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Intensification of medicine on shrimp culture

Arup Kar, Sushil Bera and Subhajit Santra

Abstract
Shrimp farming is an aquaculture business for the cultivation of marine shrimps or prawns for human consumption and is now considered a major economic and food production sector as it is an increasingly important source of protein available for human consumption. The intensification of shrimp farming had led to the development of many diseases, which resulted in the excessive use of antimicrobial agents, which is finally responsible for any adverse effects. Currently, probiotics are chosen as the best alternatives to these antimicrobial agents and they act as natural immune enhancers, which provoke disease resistance in a shrimp farm. Exploiting these probiotics in treating and preventing viral diseases in shrimp aquaculture is a novel and efficient method.

Keywords: Seed, environment, shrimp

Introduction
With the expansion of shrimp culture in India, there has been an increasing trend in using medicine and chemical in shrimp health treatment. Shrimp farming is playing a great role in the present Indian economy. It has a big contribution to the economy of a developing country like India but is always subjected to some adverse environmental consequences. Shrimp culture has been more widely than any other because of its high export value and to satisfy the ever-increasing demand of consumers. In shrimp health management and disease treatment, farmers use different compounds as a growth promoters, disinfectants, probiotics and to improve water quality and dissolved oxygen. Chemicals used in aquaculture included sodium chloride, potassium permanganate, copper compounds, malachite green, and methylene blue (Li *et al*., 1996). Commonly used chemicals in west Bengal aquaculture were lime, rotenone, various form of inorganic and organic fertilizer, salt, dipterex, antimicrobials, potassium permanganate, copper sulfate (Faruk *et al*. 2005). For the success of shrimp culture, Chemical and aqua medicine must be used responsibly. Shrimp disease is an alarming factor for which production of aquaculture is hampered. Aqua medicine is indeed an essential ingredient for successful shrimp culture. The use of aqua medicine in aquaculture systems for various purposes is widely recognized. In the East Medinipur district, about 40 pharmaceuticals companies are now producing about 400 different aqua-medicines. Excessive use of such a huge number of aqua medicine and chemicals creates environmental degradation. Most of the farmer doesn't know the proper dosages and method of their application. Thus the present status of the use of aqua medicine in the shrimp culture sector, especially in aquatic animal health management. For the health management of Fish and Shrimp, several types of probiotics are used by farmers. The common ingredients of probiotics are *Bacillus subtilis*, *B. megaterium*, *B. polymyxa*, *B. licheniformis Saccharomyces cerevisiae*, *Lactobacillus* sp, *Nitrosomonas* sp etc. Some common chemicals used for health management include sodium chloride, Formalin, Malachite green, Methyl Blue, Potassium Permanganate, and Hydrogen peroxide (Plumb,1992), Potassium Permanganate is the most widely used chemical for treating external protozoa and external Bacterial infection. For treating Fungal infection, external parasites on Shrimp and shrimp eggs as flush, prolonged or indefinite treatment or fungal control Sodium chloride and formalin is an old treatment used by the farmers (Plumb, 1992). Recently farmers have used probiotics such as Early PS, Bacto treet, Gut pro-tech, Thionil SP, Bacto Gest, Avant Back, etc. Chemicals are often used in aquaculture to Control Shrimp disease, Improve water quality Control Aquatic vegetation.
FAO, 2001 Shrimp farming has boomed in tropical and subtropical regions since the early 1980s and Southeast Asia is the leading region.

Thailand is the world's largest producer of cultured shrimps, yielding 235 000-275 000 tons annually since 1993 (FAO, 2001). Indonesia, the Philippines, and Vietnam are also among the top ten producers in the world.

