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Potential for ammonia and nitrite reducing products for shrimp farms in Andhra Pradesh

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ABSTRACT

The ammonia and nitrate problems are considered to be detrimental to the sustainability of aquaculture industry in Andhra Pradesh. Thus it is important to know about the awareness and technical knowledge about the possible symptoms, mitigating measures and quantification of losses. In addition, the farmers are very much price responsive. The ammonia and nitrite reducing products is a growing market on account of the capital intensive nature of shrimp farming. There exist many products in the market. It is also important to know about the different competing product, prices, technical support provided. The market potential for the different ammonia and nitrite reducing products was done in the state of Andhra Pradesh. The data was collected from districts; East Godavari, West Godavari and Nellore, and 180 respondents were surveyed. The study indicated that the awareness of ammonia is very high among the group of farmers. They are also of opinion in its detrimental effect on the yield losses. Currently there exist as many 21 products in the market. The market continues to remain as monopolistic competition with more and more entrants in the market. There exist numerous products, sale services technical guidance, product promotion programs, incentives and credit availability to insure the brand loyalty of customer. Nevertheless there exists a scope for new product entry into the market. With more than 45 percent of the customers showing their desire for the replacement of the product and 73 percent of aspiring for the product with different futures and other services like consultancy farm delivery. Ammonia and nitrate problem in shrimp farming will continue to occur and based on the effects, perception, awareness visible symptoms as expressed by the different farmers should be taken into account. The marketing strategy of the new product entry will be based on product development; promotion taking into account of more scientific validity. The product should be price responsive. Lastly the marketing strategy of the new product should be based on immediate and effective results.

Keywords: Shrimp, Ammonia, Nitrite, Awareness, Marketing strategy

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1. INTRODUCTION

Fisheries and aquaculture have been recognized as a powerful income and employment generator as it stimulates the growth of a number of subsidiary industries. It is an instrument for the livelihood for a large section of economically backward population of the country. Aquaculture is one of the fastest growing food sectors in the world with a impressive growth rate of over eight per cent annually (Handbook of Fisheries and Aquaculture, 2006). Over the past three decades, there has been a rapid progress in aquaculture development all over the world, particularly in Asian countries. The major changes that are noticeable indicate the transformation from a small scale homestead level activity to a large scale commercial aqua farming. The inland fisheries sector in India contributes to about 50 per cent of the total fish production (Dwivedi et al. 2005). During 2012-13 the contribution was 5.37 million tones. The shrimp contributes as one of the major commercially important species in aquaculture. Shrimp aquaculture amidst numerous governmental regulations, diseases occurrence, high cost of feed, the shrimp farm industry continuous to grow unabated. The farmed shrimp production in India during 2012-13 was 1,13,170 metric tones, which contributed to more than 50 per cent of the total shrimp production in the country.

1.1. Present status of fisheries and aquaculture in Andhra Pradesh

Andhra Pradesh ranks first not only in shrimp and freshwater prawn production but also in costal aquaculture. Andhra Pradesh is one of the major states which contribute immensely to the fish production in the country; both inland as well as marine. It ranks second in inland fish production and fifth in marine fish production. Andhra Pradesh ranks second in production of value added fish products (Anon, 2007). Tiger shrimp, *Peneaus monodon* is the most important marine candidate species in India, which is farmed along the Indian coasts. Presently it is also farmed in freshwater systems mainly in East and West Godavari districts of Andhra Pradesh. The white spot syndrome virus disease out break, occurred along the East coast of India during 1994, spread through vertical and horizontal transmissions all along the Indian coasts (Ayyappan, 2005). There are several shrimp farmers along the costal belt and the continuous release of WSSV affected waters from these farms increases the chances of spreading the disease and cause huge economic loss to the farmers. Though scampi

