ASSESSMENT OF DIFFERENT DIETARY SOYBEAN MEALS AND CORN FERMENTED PROTEIN IN PRACTICAL DIETS FOR FINGERLING CHANNEL CATFISH

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PURPOSE OF THE STUDY

The channel catfish (*Ictalurus punctatus*) has grown into the largest segment of aquaculture in the U.S., as well as one of the longest-running species of farmed fish. Producer demand for lower-cost feed could result in reduced growth performance due to antinutrients, so this study's goal was to examine the potential of using newer, improved soy- and corn-based protein formulations in practical catfish feed that may satisfy cost and nutritional concerns.

OBJECTIVES

To evaluate the efficacy of replacing solvent-extracted soybean meal (SBM) in practical diets for young channel catfish with two advanced soy products, and blending with a corn-fermented protein. Study objectives included:

- Measuring feed conversion ratio (FCR), weight gain, survival, and other data from each treatment diet
- Evaluating the diet effects on both indoor-raised catfish fingerlings and in outdoor-raised catfish juveniles

STUDY DESIGN

Four open feed formulations were tested, including a Basal diet of 32% protein and 6% lipid, containing 56.4% solvent-extracted SBM. The three comparative diets differed chiefly from this SBM formulation as follows:

- Basal-CFP: 44.5% solvent-extracted SBM & 10% corn fermented protein
- Basal-ET: 43% enzyme-treated SBM
- Basal-LO: 45% low-oligosaccharide SBM

TABLE 1: Dietary composition (g/100 g as is) of practical diets formulated to contain 36% protein and 6% lipids on an as-is basis. Diets were commercially produced by Optimal Aquafeed, Inc. (Omaha, NE, USA).

	BASAL	BASAL-ET	BASAL-LO	BASAL-CFP
Soybean meal (SBM)[a]	56.4	-	-	44.5
Enzyme treated SBM[b]	-	43.0	-	-
Low oligosaccharide SBM[c]	-	-	45.0	-
Corn fermented protein[d]	-	-	-	10.0
Poultry meal	8.0	8.0	8.0	8.0
Menhaden fish oil	2.0	2.0	2.0	2.0
Soy oil	1.4	0	0.8	0.4
Corn	20.3	34.7	31.9	22.8
Wheat middlings	10.0	10.0	10.0	10.0
Premix	0.5	0.5	0.5	0.5
CaP-dibasic	1.8	1.8	1.8	1.8

NOTE: Minor rounding adjustments are applied to individual ingredient percentages.
[a]Solvent-extracted Soybean Meal, Bunge Limited (Chesterfield, MO, U.S.)
[b]HP300, Hamlet Inc. (Findlay, OH, U.S.)
[c]Low-oligosaccharide Soybean Meal, Bright Day, Benson Hill (St. Louis, MO, U.S.)
[d]Corn Fermented Protein CFP-GT33, proprietary blend

These diets were evaluated in two separate trials: under controlled indoor recirculation aquaculture systems (**RAS**) aquaria conditions for 12 weeks, and under production conditions over a 70-day culture period using outdoor in-pond raceway systems (**IPRS**). At the endpoint of each trial, three fish were sampled from each replicate and each raceway, anesthetized, blood drawn, and euthanized for further testing.

The **RAS** trial consisted of catfish fingerlings stocked in 87.5-liter aquaria at a density of 20 each. The fish were offered one of five diets — in addition to the four Basal formulations, there was a commercial Reference diet containing 32% protein — in four replicate tanks each. The fingerlings were fed according to their growth performance at a fixed percent body weight, with feed inputs adjusted based on visual observation and intermittent FCR measures.

The **IPRS** trial conducted at Auburn consisted of 12 raceways with catfish juveniles stocked by biomass, which resulted in a density of 581 to 610 fish per raceway. These fish were initially fed with a 36% commercial floating feed until they developed a good feed response; thereafter, they were offered the four treatment diets for 70 days.

TABLE 2: Water quality parameters were recorded over the three growth trials for channel catfish (*Ictalurus punctatus*) fed with experimental diets containing different soybean meal treatments. Values represent the mean ± standard error, and values in parentheses represent the minimum and maximum water quality readings.

PARAMETERS	RAS[a] SYSTEM	IPRS[b] SYSTEM Y1
Dissolved Oxygen (mg/L)	6.81 ± 0.05 (8.7 – 4.7)	9.16 ± 0.04 (16.9 – 4.4)
Temperature (°C)	25.67 ± 0.06 (27.3 – 23.2)	20.15 ± 0.11 (30.7 – 10.9)
Salinity (ppt)	2.02 ± 0.12 (5.0 – 0.1)	0.2 ± 0.001 (0.4 – 0.1)
pH	7.53 ± 0.08 (8.5 – 6.8)	8.31 ± 0.61 (9.9 – 7.4)
Total Ammonia N (mg/L)	0.4 ± 0.19 (5.0 – 0.0)	0.3 ± 0.01 (1.6 – 0.0)
Nitrite (mg/L)	0.17 ± 0.04 (1.1 – 0.0)	0.08 ± 0.001 (0.3 – 0.0)

[a]Recirculation aquaculture system
[b]In-pond raceway system

RESULTS

In the **RAS** trial, the catfish demonstrated significantly better growth and FCR when fed the Basal-LO and Basal-CFP diets, especially compared to fish offered the Reference diet — final mean weights ranged from 47.9 to 66.5 grams, representing the range between the Reference to the Basal-LO diets. In contrast, the survival rate did not present significant differences.

In the **IPRS** trial, final mean weights ranged from 113.4 to 130.4 g, with fish consuming the Basal-ET diet exhibiting the largest gain and lowest FCR, followed closely by those consuming the Basal-CFP diet.

It should be noted that the different system as well as duration of time and conditions between these two studies may have played a role in final gains and FCR values.

Gene expression analysis of catfish livers showed decreased hepatic hexokinase expression in the Basal-LO group and increased intestinal cholecystokinin expression in all trial diet groups, indicating positive metabolic alteration of appetite in the fish, in response to changes in the feed ingredients.

BENEFIT FOR THE SOYBEAN FARMER

This study demonstrates a solvent-extracted SBM can be combined with corn-fermented protein or replaced with enzyme-treated or low-oligosaccharide SBM in practical diets for channel catfish without affecting their growth performance, survival, or health metrics. This information could be used to diversify protein choices available to catfish producers. Further work on SBM feeds containing CFP or LO soy meal is particularly recommended.

KEY TAKEAWAYS

These results suggest that newer soybean variants may be beneficial for the growth performance of channel catfish. Among the tested diets, enzyme-treated SBM (Basal-ET) produced the highest growth rates and lowest FCR, while LO and CFP blends also improved performance compared to conventional SBM and Reference diets. Such results warrant continued work on developing improved ingredients for practical feed formulations.

SCAN ME

VIEW THE PROJECT OVERVIEW