Kureshi and Davis (2002) showed the growth responses of L. vannamei to a crude protein diet Graslund *et al*., (2003) stated that the use of chemicals and biological in marine and brackish water shrimp farming in Thailand, the world's top producer of farmed shrimp. Interviews were conducted with 76 shrimp farmers in three major, major shrimp-producing regions, the eastern Gulf coast, the southern gulf coast, and the Andaman coast area. Farmers in the study used on average13 different chemical and biological products. The most commonly used products were soil and water treatment products, pesticides and disinfectants, and antibiotics used by the farmers could have negative on the culture shrimps, cause a risk of food safety, occupational health, or have negative effects on adjacent ecosystems. Manufacturers and retailers of the products often neglected to provide farmers with necessary information regarding active ingredients band relevant instructions for safe and efficient use.

Shamsuzzman and Biswas (2012) stated that in the south-west coast of Bangladesh, commonly found traditional chemicals in health management were lime, salt, potassium permanganate, Formalin, Bleaching powder, and Malachit green. Shyam *et al*. (2012) showed that the Pacific white shrimp (L. vannamei) is an economically important species with high market value. Availability of Specific Pathogen Free (SPF) and Specific Pathogen Resistant (SPR) seed and the suitability of the species for high-density culture have led to the quantum leap in the percentage contribution of the species in the world shrimp production. Alam and Rashid (2014) [1] carried out a six months study to understand the present status of the use of Aqua-medicine and Chemicals in aquatic animal health management of the Shakira district of Bangladesh.

Selection of study area

In my study work, I selected a shrimp farm (Ashalata Aqua Farm) in Dhaipukuria, Bhagwanpur II block in Purba Medinipur district West Bengal. The present study was initiated on 22th June 2019 and continued up to 19th September 2019. It has10 ponds under this farm and has a total area of 17000 sq. meters. Shrimp Culture in this farm is carried out in dug-out ponds scientifically and the types of culture include improved traditional, stagnant pond culture with management, modified extensive and semi-intensive.

Selection of species

Many factors must be considered when a farmer decides which species of shrimp he should culture. Due to its large size and high price, Penaeus monodon and P. indicus are generally considered for farming. It has also been seen that both these species are suitable for farming in Kerala's environment. Apart from these candidate species, other commercially important species such as Metapenaeus ensis, *M. monoceros*, *M. brevicornis*, Penaeus semisulcatus and P. merguiensis are also potential species that can be grown in India. Another potential candidate species that is flooding the international market is the White leg shrimp, *Penaeus vannamei*. Although the Government of India has not yet given sanctions to culture it in the country, and many Asian countries have already started to culture this species.

Advantage of *L. vannamei*

- *Penaeus vannamei* has the potential to grow as fast as P. monodon (at up to 3 g/wk) up to 20 g under intensive culture conditions.
- They are amenable to the culture at very high stocking densities of up to 150/m2 in pond culture and even as high as 400/m2 in controlled recirculated tank culture.
- Tolerates a wide range of salinities, from 0.5-45 ppt, is comfortable at 7-34 ppt, but grows particularly well at low salinities of around 10-15 ppt.
- *P. vannamei* is very tolerant to low temperatures (down to 15 °C), enabling them to be cultured in the cold season.

Description

Morphology

Shrimp of the family Penaeidae follow a similar body design to that of most Malacostracans. They are laterally compressed, elongate decapods with a well-developed abdomen adapted for swimming. Each somite (segment) is enclosed by a dorsal tergum and ventral sternum. The pleura of the cephalothorax from the branchiostegal or gill cover. The carapace has characteristic ridges (carinae) and grooves (sulci). The rostrum is always prominent, with a high median blade bearing dorsal teeth and, in some genera, ventral teeth as well. The compound eyes are stalked and laterally mobile and the somites of the head bear, in order, pairs of antennules, antennae, mandibles, maxillae (maxillae 1), and maxillae (maxillae 2). The thorax has three pairs of maxillipeds and five pairs of pereiopods (legs), the first three being chelate and used for feeding, and the last two simple (non-chelate) and used for walking. The abdomen consists of six somites, the first five with paired pleopods. The plasma is formed by the endopodites of the first pair of pleopods modified as interlocking structures for spermatophore transfer. The appendix masculina are on the endopodites of the second pair of pleopods and serve to separate the plasma into two component halves. The helium may be 'open' or 'closed', depending on the species. The spermatophore is stored for some time before spawning.

