



Hindu	27 (60)	29 (64.4)	30 (64.4)	23 (51.1)	34 (75.6)	142(63.1)
Muslim	2 (4.4)	2 (4.4)	1 (2.2)	3 (6.7)	5 (11.1)	13 (5.8)
Christian	16 (35.6)	14 (31.1)	15 (33.3)	19 (42.2)	6 (13.3)	70 (31.1)
<b>Marital status</b>						
Single	6 (13.3)	11 (24.4)	11 (24.4)	5 (11.1)	11(24.4)	44 (19.6)
Married	39 (86.7)	34 (75.6)	34 (75.6)	40 (88.9)	34(75.6)	181(80.4)
<b>Primary occupation</b>						
Non skilled job+ Aquaculture	4 (8.9)	3 (6.7)	2 (4.4)	5 (11.1)	2 (4.4)	16 (7.1)
Private job+ Aquaculture	4 (8.9)	7 (15.6)	7 (15.6)	3 (6.7)	4 (8.9)	25 (11.1)
Govt. job+ Aquaculture	9 (20)	9 (20)	9 (20)	8 (17.8)	3 (6.7)	38 (16.9)
Student+ Aquaculture	2 (4.4)	2 (4.4)	2 (4.4)	1 (2.2)	4 (8.9)	11 (4.9)
Aquaculture	26 (57.8)	24(53.3)	25(55.6)	28(62.2)	32(71.1)	135(60)
<b>Income (per month in Rs.)</b>						
<1,000	17 (37.8)	4 (8.9)	4 (8.9)	11 (24.4)	0 (0)	36 (16)
1,000-5,000	1 (2.2)	6 (13.3)	2 (4.4)	4 (8.9)	6 (13.3)	19 (8.4)
5,000-10,000	13(28.9)	11 (24.4)	7 (15.6)	9 (20)	10(22.2)	50 (22.2)
>10,000	14 (31.2)	24 (53.4)	32 (71.1)	21 (46.6)	29(64.4)	120(53.3)
<b>Communication facility utilised</b>						
Post office- Yes	45 (20)	45 (20)	45 (20)	45 (20)	45 (20)	225 (100)
Post office- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mobile phone- Yes	41 (18.2)	38 (16.9)	42 (18.7)	42 (18.7)	38(16.9)	201(89.3)
Mobile phone- No	4 (8.9)	7 (15.6)	3 (6.7)	3 (6.7)	7 (15.6)	24 (10.7)
Internet- Yes	14 (6.2)	11 (4.9)	16 (7.1)	17 (7.6)	7 (3.1)	65 (28.9)
Internet- No	31 (68.9)	34 (75.6)	29 (64.4)	28 (62.2)	38 (84.4)	160 (71.1)
Television- Yes	44 (19.6)	42 (18.7)	40 (17.8)	37 (16.4)	35(15.6)	198 (88)
Television- No	1 (2.2)	3 (6.7)	5 (11.1)	8 (17.8)	10 (22.2)	27 (12)
Radio- Yes	22 (9.8)	19 (8.4)	20 (8.9)	20 (8.9)	32(14.2)	113(50.2)
Radio- No	23 (51.1)	26 (57.8)	25 (55.6)	25 (55.6)	13 (28.9)	112 (49.8)
KCC- Yes	7 (3.1)	5 (2.2)	10 (4.4)	5 (2.2)	12 (5.3)	39 (17.3)
KCC- No	38 (84.4)	40 (88.9)	35 (77.8)	40 (88.9)	33 (73.3)	186 (82.7)
<b>Family size</b>						
Two	1 (2.2)	1 (2.2)	1 (2.2)	1 (2.2)	0 (0)	4 (1.8)
Three	1 (2.2)	1 (2.2)	3 (6.7)	1 (2.2)	5 (11.1)	11 (4.9)
Four	32 (71.1)	32 (71.1)	31 (68.9)	27 (60)	35 (77.8)	157(69.8)
Five	11 (24.4)	11 (24.4)	10 (22.2)	16 (35.6)	2 (4.4)	50 (22.2)
Six	0 (0)	0 (0)	0 (0)	0 (0)	3 (6.7)	3 (1.3)