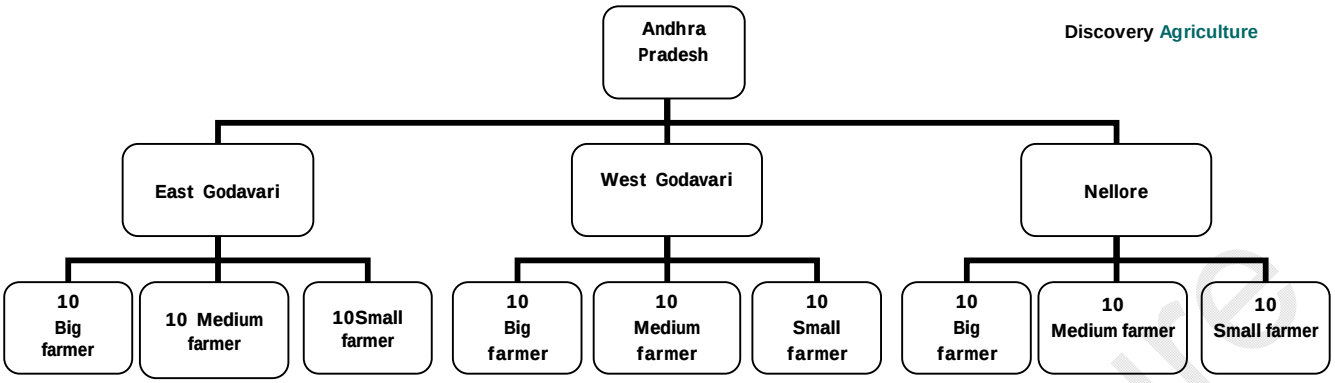

Figure 1

Sample design of the selected sample

Table 1

District wise status of development of shrimp culture in Andhra Pradesh

S/N	District	Potential area	Area developed (ha)		Area abandoned (ha)
			Land area (ha)	Water Spread Area(ha)	
1.	Srikakulam	1000	1165	932	100
2.	Vizianagaram	4000	71	57	45
3.	Visakhapatanam	7000	533	426	150
4.	East Godavari	13000	8987	7189	1600
5.	West Godavari	25000	14367	11494	725
6.	Krishna	50000	36143	28914	15000
7.	Guntur	20000	10884	8708	3500
8.	Prakasam	15000	4777	3822	50
9.	Nellore	30000	8024	6419	2000
10.	Total	174000	84951	67961	23170

Data Source: Fishing chimes, 2008

Table 2

Perception and Awareness about Ammonia and Nitrite problem and its possible causes

S/N	District	Farm size	AAA	AAN	EFD	RTM	RpH	HSD
1.	EG	0-5	8 (80)	0 (0)	8 (80)	6 (60)	7 (70)	7 (70)
		5-10	8 (80)	0 (0)	8 (80)	6 (60)	7 (70)	7 (70)
		10-20	6 (100)	0 (0)	6 (100)	6 (100)	5 (83.3)	6 (100)
		> 20	6 (100)	2(33.3)	6 (100)	6 (100)	6 (100)	6 (100)
		Total	**28(93.3)**	**4(13.3)**	**28(93.3)**	**26(86.6)**	**24(80)**	**26(86.6)**
2.	WG	0-5	5 (62.5)	1 (12.5)	7 (87.5)	5 (62.5)	5 (62.5)	3 (37.5)
		5-10	6 (85.7)	4(57.1)	6(85.7)	5 (71.4)	4(57.1)	5(71.42)
		10-20	7 (87.5)	4(50)	6(75)	7 (87.5)	6 (75)	7 (87.5)
		> 20	8 (100)	7 (87.5)	8 (100)	8 (100)	7 (87.5)	7 (87.5)
		Total	**26(86.6)**	**16(53.3)**	**27(90)**	**25(83.3)**	**22(73.3)**	**22(73.3)**
3.	NEL	0-5	5 (50)	0 (0)	7 (70)	1 (10)	2 (20)	3 (30)
		5-10	11 84.6)	5(38.4)	11(84.6)	5(38.4)	8(61.5)	9 (69.23)
		10-20	6 (85.7)	5(71.4)	7(100)	7(100)	6(85.7)	5(71.42)
		Total	**22(73.3)**	**10(33.3)**	**25(83.3)**	**13(43.3)**	**16(56.3)**	**17(56.6)**
4.	TOT	0-5	18(62.2)	1(3.57)	22(78.5)	12(42.85)	14(50)	13(46.42)
		5-10	25(89.2)	11(39.2)	25(89.2)	18(64.28)	18(64.2)	21 (75)
		10-20	17(94.4)	8 (44.4)	17(94.4)	18 (100)	15(83.3)	16(88.88)
		> 20	16 (100)	10(62.5)	16 (100)	16 (100)	15(93.7)	15(93.75)
		Total	**76(84.4)**	**30(33.3)**	**80(88.8)**	**64 (71.1)**	**62(68.8)**	**65(72.2)**