Life Stages

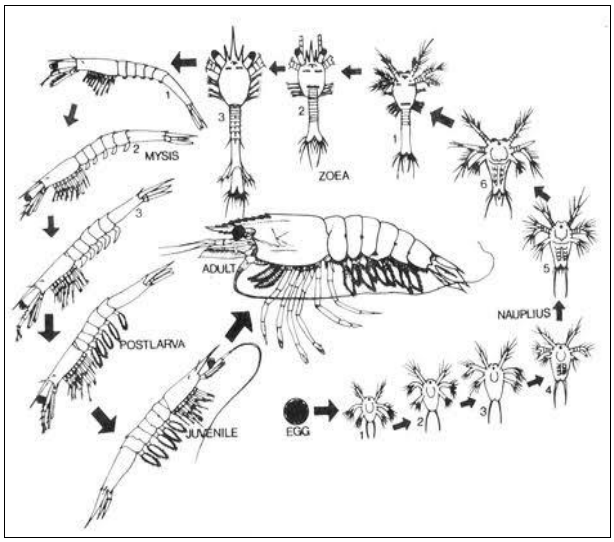

Fig 1: Life stages of Litopenaeus vannamei

Use of chemical and medicine

Different types of chemicals and medicine are used in shrimp culture. Chemicals help to increase dissolved oxygen, soil quality, and also pond preparation in shrimp culture. Medicine also helps with Gas removal, Growth promoters, disinfectants, and disease treatment. Recently, some commercial farms in both regions used probiotics as food additives for water maintenance experimentally.

Some chemicals used in shrimp culture

Some chemicals are- Potash, Bleaching, H_2O_2, Salt.

Fig 2(a): H_2O_2

Fig 2(b): Bleaching

Fig 2(c): $KMnO_4$

Types of medicine

Probiotics used in shrimp farms

Shrimp farmers were found to use probiotic products from different aqua-medicine companies such as PVS Pvt. Ltd, Virbac Pvt. Ltd., Aquatech Aquahealth, KEMIN aqua pvt ltd, Poseidon Biotech, Microbasia Pvt. Ltd. There has been increasing interest in the use of Probiotics in aquaculture with the demand to make it environment friendly. Farmer uses a range of probiotics products to control vibriosis and luminescent bacteria, improving water quality and controlling pH. The probiotics contained different beneficial bacteria, including Bacillus subtilis, *B. Pumilis*.

Table 1: Probiotics use in shrimp farms in my study area (Dhaipkuria):

Trade N.	Active Ingredients	Dose (ml/gm)	Purpose of Use	Source	Price
Yucca Sol	Bacillus SP	5-10	1. Provide natural food improved feeding growth. 2. Absorbed toxic gasses like Ammonia.	PVS Ltd.	2800.00
V_5	*Rodobacter sp, Rddococcus sp,*	300/1000^{2}m	1. Maintain algal bloom. 2. Maintain water quality, balance pH.	Virbac Pvt Ltd	1480.00
Tech care	Amino Acid, Digestive Enzymes & Proprietary blend of feed probiotic	5-10/kg feed	1. Improve immune response, molting shell formatting, weight gain, FCR.	Aquatech	
Toxi Tech	*Bacillus sp,*	1.5-2kg/Hac	Absorve toxic gasses & improve pond bottom soil.	Aquatech	2490.00

Table 2: Pond wise distribution of Probiotics

Pond no	Name of probiotics in my study area (%)					
	Yucca Sol	Lact act	Bacto treet	Gut Pro Tech	Early PS	Thionil-sp
1	20	08	12	10	20	18
2	18	10	08	10	22	22
3	22	12	20	10	18	18
4	20	35	35	30	20	20
5	20	35	25	40	20	22