(Corresponding percentages are indicated in parenthesis)

A majority of 72 per cent of fish farmers were middle aged (age 40-60), 25 per cent were young (age 20-40) and 4 per cent were old (over 60). The middle aged farmers were active in aquaculture. Younger farmers were few as they showed less interest in taking up aquaculture. The fish farmers were mostly male (72%) as women were reluctant to take up heavy farm work. Most of the fish farmers (42.2%) had an education up to secondary level and very few (0.9%) were post graduates which indicated their lack of interest in gaining education. Eighty per cent of farmers were married. Maximum fishers (60%) were engaged in fish culture while non skilled workers (7%), private job holders (11%), government workers (17%) and students (5%) were doing fish culture as a secondary activity. Most of the farmers (53%) were earning more than Rs.10,000 per month because besides aquaculture they were involved in other income

generating activities (Ahmed and Lorica, 2002; Bouis, 2000). Those who earned less than Rs.1,000 and Rs.1,000- Rs.5,000 monthly were students and women who did ornamental fish culture as their hobby. All the farmers in the study area used post office for communication because it stood closest to the farmers as opined by Chaminuka *et al.*, (2008) in Africa. A total of 89.3 per cent used mobile phones, as cheap handsets were available and 88 per cent viewed television through which they saw visuals in local language as reported by Chhachher *et al.*, in Pakistan (2012). Only 29 and 17 per cent used internet and Kisan Call Centre (KCC) respectively, due to low awareness. All farmers had nuclear families and most (69.8%) with four members and only 1.3 per cent had more than 6 family members, and this was also reported by Ali *et al.*, (2008) in Bangladesh.

Table 2: Aquaculture practices followed by farmers (n=225)

	Kollam (n <sub>1</sub> =45)	Alappuzha (n <sub>2</sub> =45)	Kottayam (n <sub>3</sub> =45)	Ernakulam (n <sub>4</sub> =45)	Thrissur (n <sub>5</sub> =45)	Total (n=225)
<b>Type of fish cultured</b>						
Ornamental fish	28 (62.2)	28 (62.2)	15 (33.3)	24 (53.3)	10 (22.2)	105 (46.7)
Food fish	11 (24.4)	11 (24.4)	12 (26.7)	13 (28.9)	15 (33.3)	62 (27.6)
Both	6 (13.3)	6 (13.3)	18 (40)	8 (17.8)	20 (44.4)	58 (25.8)
<b>Land area owned (in cents)</b>						
0 - 10	4 (8.9)	3 (6.7)	0 (0)	5 (11.1)	9 (20)	21 (9.3)
10 - 20	26 (57.8)	22 (48.9)	6 (13.3)	23 (51.1)	18 (40)	95 (42.2)
20 - 30	11 (24.4)	6 (13.3)	3 (6.7)	9 (20)	5 (11.1)	34 (15.1)
30 - 40	3 (6.7)	1 (2.2)	6 (13.3)	4 (8.9)	1 (2.2)	15 (6.7)
> 40	1 (2.2)	13 (28.9)	30 (66.7)	4 (8.9)	12 (26.7)	60 (26.7)
<b>Type of ownership of land area</b>						
Lease	5 (11.1)	5 (11.1)	0 (0)	4 (8.9)	1 (2.2)	15 (6.7)
Own	40 (88.9)	40 (88.9)	45 (100)	41 (91.1)	44 (97.7)	210 (93.3)
<b>Aquaculture experience (in years)</b>						
Two	24 (53.3)	24 (53.3)	10 (22.2)	23 (51.1)	12 (26.7)	93 (41.3)
Three	9 (20)	9 (20)	5 (11.1)	5 (11.1)	17 (37.8)	45 (20)
Four	6 (13.3)	6 (13.3)	0 (0)	7 (15.6)	7 (15.6)	26 (11.6)
>Four	6 (13.3)	6 (13.3)	30 (66.7)	10 (22.2)	9 (20)	61 (27.1)
<b>Type of fish farming practiced</b>						
Monoculture	2 (4.4)	2 (4.4)	5 (11.1)	2 (4.4)	33 (73.3)	44 (19.6)
Poly culture	41 (91.1)	41 (91.1)	40 (88.9)	41 (91.1)	11 (24.4)	174 (77.3)
Both	2 (4.4)	2 (4.4)	0 (0)	2 (4.4)	1 (2.2)	7 (3.1)
<b>Number of workers employed</b>						
Zero	30 (66.7)	30 (66.7)	5 (11.1)	28 (62.2)	19 (42.2)	112 (49.8)
One	1 (2.2)	1 (2.2)	2 (4.4)	1 (2.2)	8 (17.8)	16 (5.8)
Two	7 (15.6)	7 (15.6)	9 (20)	8 (17.8)	7 (15.6)	38 (16.9)
Three	7 (15.6)	7 (15.6)	4 (8.9)	8 (17.8)	8 (17.8)	34 (15.1)
Four	0 (0)	0 (0)	7 (15.6)	0 (0)	0 (0)	7 (3.1)
Five	0 (0)	0 (0)	18 (40)	0 (0)	0 (0)	18 (8)
<b>Way of utilisation of yield</b>						
Sold	25 (55.6)	25 (55.6)	18 (40)	19 (42.2)	11 (24.4)	98 (43.6)
Sold and own use	20 (44.4)	20 (44.4)	27 (60)	26 (57.8)	34 (75.6)	127 (56.4)
<b>Way of marketing produce</b>						
Word of mouth	20 (44.4)	17 (37.8)	27 (60)	13 (28.9)	9 (20)	88 (38.2)
Sign boards	17 (37.8)	17 (37.8)	11 (24.4)	19 (42.2)	24 (53.3)	86 (39.1)
Advertisements	2 (4.4)	3 (6.7)	2 (4.4)	3 (6.7)	3 (6.7)	13 (5.8)
Coordinators	6 (13.3)	8 (17.8)	5 (11.1)	8 (20)	9 (20)	38 (16)