* (Figures in parentheses indicates percentage to total)

AAA- Awareness about Ammonia AAN- Awareness about Nitrite

EFD - Excess feeding RTM- Rise in temperature

RpH- Rise in pH HSD- High stocking density

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Table 3
Perception and Awareness about the effects of Ammonia and Nitrite problem

S/N	District	Farm size	PPR	BCR	FD	LSP	Ph	BGF
1.	EG	0-5	4 (40)	7 (70)	3 (30)	5 (50)	8.4	6 (60)
		5-10	3 (37.5)	5 (62.5)	5 (62.5)	4 (50)	8.4	4 (50)
		10-20	3 (50)	3 (50)	2 (33.3)	3(50)	8.3	2 (33.3)
		> 20	0 (0)	6 (100)	1 (16.6)	5 (83.3)	8.6	6 (100)
		Total	10(33.3)	21(70)	11(36.6)	17(56.6)	8.4	1860)
2.	WG	0-5	8 (100)	8 (100)	6 (75)	7 (87.5)	8.3	3 (37.5)
		5-10	7 (100)	3 (100)	7 (100)	7 (100)	8.3	2 (28.5)
		10-20	6 (75)	6 (75)	5 (62.5)	5 (62.5)	7.2	3 (37.5)
		> 20	8 (100)	8 (100)	6 (75)	8 (100)	8.3	7 (87.5)
		Total	29(96.6)	29(96.6)	24(80)	27(90)	8.0	15(50)
3.	NEL	0-5	7 (70)	5 (50)	7 (70)	9 (90)	8.5	6 (60)
		5-10	1(76.2)	10(76.9)	10(76.9)	7(53.8)	6.5	5 (38.4)
		10-20	7 (100)	6(85.71)	6 (85.7)	7 (100)	6.9	6(85.71)
		Total	24(80)	21(70)	23(76.6)	23(76.6)	7.3	17(56.6)
4.	TOT	0-5	19(67.8)	20(71.4)	16(57.1)	21 (75)	8.4	15(53.5)
		5-10	20(71.4)	22(78.5)	22(78.5)	18(64.2)	7.5	11(39.2)
		10-20	15(83.3)	13(72.2)	12(66.6)	13(72.2)	7.7	9(50)
		> 20	9 (56.2)	16(100)	8 (50)	15(93.7)	8.4	15(93.7)
		Total	**63(70)**	**71(78.9)**	**58(64.4)**	**67(74.4)**	**7.9**	**50(55.6)**

(Figures in parentheses indicates percentage to total)
PPR - Pleopods and periopods reddish, BCR - Body colour reddish, FD – Feed drop, LSP - Loose shell problem, pH - pH of Water
BGF - Black gill formation

Table 4
Perception and awareness of the respondents on the yield loss due to ammonia

S/N	District	Farm size	LOS	TIO
1.	East Godavari	0-5	6 (60)	46
		5-10	6 (75)	61
		10-20	5 (83.3)	54
		> 20	6 (100)	70
		Total	23(76.6)	58
2.	West Godavari	0-5	6 (75)	42
		5-10	7 (100)	61
		10-20	7 (87.5)	46
		> 20	8 (100)	62
		Total	28(93.3)	53
3.	Nellore	0-5	10(100)	24
		5-10	11(84.6)	50
		10-20	7 (100)	60
		Total	28(93.3)	44
4.	Total	0-5	22(78.5)	37
		5-10	24(85.7)	56
		10-20	17(94.4)	53
		> 20	16(100)	66
		Total	**79(87.8)**	**53**