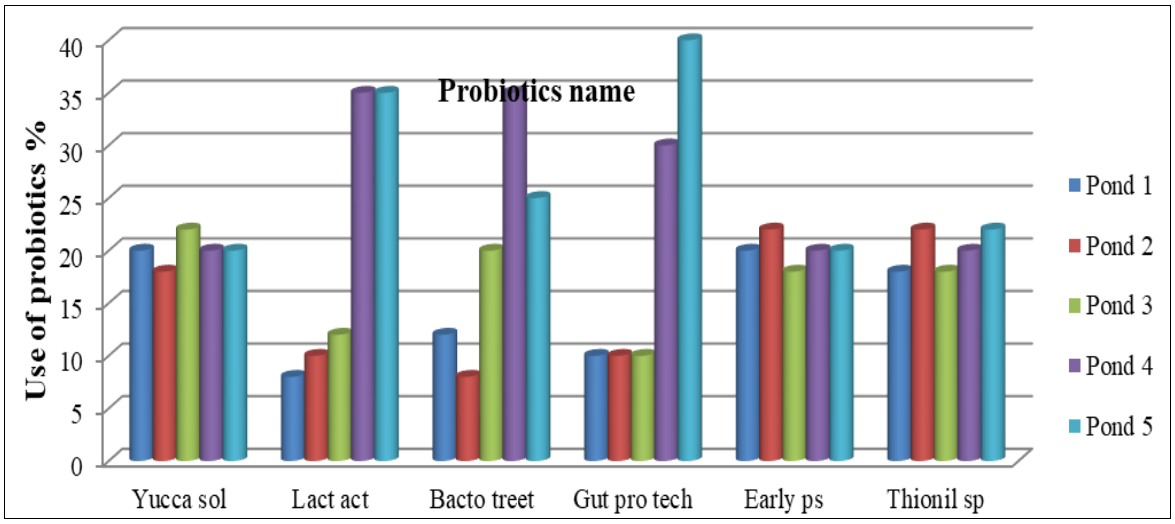

Fig 3: Analysis of the different types of probiotic use in a different pond

Aqua-medicines used to increase dissolved oxygen

To increase dissolved oxygen Recharge, Sea fresh, Oxy-tech, Micro O_2, were used. The list of such aqua-medicines with their active ingredients, prescribed dosage, sources, and the approximate price is shown in Table 3. This medicine was used to increase dissolved oxygen in aquaculture ponds.

Table 3: Aqua-medicines used to increase dissolved oxygen

Trade Name	Active	Dose (ml/gm)	Purpose of Use	Source	Price
Recharge	H_2O_2 / CaO_2	1.5kg/1000^{2}m	To increase DO.	Growel	160.0
Sea Fresh	Spetalized sodium derivatives	3kg/1000^{2}m	To increase DO in water.	CPF	1325.00
Oxy Tech	Specialized sodium derivatives	3kg/1000^{2}m	To increase DO in water	Aquatech Aquahealth	863.00

Table 4: Pond wise distribution of O_2 promoter use in Shrimp culture:

Pond no	O_2 promoter use (%)			
	Pond no	Pond no	Pond no	Pond no
1	15	20	15	20
2	10	15	25	15
3	20	25	20	25
4	25	20	15	20
5	30	20	25	20