(Corresponding percentages are indicated in parenthesis)

Around 47 per cent and 28 per cent respectively were doing ornamental and fish culture and 26 per cent were engaged in both. Most farmers (42%) owned 10-20 cents and only 27 per cent owned >40 cents. 9.3 per cent owned up to 10 cents and 7 per cent owned 30-40 cents, which showed that farmers were not engaged in intensive fish culture. A total of 93 per cent of farmers owned land area and remaining leased ponds for aquaculture, similar to a report by Ali *et al.*, (2008 & 2010) in Bangladesh. Forty one per cent had 2 years of experience in aquaculture whereas 27 per cent had more than 4 years, 20 per cent had 3 years and 11.6 per cent had 4 years. A total of 77 per cent were doing polyculture as it was less expensive as given by Ahmed *et al.*, (2010) in Bangladesh. Only 20 per cent were doing monoculture and 3 per cent were doing both. A total of 50 per cent were not employing workers and only 8 per cent employed maximum

workers, which showed lack of intensive culture. Those having large pond area were employing 4 to 5 workers, which increased their income (Boserup, 1993). A total of 56 per cent used and sold their yield simultaneously and so they restricted need for marketing information as declared by Molnar and Hanson (1996). Remaining farmers entirely sold their product by keeping signboards near to their ponds/home, a bulk of 39 per cent marketed their produce, while 38 per cent marketed through word of mouth, 6 per cent advertised their venture in social gatherings like festivals and 16 per cent were helped by coordinators. Initial capital for starting aquaculture was more than Rs.20,000 for all farmers and they were learning practices from progressive farmers.

