



Purpose of study

Indirect criteria to select the farmed fish lines to enhance the efficiency of soybean meal utilization in their diet

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Purpose

This project seeks to identify the best lines among selected families of rainbow trout, which can utilize plant protein (soy-based ingredients) most efficiently and investigate potential identifiers to help improve future selection programs.

Objectives

This study aims to determine if genetic selection and feed improvement strategies can be used to increase the efficiency of soy-based diet consumption, and to develop an indirect benchmark to select the families of rainbow trout to enhance the efficiency of soybean-based diets utilization in two ways:

- 1 ▶ To determine the relationship between residual feed intake and body weight variations using compensatory feeding regimes.
- 2 ▶ Developing alternative method to improve feed efficiency of Soybean Meal Diet

Study Design

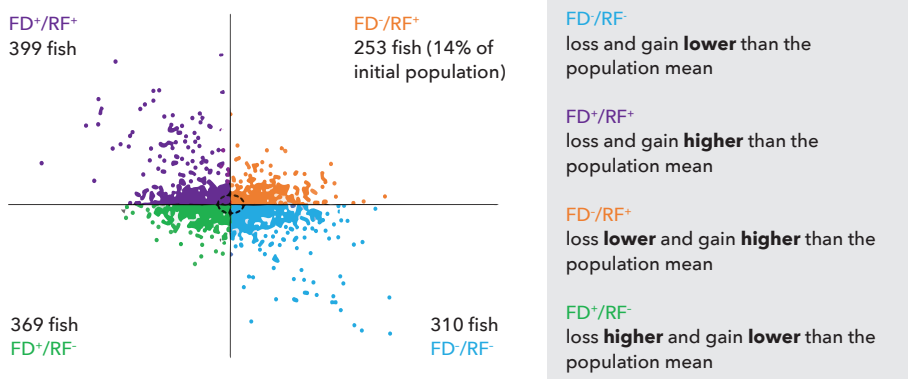
Utilizing an in-house formulated soybean-based feed, 12 families of rainbow trout were selected. These 12 lines were identified as being able to tolerate high quantities of plant protein-based feed for seven generations. The fish were reared in the same condition in four tanks over a 22 month period.



The fish were tagged and weighed individually. The fish were then fed in a cycle of feed deprivation (FD) and re-feeding (RF). They were sorted according to their growth rate, expressed as Thermal Growth Coefficient (TGC) value, measured during the feed deprivation and re-feeding periods: low or high weight loss during feed deprivation (FD- and FD+) and low or high weight gain during re-feeding (RF- and RF+), making up four groups: FD-/RF-, FD+/RF+, FD-/RF+ and FD+/RF-.

Figure 3:

Fish shows variation in terms of weight gain and loss in response to FD and RF. Group of fish. Total fish were divided into four groups based on weight gain and loss of fish during feeding regime.



253 fish from each group were randomly distributed into three replicated tanks, and fed using the same soybean meal diet. After 8 weeks, their feed conversion ratio (FCR= Feed fed (g)/ body weight variations (g)) was recorded.

Results

The strain of rainbow trout, selected by the indirect benchmark criteria from among the 12 families, showed significantly greater feed efficiency. The group that showed that the FD-/RF+ had the lowest FCR, and the group FD+/RF- on the other end of the spectrum displayed the highest FCR, translating to the lowest feed efficiency.

Overall, 23 fish from the FD-/RF+ group showed to have the best feed efficiency capacity compared to the other groups. These fish would be considered for the breeding program as this group has FCR 0.99 whereas other groups exhibited FCR in the range of 1.26 -1.41. Feed efficiency capacity increased from 26 to 41%.

Benefit for the Soybean Farmer

By improving family lines of fish, thereby increasing feed efficiency, soybean meal can be increased in fish feed formulations. This is good news for US soybean producers, as increased use in fish feed means more bushels sold. As these methods are implemented across multiple species, the potential for US soy will only increase.

Next steps

The alternative methods to improve the feed efficiency could be used for to improve the family lines for other fish species such as Atlantic salmon, tilapia, large-mouth bass, hybrid bass and catfish etc.

The long-term impact of this proposed project is to develop a method to produce rainbow trout families with best performance in terms of growth and feed efficiency to the US and the global aquaculture industry.

In addition, the cost of fish production can be decreased by enhancing the utilization of soybean meal via improving the feed efficiency by 15% per generation. This information has application to all cultured fin-fish species and would assist in increasing US soy meal in aqua-feeds.

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Increased soybean efficiency