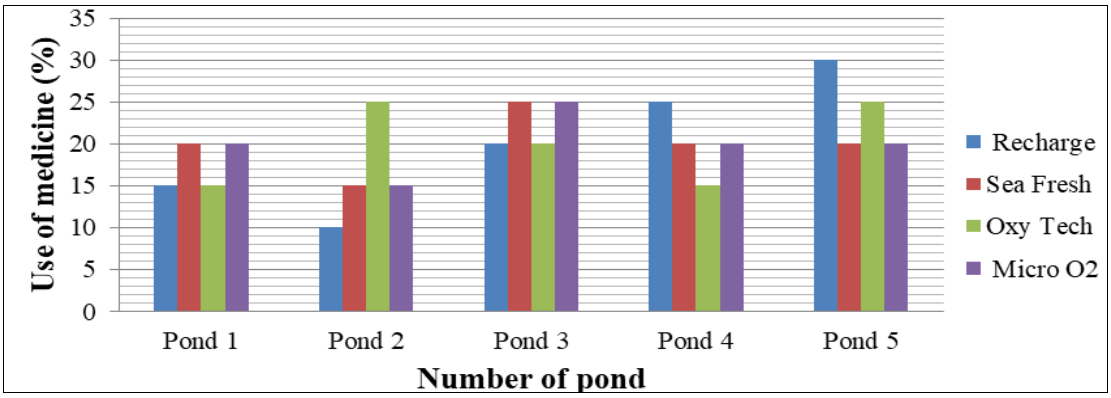

Fig 4: Graphical analysis of the different types of O_2 promoter in a different pond

Growth promoters used in shrimp farms

Several aqua-medicines were found to be used as growth promoters as well as to increase fish production. Him-C, Calgophos, MV-24, C-Feed, P- Liv, Pro marine were used. The list of such aqua medicines with their active ingredients, prescribed dose, sources, and the approximate price is shown in Table 5.

Table 5: Growth promoters used in my study area (Dhaipukuria)

Trade Name	Active Ingredients	Dose (ml/gm)	Purpose of Use	Source	Price / Kg
Him-C	Vitamine C	10gm/kg Feed	1. Control stress formation of exoskeleton. 2. Improve survival rate, FCR.	Himalaya	700.00
Calgophos	Ca, Mg. Na, Zn, Cu, K, Diacid, Phosphate	5-10ml/kg Feed	1. Optimizes exuvating process. 2. Rigidity & brightness of outer layer.	Virbac	450.00
MV- 24	Vit(A, D_3, E, K_3, C, B_1, B_2, B_3, B_5, B_6, B_7, B_8, B_9, B_{12} Mineral	2-5gm/kg Feed	1. Reduce stress & mortality. 2. Help to optimize meet colour & quality.	Virbac	2660.0
P- Liv	it B_{12}, K, Methionine, Lysine	10-20ml/kg	1. Prevent liver/Hepatopancreas disorder. 2. Improve body weight with FCR.	PVS Ltd	450.00
Pro Marine	Vitamine & Mineral	5gm/kg Feed	1. To reduce unwanted microorganisms. 2. Reduce bacterial growth.	Virbac	1500.0

Table 6: Pond wise distribution of growth promoter use in my study area:

Pond no	Use of Growth promoter (%)					
	Him-C	Calgophos	C- Feed	MV- 24	P- Liv	Pro Marine
1	20	15	18	10	12	15
2	18	20	22	14	08	14
3	22	22	15	10	15	11
4	20	25	20	36	30	35
5	20	18	25	30	35	25

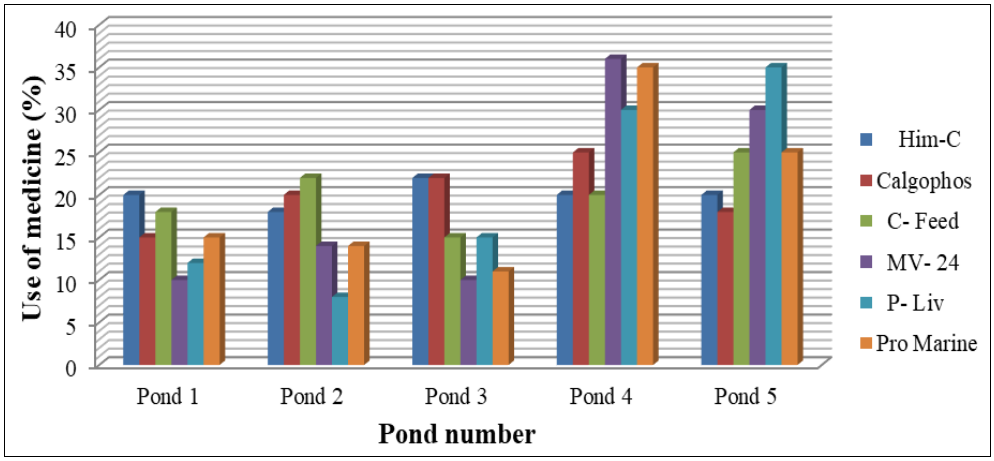

Fig 5: Graphical analysis of the different types of growth promoter use in a different pond

Medicine used as a disinfectant in shrimp farms: Farmers used aqua-medicines as a disinfectant to keep their pond free from pollution or pathogen. I-WFS, Omega Protein, Get out, Hepano Mix, Attract, Erawan-G, Hydroleta was used as a disinfectant. Their active ingredients, prescribed dosage, sources, and approximate price are shown in Table 7.

