Effect of White Feces Syndrome on survivals and yields of Shrimp *Litopenaeus vannamei* culture systems in Nellore coast

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***Abstract*- There is regular threat of several diseases all over the world since beginning and the disease impact is increasing year on year, in this context the present study has been made on production estimation and their economic loss correlated with disease impacts in the Nellore coastal zone of shrimp farming, especially on the White Feces Syndrome (WFS). In order to estimate the effect of White Feces Syndrome (WFS) on survival and total yields of shrimp in culture systems in Nellore coast, in the present study culture ponds are selected to observe WFS impact on survivals, total yieldsand cost of production in two different areas Eswaravaka (S1) and Pallamparthi (S2) coastal villages in the Nellore coast. The salinity ranging between 5 to 6 ppt in S1 and 16 to 25 ppt in S2 shrimp farming sites. The changes in plankton density and water quality parameters are observed prior to onset of WFS symptoms. WFS observed in the initial stages of culture at 37 and 43 DOC with poor feeding and survival loss after symptoms of disease during the culture upto104 to 116 days harvest. The maximum survival was recorded as 65% (S1) and 62% (S2) and the yield confined to 3795 kg/ha and 4108 kg/ha respectively in the culture ponds, Feed Conversion Ratio (FCR) is 1:1.5 for S1 and 1:1.6 for S2 shrimp farming sites.**

***Keywords*: *Litopenaeus vannamei,* WFS, survivals, yields, Production cost, Profit margin**

INTRODUCTION

The *Litopenaeus vannamei* is widely cultured farm reared shrimp in India and other Southeast Asian countries and also cultured in Central and South America (Wen-Young Tseng, 1998). consumed in major countries like United States of America, European countries, China, Japan, Thailand, Indonesia etc.The *Litopenaeus vannamei* culture is commonly practised by Extensive, Semi Intensive & intensive systems. Indian farmers are practising mostly modified extensive to semi-intensive & some intensification is observed during 2018 to 2021.

L vannamei is an alternative shrimp besides Monodon, white shrimp is able to grow in a wide range of salinities (0 to 50ppt) (Karthikeyan (1994) and Gunalan *et al*. (2010). low Crude protein feed requirement (20-30%), better Feed Conversion Ratio (FCR) and possible stocking density could be higher than 150pcs/m2 (Budiardi *et al.,* 2005). and intensification is growing rapidly due to worldwide market demand. White Feces Syndrome is an intestinal disorder affecting cultivated L vannamei shrimp worldwide (P. Piamsomboon *et al.,* 2022). These symptoms are identified by the presence of White fecal Strings floating on the water surface on Grow out ponds which results in poor Growth and Survival rates. Reduced Feed intake, gut with yellowish to whitish floating on water surface with retarded growth P. Piamsomboon, (2022), loose exoskeleton and Histopathology revealed thin intestinal wall combined with the disappearance of microvilli, usually occurring during 50-60 days of stocking in Indonesia region (Chalor 2010), presence of white strings floating on surface Durai *et al*., (2015) emphasized on the water quality parameters, dissolved oxygen in culture water associated with toxic gases like ammonia.

The present study is on White Feces Syndrome to estimate survival, yield and cost of production has been emphasized to correlate the economic loss occurred in *L vannamei* culture ponds of Andhra Pradesh selectively in Nellore coastal region.

MATERIALS AND METHODS

Two farms are located in Nellore district at Gudur Division, located close to Kota mandal. Site 1 (S1) is

located at Eswaravaka (Vi & Po), away from 14.2 km from Kota mandal (Low saline bore water with salinity ranging from 4 to 6 ppt). Site 2 (S2) is located at Pallamparthi Village 23km away from Kota mandal (Creek Based farm & water source with salinity ranging from 16 to 25 ppt). The farm geographical pictures are given in figure 1, 2, 3 & 4.

Figure 1 – Eswaravaka Pond Location (S1)

Figure 2 – Eswaravaka Farm Location (S1)

Figure 3 – Pallamparthi Pond Location (S2)

Figure 4 – Pallamparthi Farm Location (S2)

Regular farming activities like daily feeding, weekly minerals and probiotics has been followed and data of culture practice has been recorded in both farms for analysis right from pond preparation to harvest. Input data includes Pond preparation, Pumping, Chlorination, Seed Stocking, Feeding, water quality management through probiotics, minerals and liming etc. Site 1 includes bore water pumping without reservoir and Gravity harvest by sluice gates for each ponds, comprising 3 ponds of 0.65, 0.70 and 0.63 ha with total water spread area of 1.98 ha respectively. Site 2 includes creek water reservoir (0.8 Ha) for chlorination and gravity harvest by sluice gates for each ponds, comprising 3 ponds of 0.72, 0.74 and 0.70 ha with total water spread area of 2.16 ha respectively. Two different farms are selected to identify the impact of WFS in different salinities maintained in the culture ponds. The shrimp farming sites (S1 and S2) are stocked with seed (PL10) by Vaisakhi Bio marine hatchery from Visakhapatnam. The culture ponds stocked with same stocking density of 30pcs/m^2. The culture ponds adopted for the present work is followed usual pond management practices. The shrimps fed with Manamei shrimp feed (Avanti feeds Ltd) followed by the proper feed management.

