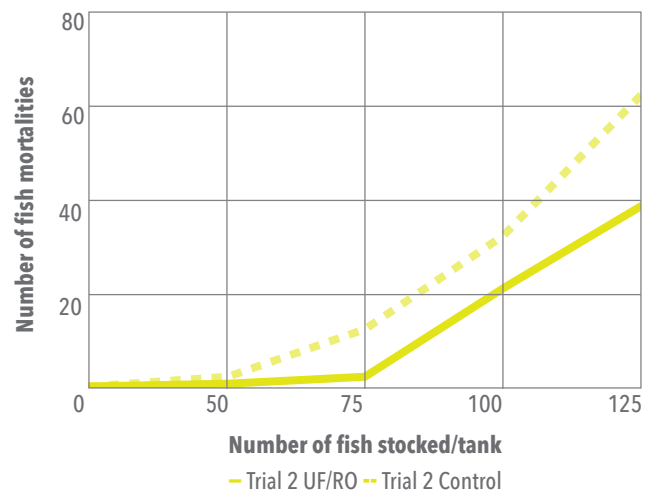
Trout reared under UF/RO conditions achieved larger body weight when compared to the control trout.

## Mortality Rate



## Trial #1

Trout stocked at higher densities (75-125 fish/tank) in control tanks displayed higher mortality rates, especially at 125 fish density. The average biomass mortalities at 125 density is about 1300 gm/tank. Whereas, the UF/RO tanks had zero mortalities until the 125 density. As a result, the percentage of biomass gain was 10-15% greater for UF/RO trout compared to the control group.



## Trial #2

Final stock densities for control trout declined significantly when fish were stocked over 100 fish/tank and both control and UF/RO tanks had trout achieve similar final average body weight of about 50 gm. Compared to the data in trial one, control group mortality had about 50% cumulative mortality and UF/RO fish had 33.4% mortality rate.



Soybean efficiency



Increased soybean use

## Key takeaways

- Utilizing ultrafiltration (UF) and reverse osmosis (RO) in farm-raised systems increases body weight and reduces mortalities, even at high stocking densities.
- Adding these modifications to commercial systems can increase overall yield and decrease operation costs.
- Based on data collected from both trials, when paired with UF/RO systems soybean inclusion diets increased trialed fish body weight and reduced mortalities.
- In future trials, diets containing 20% soybean meal are hypothesized to yield more consistent average body weights compared to fishmeal.

Combines Ultrafiltration and Reverse Osmosis Technologies to Increase Soy Protein Use in Aquaculture Feeds. Prairie AquaTech LLC



**Soy Aquaculture Alliance**

**Andy Tauer**, Executive Director | 8425 Keystone Crossing, Suite 200 | Indianapolis, IN 46240 | (317) 644-2862 | [atauer@soyaquaalliance.com](mailto:atauer@soyaquaalliance.com)

© 2019 Soy Aquaculture Alliance. Feeding new opportunities. Funded with soybean checkoff dollars.