Table 7: Medicine used as a disinfectant in shrimp farms

Trade Name	Active Ingredients	Dose (ml/gm)		Purpose of Use	Source	Price
Omega-protein	Omega 3 fatty acid, Amino acid, P, Mg, Mn, Cu, Zn,	20-30gm/kg		Improve feed utilization efficiency, growth immune response & resistance in shrimp.	ASCENDS	1278.00
Hepano Mix	Amino acid & Vitamins	10gm/1kg Feed		1. Strength hepatopancreas function. 2. Improve Immune function.	Virbac	3200.00
Attract	Natural multivitamin	5-10 gm/kg		1. Attractant 2. Growth promoter.	PVS Laborabries	780.00
Hydro Leta	Algal 1-3B gluean and coated vit- C	5-10gm/ Feed		1. Improves immunity. 2. Reduces stress.	Kemin Industries	1999.00

Table 8: Pond wise distribution of disinfectant in my study area:

Pond Number	Disinfectant use (%)						
	Omega- protein	Hepano Mix	Hydro Leta	i-WFS	Get-Out	Attract	Erawan- G
1	20	20	18	10	08	09	11
2	18	20	22	08	12	11	10
3	15	18	20	12	10	10	09
4	25	22	18	30	35	33	30
5	22	20	22	40	35	37	40

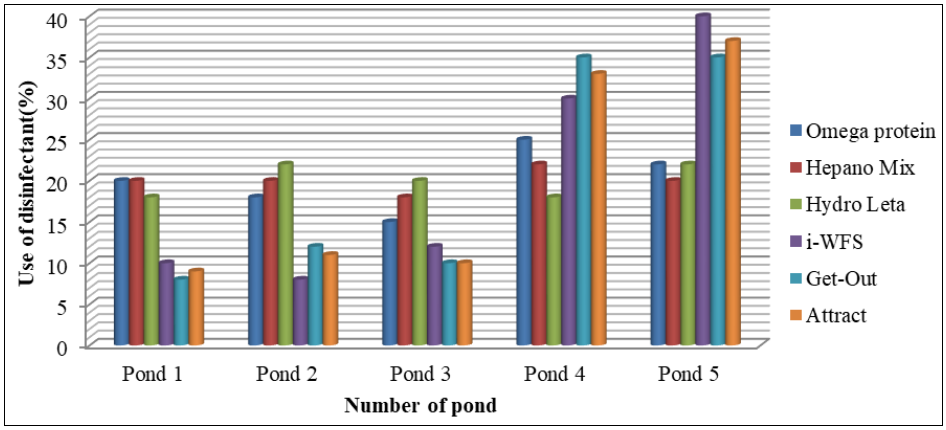

Fig 6: Graphical analysis of the different types of Disinfectant used in a different pond

Medicine used for water and soil quality management in shrimp farms: Many aqua-medicine companies were found in my study area (Dhaipukuria), such as Aquatech aqua health, Virbac, CPF, Shanxi Teach Team JHC Product. C. ltd, Growel. Various types of aqua medicines were produced by those companies which were used in aquaculture activities for water and soil quality management (Table 9).