(Figures in parentheses indicates percentage to total)
LOS- Awareness about loss due to Ammonia TIO- time of incidence occurrence (days onwards)

farming has been seen as an alternative to tiger shrimp farming, the same could not share the popularity due to its inherent disadvantage, which includes poor growth rate, labour intensiveness, and lack of quality seed material in time as well as in quantity, etc. Godavari is a perennial river and supplies water throughout the year from its canal system. The ground water of Godavari districts is saline in nature (20 to 30 ppt). Therefore the farmers fulfill their need of saltwater during shrimp farming by pumping the ground water. Shrimp farming in this region is being carried out at a salinity range between one to fifteen ppt. The size of ponds used for shrimp farming in this region varies widely between one to ten acres, while majority of the farmers have an area of four acres. The soil is clayey and alkaline in nature and has good water holding capacity which enables the farmers to adopt zero water exchange, though minimal water exchange is not uncommon (Athithan, 2007).

1.2. Aquaculture potential in Andhra Pradesh

1.2.1. Ammonia

Ammonia is the most toxic form of inorganic nitrogen produced in pond water. It originates due to mineralization of organic matter by heterotrophic bacteria and as a byproduct of nitrogen metabolism by most aquatic animals (Kumar, 2007). The ammonical nitrogen content of water is an index of the degree of its pollution. Its concentration in unpolluted water should never more than 0.1 mg/l and below this amount healthy growth of fish is expected. Aquatic autotrophs rapidly utilize ammonium ions in preference over nitrite and thus, usually prevent it from reaching to toxic level. Unionized ammonia (NH_3) is toxic to shrimp but the ammonium ion (NH_4^+) is non toxic and further the toxicity of unionized ammonia is more toxic when dissolved oxygen concentration is low. Shrimps excrete most of their nitrogenous wastes through the gills in the form of ammonium ion (NH_4^+).

1.2.2. Nitrite

The most undesirable form of nitrogen in aquaculture system is nitrite which originates from the reduction of nitrate by bacteria in the aerobic mud or water. Nitrite-N concentration in culture water should not exceed more than 0.5 mg/lit as its higher amount results methamoglobin production (Camargo Julio, 2006). Nitrite in the blood oxidizes haemoglobin to methamoglobin, which is incapable of transporting oxygen. Excess of nitrite is toxic to fish and leads to mortality.

2. NEED FOR THE STUDY

The ammonia and nitrate problems are considered to be detrimental to the sustainability of aquaculture industry in Andhra Pradesh (Sekar et al, 2006). Thus it is important to

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Table 5
Consumption of Ammonia and Nitrate reducing products

S/N	Product	Dose	Cost	No of Users
1.	Bio aqua	1	540	2 (2.15)
2.	Biocarbdry	1	1000	6 (6.45)
3.	Formalin	5	300	1 (1.07)
4.	Gasonix	0.31	441	3 (3.22)
5.	Gasorid	0.32	532	5 (5.37)
6.	Nitrobacter	0.5	500	1 (1.07)
7.	Odoban	0.47	691	11 (11.82)
8.	Oxidol	0.78	318	6 (6.45)
9.	Pond fresh	0.5	855	1 (1.07)
10.	Prosap	0.5	869	2 (2.15)
11.	Proxy PS	1.57	813	6 (6.45)
12.	Spark PS	1	848	6 (6.45)
13.	Super biotic	5	550	1 (1.07)
14.	Super PS	5	650	6 (6.45)
15.	TO Ban	0.2	500	3 (3.22)
16.	Yucca	0.5	700	1 (1.07)
17.	Yucca 30	0.5	658	6 (6.45)
18.	Yucca care	0.2	161	1 (1.07)
19.	Yucca gold	0.5	850	2 (2.15)
20.	D ammonia	0.5	343	4 (4.30)
21.	Deodarase	0.34	572	19 (20.43)

(Figures in parentheses indicates percentage to total)