RESULTS

In S1, White feces (Figure 5) is observed by 43 Days of Culture (DOC), 6.0 gms of Average Body Weight (ABW), feeding is normal until DOC 45 days & White feces floating on pond water surface increased severely during DOC 44 to 54 days (ABW 6.5 gms) and gradually reduced from 55 DOC to 58 days (ABW 7.0 gms). The white feces strings on water are not observed after DOC 59 days. During WFS period gut probiotics and immuno stimulants were added as feed supplements to enhance immunity. The changes in plankton bloom is observed during 40 DOC and fluctuating water quality parameters like increase in

pH from 7.9 to 8.3 (Wang et al., 2004 and Gunalan *et al.,* 2011) with Sacchi disc visibility reading reduced from 18 cms to 10 cms during the white feces period. However feed drop is observed and growth is also reduced after recovery from white feces. Survival loss is observed as per the daily feed consumption. In the microbiological analysis green colonies tend to show 20, 30 and 30 cfu/ml respectively in pond-1, 2 and 3. The yellow colonies count is normal with 110,130 and 100 cfu/ml respectively.

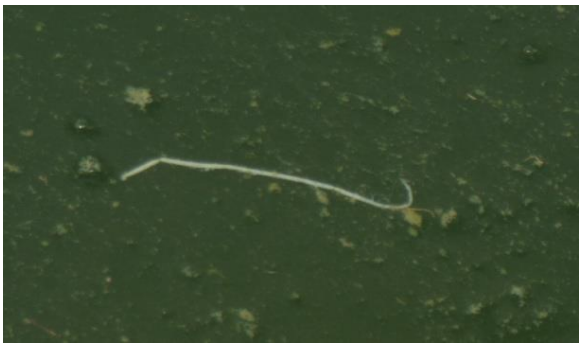

Figure 5 –White feces floating on pond water surface in S1 sampling site

Table:1; Harvest details of shrimp *Litopenaeus vannamei* in Eswaravaka (S1)farming area

Culture Pond	Total Seed stocked	Stocking Density/m^2	DOC	ABW (gms)	Biomass (Kg)	FCR	ADG	Survival %	Yield/ha
Pond-1	195000	30	104	21	2703	1.53	0.20	66%	4158
Pond-2	210000	30	106	20.7	2695	1.48	0.20	62%	3850
Pond-3	189000	30	110	21.3	2737	1.51	0.19	68%	4345
TOTAL	594000	30	107	21	8135	1.50	0.20	65%	4108

In S2, White feces (Figure 6) is observed by 37 Days of Culture (DOC), Average Body Weight (ABW) 5.5 gms, feeding is normal until DOC 39 days & White feces floating on pond water surface increased severely during DOC 40 to 51 days (ABW 6.2 gms) and gradually reduced from 52 DOC to 55 days (6.7 gms), White feces strings on water is not observed after DOC 55 days. During WFS period gut probiotics & Immuno stimulants were added as feed supplements to enhance immunity. Changes in plankton bloom is observed during DOC 34 and fluctuating water quality parameters like increase in pH from 8.1 to 8.4 with sacchi disc reading reduced from 21cms to 12cms during the WFS period. However, feed drop is observed and growth is reduced after recovery from white feces. Survival loss is observed as per feeding ration. Microbiology analysis – Green colonies tend to show 40,50 &40cfu respectively in 3 ponds. Yellow colonies are normal with 180,160 & 180.

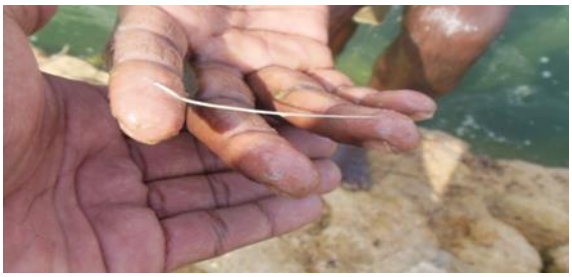

Figure 6 –White Feces floating on pond water surface in S2 sampling site

Table:2; Harvest details of shrimp *Litopenaeus vannamei* in Pallamparthi (S2) farming area

Culture Pond	Total seed stocked	Stocking Density/m^2	DOC	ABW (gms)	Biomass (Kg)	FCR	ADG	Survival %	Yield/ha
Pond-1	216000	30	116	20	2765	1.60	0.17	64%	3840
Pond-2	222000	30	114	20.7	2849	1.58	0.18	62%	3850
Pond-3	210000	30	116	20.5	2583	1.54	0.18	60%	3690
TOTAL	648000	30	115	20.4	8197	1.57	0.18	62%	3795

Table 3 – Comparison of culture ponds (S1 and S2) production cost analysis of shrimp *Litopenaeus vannamei*.