Table 9: Medicine use for water and soil quality management in shrimp farms

Trade Name	Active Ingradients	Dose (ml/gm)	Purpose of Use	Source	Price / Kg
Hydromin	Ca, K, P, Mg, Mn, Cu, Co, I, Io, Su, Dl-Methionine, L. Lysine	2-3kg/1000m^2	Weight gain, Molting soft cell problem, planton growth, Increase hardness.	Aquatech Aqua health	165.00
Watrmin	Ca, Mg, K, P, Na, Su	2-3kg/1000m^2	Maintanance health growth and productivity of prawn.	Virbac	998.00
Toximar	Natural hydrated sodium calcium Aluminium Silicate	3-4kg/1000m^2	Birds and neutralizes toxins	Virbac	1380.0
Sodamix	Ca^{21},Mg^{2+},Na,K^+,Cl,SO_4^{2-}	4-5kg/1000m^2	1. Increase mineral level in water. 2. Increase Alkalinity and hardness.	CPF	

Chemical use in shrimp farm

Potash, lime, formalin, methylene blue, benzalkonium chloride, salt, and malachite green, were found to be used for disease treatment. The list of such chemicals with their active ingredients, dose, the purpose of use, sources, and the approximate price is shown in Table 10.

Table 10: Chemical use in study area (Dhaipukuria)

Trade Name	Active Ingradients	Dose (ml/gm)	Purpose of Use	Source	Price / Kg
Potash	$KMnO_4$	2-3ppm	For water treatment	Chemical seller	195.00
Lime	Cao, $Ca(OH)_2$	1kg/Dec	Pond preparation	Chemical seller	15.00
Bleaching	Chlorine	60ppm	Water treatment	Chemical seller	60.00
Salt	Nacl	1kg/Dec	Pond preparation	Chemical seller	08.00

Different types of problems during shrimp farming and their solution

During Shrimp farming in Purba Medinipur District farmer faces different types of problem. To overcome the problem during shrimp culture Farmer should have a proper idea of Aquaculture medicine management.

Table 11: Problem & solution of shrimp Culture

S. No	Problem	Solution
1	Molting Problem	Liming + Minerals
2	Gas Problem	Ex-Am, Geosol, H_2O_2
3	Gill choked	Seafresh, KMnO4,
4	White Muscle syndrome	Calmag, K-max, Sodamix
5	Size variation	Double Feeding
6	Mg shortage	Calmag, K-max
7	Pond Bottem problem	Sludge remove+H2O2, Ex-Am, Geosol
8	Mineral shortage	MagKcal, Enhance, Rider
9	Down pH	LSP+MgSO4 + NaHCO3
10	High pH	NaHCO3 +Dolo
11	Gut Problem	Biogut + Avant pro

The use of medicine in Aquaculture systems for various purposes is widely recognized and the benefits of medicine usage in aquaculture are many. The aquaculture activities in Purba Medinipur districts are also influenced by many medicines. The present study was carried out to know the current status of the use of medicine in the shrimp farm of Dhaipukuria, Bhagwanpur two block and Analysis the production cost. The present study identified a range of aqua medicine and chemical Marketed by different companies for using various activities of aquaculture. Many different diseases were found in this culture and also noticed the of this disease. The present study also noticed several new products with various trade names in the market, which included Hydeomin, Watrmin, Toximar, soda mix, Jinong Humic Acid, Sokrena-WS, Gasonix+Y, etc. The local animal feed and chemical shops are the main sources of these compounds. It was found that most farmers used chemicals during pond preparation, for improving water quality and disease treatment. Generally, Disease treatment in aquaculture can be of great value when the medicine is used properly used, but when improperly used medicine then the fish can cause large losses of shrimp. To properly use medicine to the water or feed, it is important to accurately determine the dosage and the best application method. In the present study, about 13 branded probiotics were found available in the market to use mainly in the shrimp culture to control vibriosis, luminescent bacteria, improve water and soil quality, and control pH.

Conclusion

In shrimp, culture success depends on feed, seed, environment, and management. In my study area in four ponds among five fluctuations of DO, pH is low and Hardness and alkalinity are high. Due to environmental parameter fluctuation, shrimps are not taken in appropriate quantity. Excess feed damage water parameter for this not survives properly and shrimp are very weakness. For this, shrimp attract various diseases, reduce the growth rate. For this, at present different medicine use it help to shrimp being the normal life span.

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