Table 6
Opinion about farm delivery and consultancy

S/ N	District	Farm size	FAD	CON
1.	East Godavari	0-5	0 (0.00)	0 (0.00)
		5-10	2 (25.00)	0 (0.00)
		10-20	2 (33.30)	0 (0.00)
		> 20	5 (83.30)	0 (0.00)
		Total	**9 (30.00)**	**0 (0.00)**
2.	West Godavari	0-5	2 (0.00)	0 (0.00)
		5-10	0 (0.00)	1 (14.20)
		10-20	0 (0.00)	0 (0.00)
		> 20	8 (100.00)	2 (25.00)
		Total	**8 (26.60)**	**3 (10.00)**
3.	Nellore	0-5	0 (0.00)	0 (0.00)
		5-10	1 (7.60)	2 (15.30)
		10-20	4 (57.10)	1 (14.20)
		Total	**5 (16.60)**	**3 (10.00)**
4.	Total	0-5	0 (0.00)	0 (0.00)
		5-10	3 (10.70)	3 (10.70)
		10-20	5 (27.70)	1 (5.50)
		> 20	14(87.50)	2 (12.50)
		Total	**22(24.40)**	**6 (6.70)**

* (Figures in parentheses indicates percentage to total)
FAD- Farm delivery CON- Consultancy ASS- After sales services

know about the awareness and technical knowledge about the possible symptoms, mitigating measures and quantification of losses. In addition, the farmers are very much price responsive. The Ammonia and Nitrite reducing products is a growing market on account of the capital intensive nature of shrimp farming. There exist many products in the market. It is also important to know about the different competing product, prices, technical support provided. The market potential for the different ammonia and nitrite reducing products w as done in the state of Andhra Pradesh with the following objectives.

2.1. Objectives

- to estimate the economic loss due to the Ammonia and Nitrite
- to analyse the awareness about different products available in Andhra Pradesh market.
- to develop a marketing strategy for the new entering product in the market.

3. METHODOLOGY

The aim of the study was to find out the awareness and economic loss due to the ammonia and nitrite and to develop a viable marketing strategy for a new product entry in the market in selected districts of Andhra Pradesh. A structured questionnaire was developed which contained details on the personal information, awareness and causes of Ammonia and Nitrite, suggestion for product development, presently using products, any indigenous methods, about test kits used by them, about danger, action and acceptable levels of above said problems and awareness about use of chemicals and eco-friendly products. Andhra Pradesh was selected purposively for the study as Andhra Pradesh ranks first in shrimp and prawn production. The culture practices in Andhra Pradesh are semi intensive and intensive with high stocking density and excessive feeding. Due to high stocking density problems like Ammonia, Nitrite, are unavoidable in the farm. Lot of shrimp area was left abandoned or shrimp farming closed down as a result of the yield losses. The sampling was done

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in selected district of Andhra Pradesh viz., East and West Godavari and Nellore. Based on the available area and production, three districts; East Godavari, West Godavari and Nellore, were selected (Table 1). From each districts, 30 respondents were selected as big, small, and medium. Care was taken that the selected respondents were progressive. The detailed study design is indicated in Figure 1. The data was collected using a structured questionnaire including the different aspects of shrimp farming, and with specific reference to ammonia and nitrate problem. The data was analysed using average and percentage analyses.

