Effects of MOTIV™ on Productivity and Survivability of *Litopenaeus vannemei* in a Salinity Stress Test

OVERVIEW

Shrimp production has evolved to optimize growth and performance using technologies to improve productivity. However, even under controlled farming practices, the potential for stress-inducing environmental factors to impact the shrimps' health may still occur, affecting growth and feed conversion, potentially leading to morbidity and reduction in survivability. MOTIV is a functional protein developed specifically for use in shrimp diets to reduce the negative impacts of stress, and provides a complementary amino-acid profile to help formulators, feed manufacturers and producers to achieve optimal growth performance.

OBJECTIVE

To evaluate the impacts of different levels of MOTIV inclusion in the diets of shrimp under a salinity stress test.

MATERIALS AND METHODS

- **Animals:** *L. vannamei* were acquired from the SIS super-growth hatchery as post-larva and reared on a common diet until reaching 15 g in size.
- **Diets and Treatments:** Diets (approximately 42% protein and 7% lipid) were formulated to balance nutrients and to meet the nutrient requirements of shrimp (Table 1). Diets were pelleted.
- **Three Treatments were Formulated:**
  - Control: Basal Diet (containing 32% Peruvian fishmeal)
  - MOTIV 7.5: MOTIV included at 7.5% by replacing Peruvian fishmeal on a wt/wt basis.
  - MOTIV 12.5: MOTIV included at 12.5% by replacing Peruvian fishmeal on a wt/wt basis.
- **Trial Design:**
  - Each diet was arranged for three shrimp group replicates, consisting of a floating bucket (42 x 64 x 50 cm) with 15 shrimp per bucket as the first replicate (Figure 1).
  - Shrimp were fed each treatment for seven weeks and performance data was collected.
  - At the end of seven weeks a subset of shrimp was harvested for coloration testing by boiling the shrimp in water for three minutes, submersing in ice water, then were accessed for pigmentation using the SalmoFan™ color scale.
  - Another subset of 10 shrimp from each replicate were placed in chlorine-free tap water (no saline) with aeration and mortality recorded at six hours and 12 hours.

TABLE 1: Treatment Diet Formulations.

	Control	MOTIV 7.5%	MOTIV 12.5%
Ingredients			
Fishmeal (anchovy)	320.000	245.000	195.000
MOTIV	0.000	75.000	125.000
Soybean meal, 48% CP, solvent-extracted	280.000	265.000	258.000
Fish oil, tuna oil, co-products	16.000	19.000	20.000
Wheat flour	280.000	280.000	280.000
Wheat gluten meal, 78% CP	60.000	60.000	60.000
Choline chloride, 60% choline	2.000	4.000	6.000
Soy lecithin	18.000	20.000	21.000
Cholesterol	0.000	0.250	0.425
Monocalcium phosphate, MCP, Ca $(H_2PO_4)_2$	6.500	8.000	8.000
Salt, NaCl	6.000	8.000	10.000
Rovimix-stay-C 35, ascorbyl-monophosphate	2.000	2.000	2.000
Shrimp premix	5.000	5.000	5.000
DL-Methionine	2.000	2.800	3.000
L-Threonine	1.000	2.075	2.000
L-Lysine	0.625	3.000	3.700
Mold inhibitor (calcium propionate)	0.750	0.750	0.750
BHT/BHA	0.125	0.125	0.125
Total	1000.000	1000.000	1000.000

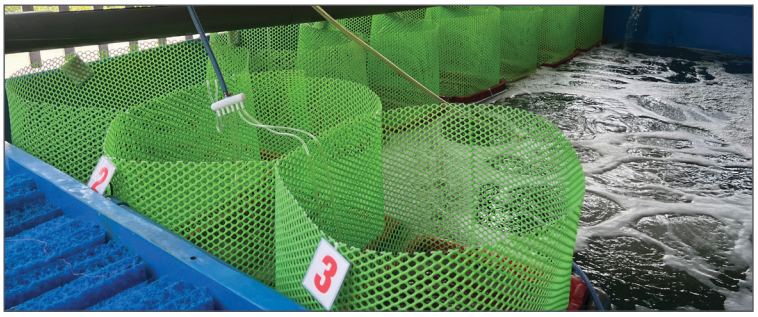

FIGURE 1: RAS system used in the trial.

RESULTS

Shrimp Performance:

- Shrimp fed MOTIV 7.5% performed significantly better (P≤0.05) than the control, and the MOTIV 12.5% shrimp performed numerically better than the control shrimp (Table 2).
- Although not significantly different from the control, both levels of MOTIV had a 7% better survival rate compared to the control over the seven-week trial (Table 2).

TABLE 2: Performance of shrimp fed two levels of MOTIV compared to control shrimp.

Treatment	Initial Weight (g)	Final Weight (g)	ADG (g/day)	FCR	Survival Rate
Control	14.69 ± 0.30[a]	32.53 ± 0.32[a]	0.65 ± 0.01[a]	1.33 ± 0.03[a]	77.78 ± 3.85[a]
MOTIV 7.5%	14.51 ± 0.20[a]	34.14 ± 0.20[b]	0.68 ± 0.00[b]	1.27 ± 0.02[b]	84.44 ± 3.85[a]
MOTIV 12.5%	14.53 ± 0.29[a]	33.24 ± 0.52[a]	0.66 ± 0.01[a]	1.29 ± 0.01[a]	84.44 ± 3.85[a]

[a,b] means different within same column are significantly different.

Color Evaluation:

- As seen in Figure 2, shrimp coloration increased with increasing levels of MOTIV. SalmoFan™ scores were:
  - Control (1): 22
  - MOTIV 7.5 (2): 23+
  - MOTIV 12.5 (3): 24+

FIGURE 2: Shrimp coloration with different levels of MOTIV.

Salinity Stress:

- At six hours, there were significantly more mortalities in the control at 46.67% vs. 26.67% for both the MOTIV 7.5% and 12.5% (Table 3).
- At 12 hours, mortality in the control was significantly higher at 93.33% than the MOTIV 7.5% and 12.5%, which were 56.67% and 63.33%, respectively.

TABLE 3: Percent mortality of shrimp in salinity stress test.

Mortality (%) at 6 hr & 12 hr at Zero-Salinity Stress Test		
Treatment	**Mortality (%) at 6 hr (0-Salinity Test)**	**Mortality (%) at 12 hr (0-Salinity Test)**
Control	46.67 ± 5.77[a]	93.33 ± 11.55[a]
MOTIV 7.5%	26.67 ± 5.77[b]	56.67 ± 5.77[b]
MOTIV 12.5%	26.67 ± 5.77[b]	63.33 ± 5.77[b]

[a,b] means different within same column are significantly different.

SUMMARY

In this trial, MOTIV was demonstrated to provide significantly improved productivity in *L. vannamei* as shown by improvements in growth, ADG and FCR. MOTIV also continues to demonstrate value in creating increased shrimp coloration without the need for excess astaxanthin. Under stress conditions, MOTIV significantly reduced shrimp mortality. These findings would suggest that MOTIV is a robust ingredient that provides optimized nutrients for growth, but also functionality to increase shrimp yield in the face of environmental stressors.