ADVANCED SOY IN PRODUCTION DIETS FOR CATFISH

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PURPOSE OF THE STUDY

To address the limitations of traditional solvent-extracted (SE) soybean meal (SBM) by comparing it against new high-protein, low-oligosaccharide (LO) and fermented/enzyme-treated (ET) soy products on the growth and performance of hybrid catfish — channel (*Ictalurus punctatus*) x blue (*I. furcatus*) catfish — in life stages from fingerling to commercial-size adult.

In addition, we evaluated the inclusion of an ethanol coproduct, corn fermented protein with yeast (CFP), alongside SE-SBM (**Basal** diet) to improve amino acid balance and enhance the nutritional contribution of yeast byproducts at later life stages.

OBJECTIVES

- To evaluate the comparative performance of 4 diets for hybrid catfish with SBM as the primary protein source:
  - Basal diet containing 56.4 grams/100 g SE-SBM
  - Basal-ET diet containing 43 g/100 g ET-SBM replacing the SE-SBM
  - Basal-LO diet containing 45 g/100 g LO-SBM replacing the SE-SBM
  - Basal-CFP diet reducing the SE-SBM component to 44.5 g/100 g and including 10 g/100 g CFP
- Determine feed conversion efficiency and nutrient retention
- Assess implications for cost and scalability

TABLE 1: Composition (g/100 g as-is) of practical diets formulated as advanced fingerling and grow-out diets for Hybrid catfish. Diets were commercially produced by Optimal Aquafeed Inc. (Omaha, NE, U.S.).

	BASAL	BASAL-ET	BASAL-LO	BASAL-CFP
Soybean Meal (SBM)[1]	56.4	-	-	44.5
Enzyme treated SBM[2]	-	43.0	-	-
Low Oligosaccharide SBM[3]	-	-	45.0	-
Corn Fermented Protein[4]	-	-	-	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 Mids.	10.0	10.0	10.0	10.0
Premix (proprietary)	0.5	0.5	0.5	0.5
CaP-dibasic	1.8	1.8	1.8	1.8

[1] Solvent Extracted Soybean Meal, Bunge Limited (Chesterfield, MO, U.S.)
[2] HP300, Hamlet Inc (Findlay, OH, U.S.)
[3] Low Oligosaccharide Soybean Meal, Bright Day, Benson Hill (St. Louis, MO, U.S.)
[4] Corn Fermented Protein CFP-GT33 proprietary blend.

METHODS

The study was conducted at the E.W. Shell Fisheries Research Station (Auburn, AL) and included three trials.

- **Trial 1: Indoor RAS Fingerlings**
  An indoor recirculation aquaculture system (**RAS**) 61-day trial consisting of a series of 57-liter aquaria stocked with young fingerlings from Auburn's Genetics Unit
- **Trial 2: IPRS-I**
  An outdoor research pond equipped with 12 in-pond raceway systems (**IPRS-I**) of 200 square feet each, growing fingerlings provided by Jubilee Farms for 137 days to advanced stocker size
- **Trial 3: IPRS-II**
  A continuation of the IPRS-I trial growing stockers to commercial-size fish (**IPRS-II**) for 81 days

In the **RAS** study, 15 fingerlings grown to an initial weight of 4 g on commercial crumble feed were stocked in each nursery aquarium to begin the trial, consisting of 4 replicates for each treatment. The Basal-CFP diet was not fed in this trial.

In **IPRS-I**, each of the 12 raceways was stocked with 425 fingerlings with a initial weight mean of 58 g. In IPRS-II, stocker fish were reallocated and placed back in the raceways at a stocking density of 350 each, with an initial weight mean of 226 g. All 4 diets were fed in these IPRS trials.

In the **RAS** trial, fingerlings were allocated a fixed level of feed based on overall mean of the population. During **IPRS-I** — June to November — each raceway was initially offered 50-100 g each day until the fish were on feed, thereafter they were fed to satiation. From November to April when the fish were not in trial, each raceway received 100 g per week maintenance.

When the **IPRS-II** trial began in late April, the fish were fed at apparent satiation once a day until mid-June, thereafter, the feed inputs were reduced to 90-95% satiation, which was adjusted weekly. RAS to IPRS was chosen to validate performance under both controlled and production-scale conditions.

RESULTS

In general across these trials, the **Basal-LO** diet or inclusion of **Basal-CFP** complementary protein to SE-SBM resulted in the best growth response from the fish.

Hybrid catfish fed the **Basal-CFP** diet exhibited higher moisture content than those fed the Basal diet, and intraperitoneal fat (IPF) values were significantly higher in fish fed the **Basal-ET** diet in the RAS trial, than in other diets.

Protein retention and use efficiency in growth for fish offered the **Basal-LO** diet was superior to that of fish reared on the Basal diet — indicating an improvement in nutrient availability.

With minimal differences in final biomass, weight gain, feed conversion (FCR), survival, and condition index overall among the diets in these trials, it can be concluded that all 4 tested formulations are suitable for commercial evaluation. Cumulative results to date, however, indicate that processing SE-SBM or blending it with CFP can enhance performance. Also, fish fed the Basal-LO and Basal-CFP diets appeared to benefit from better growth and higher percentages of protein within whole-body analysis across the trials.

TABLE 2: IPRS-I: Response of hybrid catfish fingerlings (57.9 ± 3.6 g) stocked at 425 fish per raceway and reared on four soy-based feeds formulated to contain 36% protein, and fed for a 137-day period in an IPRS.

	FINAL BIOMASS (KG)	AVERAGE WEIGHT (G)	WEIGHT GAIN (G)	WEIGHT GAIN (%)	FCR*	ANPR*	SURVIVAL
Basal	92.9	230.3	176.3	325.4	1.54	26.75^{b}	95.06
Basal-ET	105.2	254.8	193.8	320.0	1.41	32.40^{ab}	96.00
Basal-LO	125.2	294.6	236.2	404.5	1.29	37.06^{a}	100.00
Basal-CFP	127.5	300.8	242.6	417.2	1.37	32.84^{ab}	98.98
PSE	14.64	13.76	24.70	40.91	0.0639	1.984	6.432
P-value	0.3454	0.2231	0.2421	0.2717	0.1221	0.0384	0.9302

FCR is based on net gain and feed input.

BENEFIT FOR THE FARMER

This study extends a previous, similar study conducted with channel catfish to hybrid catfish, the latter being the breed of choice by the majority of U.S. catfish farmers — who are the largest collective users of SBM in U.S. aquaculture. Accordingly, the hybrids outperformed their channel catfish counterparts in FCR, survival, and weight gain. These trials, therefore, demonstrate scientific support to increase demand for soy-based protein within the largest segment of aquaculture producers.

SCAN ME

VIEW THE PROJECT OVERVIEW