4. RESULTS AND DISCUSSIONS

The detailed survey schedule was employed to collect the different qualitative and quantitative information related to shrimp farming. The details on different problems related to Ammonia and Nitrite, were collected on account of its awareness, causes, effects, reducing products, etc. Numerous average and percentage analysis were estimated and graphical illustration were done. In order to deduce meaningful conclusions, the data were stratified into four namely, marginal, small, medium, and big farmers. In the context of the study, the marginal farmer has a land holding of less than 5 acre farm, small farmer 5-10 acre, medium farmer 10-20 acre and big farmer more than 20 acre farm area. For better clarity and understanding the results and discussion on the different Ammonia and Nitrite reducing products are discussed under the following heads. The details about the perception and awareness about ammonia and nitrite and their possible causes are furnished in Table 2. The major causes suggested were excess feeding, rise in temperature, rise in pH, and high stocking density. The analysis reveals that 84.4 per cent of the total respondents are aware about ammonia problem and 33.3 per cent about nitrite problem. In East Godavari district, awareness about ammonia is 93.3 per cent and only 13.3 per cent were aware about nitrite. Most of the farmers feel that excess feeding (93 per cent) and high stoking density (86.6 per cent) were the major causes of ammonia and nitrite problem. In West Godavari district, awareness about ammonia is 86.6 per cent and nitrite was 53.3 per cent. Majority of the farmers consider that excess feeding (90 per cent) and high stoking density (73.3 per cent) and rise in pH (73.3 per cent) are the major causes of ammonia and nitrite problem. In Nellore district, awareness about ammonia was 73.3 per cent and nitrite was 33.3 per cent. Most of the farmers feel that excess feeding (83.3 per cent) is responsible for ammonia and nitrite problem. The analysis also reveals that the awareness level about ammonia and nitrite problems is highest among big farmers (100 per cent) and lowest among the marginal farmers (62.28 per cent). This indicates its higher occurrence and visible symptoms in big farms.

The details about the Perception and Awareness about the effects of Ammonia and Nitrite problem are furnished in Table 3. The major effects are feed drop, loose shell problem, black gill formation, reddish pleopods and periopods, reddish body colour reddish, etc. The analysis reveals that loose shell problem (74.4 per cent) and reddish body color (78.9 per cent) are the most visible effects of ammonia and nitrite problem. In East Godavari, 70 per cent farmers are able to recognize that reddish body colour of the shrimps is because of stress on the shrimps due to ammonia and 60 per cent farmers were aware about the problems of black gill formation due to accumulation of ammonia and nitrite in the gills. In West Godavari, majority of the farmers were facing problems like reddish pleopods (96.6 per cent) and reddish body colour (96.6 per cent) of the shrimp. Farmers in Nellore district consider that effects of ammonia and nitrite are reddish pleopods (80 per cent), feed drop (76 per cent) and loose shell problem (76 per cent). The analysis reveled that farmers are aware that ammonia and nitrite in pond is responsible for reddish body colour of shrimp.

The details about the perception and Awareness of the respondents on the yield loss due to ammonia and nitrite are furnished in Table 4. Due to excess ammonia and nitrite, shrimp gets stressed and it shows lethargic behavior and at last mortality occurs. The analysis reveals that in general 87.8 per cent of the farmers are aware that ammonia problems lead to loss of yield and this problem is encountered on the 54th day of the culture period on an average. Individually this awareness in East Godavari, Nellore and West Godavari is 76.6 per cent, 93.3 per cent and 93.3 per cent respectively. The problem was generally encountered on 42nd, 53rd and 45th day of the culture period in East Godavari, Nellore and West Godavari districts respectively. Analysis reveals that most of the farmers are accept that there is loss due to ammonia and nitrate.

There are number of ammonia and nitrite reducing products used in the Andhra aquaculture market. Deodarase, is having major market share (about 20 per cent) among all these products followed by Odoban, Proxy PS, and Spark PS etc. The respondent opinion on the product services namely farm delivery and consultancy are listed in Table 5. The results revealed that 24.4 per cent of the farmers are getting farm delivery and 6.7 per cent of the farmers are provided consultancy with the product they purchase. From the study, it has been seen that in East Godavari, 30 per cent farmers are getting farm delivery and 26 per cent farmers in West Godavari. In West Godavari only 10 per cent farmers are getting the facility of consultancy for the ammonia and nitrite reducing product. In Nellore 26.6 per cent farmers are getting farm delivery and 10 per cent are getting consultancy. It has been seen that generally the big farmers are provided this type of facilities because they gave the orders in bulk on account of. Small farmers are not able to get farm delivery and consultancy services (Table 6).