Quantity and Input in Rupees		Quantity	Input S1 (Rs)	Quantity	Input S2 (Rs)
Pond Preparation	Ploughing, Vermicompost and Liming	800 kg	22250	950 kg	24150
Water Pumping	Filling Cost	6000m3	14000	6000m3	12000
Water Treatment	KmN04 & Chlorination	160 kg	10800	297 kg	17900
Water Preparation	Fermentation	2 dose	1200	2 doses	1800

	Probiotics	2 dose	2300	2 doses	2800
	Liming & Gypsum	1 dose	1600	1 dose	2000
Pre Stocking Total (Rs)			52150		60650
Seed Cost		594000 nos	207900	0.3	207900
Feed Cost		12257 Kg	857990	11561	869551
Minerals	Saldo, Minermate, KCl2,MgCl2, CaCl2	1465	83500	1855	86820
Probiotics	Water, Soil, Gut & Immunostimulants (kg)	279	76200	321	76800
Fermentation Juice	Jaggery+Rice Bran + Yeast (Kg)	360+360+6	22000	360+360+6	22000
Power	Ebill Rs 4.2/- per unit & Diesel (Lts) Rs 92/- per litre		378000		427000
Labour	Feed Boys Rs 9583/- per head * 4 months		135000		200000
Transportation	All materials (Feed/Seed/Lime etc)	20000		23000	
Aerator Maintanance	Motor Winding & maintenance	40000		44000	
Lease	Rs 1,00,000/- per Acre/Year	150000		167000	
TOTAL PRODUCTION COST (Rupees)		2022740		2184901	
Biomass harvested and Income in Rs		8135	2521850	8197	2541070
Production Cost Per Kilogram (Rs)		249.00		267.00	
Selling Price Per Kilogram (Rs)		310.00		310.00	
Profit Per Kilogram (Rs)			61.00	43.00	
Profit Per Acre in Rs			1,00,828	65,957	

DISCUSSION

In the present study salinity was maintained at 5 to 6 ppt for site 1 and 16 to 25 ppt for site 2 respectively (Parket et al., 1974; Samocha et al., 1998). All parameters were recorded weekly for Best Management Practices (BMP) and animal samplings were done to estimate weekly growth and health condition of shrimp population in the respective ponds of both study farms. Weekly animal sampling is very essential to know the health condition, growth rates and estimate survival for proper feeding.

This study reveals that White Feces Syndrome affect growth rates and survival of shrimps in L vannamei culture ponds (Chalor Limsuwan (2010) and Gunalan *et al*., (2014), majorly affecting the survival rates reduced to less than 65%. This study reveals that WFSis observed at Initial stages of culture and become very difficult to manage growth rates after recovery of disease symptoms, this study also reveals that prolonged culture of WFS ponds tend to show low productivity and low profit or no profit margin compared to Normal culture ponds.No signs of size variation and retarded growth (Thanprasittipap *et al* 2013).Changes in plankton bloom and water quality parameters are observed prior to onset of WFS symptoms (Mohamad I. K et al 2021)This study also reveals that impact of growth rates and survival in creek water and bore water areas (Vinod B et al 2020),where saline ponds adjacent to creek water farms resulting inless growth and survival compared withlow saline bore water culture areas (Cao, H *et al*., 2015).

WFS harvested farm showing slow growth by reduced Average Daily Growth (ADG) of 0.18 & 0.2 respectively there by decrease in production of biomass where it is confined to 4108 and 3795 kg/ha (Table 1 & 2 comparision) as the approximate harvest biomass would be around 6000 to 8000 kg for normal harvested culture ponds (MPEDA 2019-20). We can observe a decline of 35% to 50% production in Biomass, there by increased Cost of Production leads to low Profit margin.Feed Conversion Ratio (FCR) is increased in White Feces Syndrome ponds as initially feed is consumed as normal survival & tend to decline seed survival &increased Feed Conversion Ratio (Claude E. Boyd 2021)

Comparatively S1, which is under low saline bore water farming showing slightly better performance with input production cost Rs 249/- than S2, under high saline creek water farming input production cost is Rs 267/- per kg. whereas WFS ponds showing a profit margin of Rs 1,00,828/-& Rs 65,957/- of bore and creek water respectively (Table 3). Input cost and selling price are subject to change based on consumer markets

Above all L. vannamei harvested Biomass is processed and exported to other countries like U.S.A, U.K, and Southeast Asian countries, in this regard selling price fluctuation also has the impact on Profit margin, sometimes farmers are selling at low price than Cost of Production, which tends to lose profit and

loss to Shrimp farming industry (MPEDA 2019-20). From the above analysis it is clear that due to White Feces Syndrome there is a huge difference in production & profit margin/kg for farmers.

CONCLUSION

The present study shows that WFS symptoms resulting in decline of survival and total yield in the *L. vannamei* culture ponds. In addition, it also indicates that low salinity is slightly better to control or mitigate WFS symptoms compared with high salinity. The study also shows the profit and loss incurred, low margin or economic loss due to WFS in culture ponds. There is a need to find out further studies to control or mitigate White Feces Syndrome and its associated factors in order to improve survival and yields in culture ponds to prevent economic loss to farming community.

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