During the survey questions were asked to the farmers about satisfaction with product, replacement of the product, features desirable in the new product like low price, good results, farm delivery etc. The study reveals that out of 90 respondents, 73.3 per cent are satisfied with the current product, 45.6 per cent farmers want to replace the current product, and 73.3 per cent farmers want a new product with different features as stated above (Table 7). In East Godavari, 63.3 per cent farmers are satisfied with their currently using product, 50 per cent farmers want to replace the currently using product and 73.3 per cent farmers want a new product. In West Godavari district, 70 per cent farmers are satisfied, 43.3 per cent farmers want to replace their currently using product and 73.3 per cent farmers want a new product. In Nellore district, 86.6 per cent farmers are satisfied, 45.6 per cent farmers want to replace their currently using product and 73.3 per cent farmers want a new product. It has been seen that generally the small farmers want to replace the current product so they can be targeted by a new entrant.

5. CONCLUSIONS

The major findings which had emanated from the study is listed below

1. Awareness of ammonia is 85 per cent and nitrite is 33 per cent in the sampled area.
2. Most of the farmers consider that both ammonia and nitrite problems are one and the same.
3. Most visible effects of ammonia and nitrite are reddish body colour and loose shells.
4. The Incidence of occurrence of the problem is on the 58th day in EG, 53rd day in WG and 44th day in Nellore district.
5. Only big farmers are getting the services like farm delivery and consultancy.
6. 73 per cent farmers are satisfied with currently using product because they are thinking that they are using best product in the market.
7. 46 per cent farmers want to replace the current product.
8. 73 per cent farmers wanted product having lesser price, good and fast results.
9. Mostly the big farmers are satisfied with the products they are using while a major proportion of marginal and small farmers want to replace the product.

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Table 7
Respondent Opinion on new product development

Sl. No.	District	Farm size	SWP	RPR	NPR
1.	East Godavari	0-5	4 (40.00)	6 (60.00)	5 (50.00)
		5-10	6 (75.00)	3 (37.50)	6 (75.00)
		10-20	4 (66.60)	2 (33.30)	6 (100.00)
		> 20	5 (83.30)	4 (66.60)	5 (83.30)
		Total	**19(63.30)**	**15 (50.00)**	**22(73.30)**
2.	West Godavari	0-5	5 (62.50)	5 (62.50)	7 (87.50)
		5-10	5 (71.40)	1 (14.20)	5 (71.40)
		10-20	3 (37.50)	4 (50.00)	5 (62.50)
		> 20	8 (100.00)	3 (37.50)	5 (62.50)
		Total	**21(70.00)**	**13(43.30)**	**22(73.30)**
3.	Nellore	0-5	9 (90.00)	6 (60.00)	6 (60.00)
		5-10	11(84.60)	5 (38.40)	11(84.60)
		10-20	6 (85.70)	2 (28.50)	5 (71.40)
		Total	**26(86.60)**	**13(43.30)**	**22 (73.30)**
4.	Total	0-5	18(64.20)	17(60.70)	18 (64.20)
		5-10	22(78.50)	9 (32.10)	22 (78.50)
		10-20	11(61.10)	7 (38.80)	14 (77.70)
		> 20	15(93.70)	8 (50.00)	12 (75.00)
		Total	**66(73.30)**	**41(45.60)**	**66 (73.30)**

*(Figures in parentheses indicates percentage to total)
SWM- Satisfied with the product RPR- Wants to replace the product NPR- new product requirement

Deodrase has maximum market share in ammonia and nitrate reducing products followed by Odoban, Proxy PS, and Spark PS.

SUMMARY OF RESEARCH

The study indicated that the awareness of ammonia is very high among the group of farmers. They are also of opinion in its detrimental effect on the yield losses. Currently there exist as many 21 products in the market. The market continues to remain as monopolistic competition with more and more entrants in the market. There exist numerous products, sale services technical guidance, product promotion programs, incentives and credit availability to insure the brand loyalty of customer. Nevertheless there exists a scope for new product entry into the market. With more than 45 percent of the customers showing their desire for the replacement of the product and 73 percent of aspiring for the product with different futures and other services like consultancy farm delivery.

FUTURE ISSUES

Ammonia and nitrate problem in shrimp farming will continue to occur and based on the effects, perception, awareness visible symptoms as expressed by the different farmers should be taken into account. The marketing strategy of the new product entry will be based on product development; promotion taking into account of more scientific validity. The product should be price responsive. Lastly the marketing strategy of the new product should be based on immediate and effective results.

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