**Table 3:** Important farmer oriented activities benefitting individual farmers

*FOA	Kollam	Alappuzha	Kottayam	Ernakulam	Thirissur	Kerala	Awareness score	**Awareness
*A	45 (100)	45(100)	45 (100)	45 (100)	45 (100)	225 (100)	225	H
*B	36(80)	37(82.2)	45 (100)	40 (88.9)	39 (86.7)	197(87.6)	197	H
*C	28 (62.2)	28(62.2)	45 (100)	27 (60)	39 (86.7)	167 (74.2)	167	M
*D	21 (46.7)	21(46.7)	45 (100)	27 (60)	40 (88.9)	154 (68.4)	154	M
*E	10 (22.2)	10(22.2)	45 (100)	45 (100)	40 (88.9)	150 (66.7)	150	M
*F	6(13.3)	6(13.3)	45 (100)	45 (100)	42 (93.3)	144 (64)	144	M
*G	3(6.7)	5 (11.1)	11 (24.4)	35 (77.8)	40 (88.9)	94 (41.8)	94	L
*H	4 (8.9)	4 (8.9)	6 (13.3)	40 (88.9)	31 (68.9)	85 (37.8)	85	L
*I	1 (2.2)	0 (0)	0 (0)	3 (6.7)	2 (4.4)	6 (2.7)	6	VL
*J	0 (0)	0 (0)	0 (0)	1 (2.2)	4 (8.9)	5 (2.2)	5	VL

(Percentages are indicated in parenthesis) \* FOA-Farmer oriented activities, \*A-Training, B- Farmer to farmer technology dissemination at demonstration plot, C- Exposure visit, D- Farmer Interest Group, E-Farmer Scientist interaction, F- District level training institution, G- Farm school, H- Agriliclinics, I- Awards are given to best farmer at state level and J- SREP, \*\* Awareness - Awareness on FOA (based on score range: 5-60 – Very Low awareness (VL), 60-115 - Low awareness (L), 115-170 - Medium awareness (M), 170-225 - Highly aware (H)

All farmers were aware of training organised for them but they were least aware of SREP and awards given to the best farmer at state level. Extrinsic motivation in the form of rewards and incentives should be awarded to farmers so that they would work hard to get more yields, to get such rewards as asserted by Tilman *et al.*, (2002). Although provisions existed under innovative activities in ATMA, to give awards to best performing ATMA district, to the best organised group, and to the best farmer at block level, this was not currently practiced, and if such award could be given to deserving farmers, it could serve as a motivational factor to other farmers.

**Table 4:** Perceived changes gained by farmers from ATMA (n=225)

Changes gained	Strongly Disagree	Disagree	Agree	Strongly Agree	Total score	Rank	* Changes gained (based on score range)
Knowledge on BMPs	3 (1.3)	1 (0.4)	99 (44)	122 (54.2)	790	1	High
Skill development	5 (2.2)	2 (0.89)	122 (54.2)	96 (42.7)	759	2	High
Knowledge on improved farming practices	7 (3.1)	8 (3.6)	111 (49.3)	99 (44)	752	3	High
Support based on farming needs	15 (6.7)	7 (3.1)	112 (49.8)	91 (40.4)	729	4	High
Increased income	19 (8.4)	4 (1.8)	144 (64)	58 (25.8)	691	5	Medium
Increased financial support	32 (14.2)	13 (6.7)	117 (52)	61 (27.1)	653	6	Medium
Marketing support	98 (43.6)	75(33.3)	33(14.7)	19(8.4)	423	7	Very Low

(Percentages are indicated in parenthesis)

\* Score range: 423-515- Very Low, 516-608 – Low, 608-700- Medium, 700-792 – High

The foremost change perceived by farmers through ATMA was knowledge on best management practices, improved farming practices and skill development. They expected more marketing support from officials as it ranked least (rank 7). Adequate knowledge on BMPs could lead to better yield and improved income. ATMA should organise training programmes on BMPs in association with each district DoF, led by an aquaculture expert. As knowledge on BMP could be increased through information dissemination as affirmed by Rahelizatovo *et al.*, (2004), dissemination through leaflet, exhibition and internet was to be promoted. Awareness programme should be organised for farmers by SAMETI, ATMA and state DoF on skill development activities like measuring water and soil quality parameters, breeding, feed manufacturing, net making and mending, as skill development and training, could increase understanding of formal research among farmers as opined by Martin and Sherington (1997). Training programmes should be organised by ATMA in coordination with state DoF for women/men SHGs and women/men fish farmer groups in making value added fish products like fish fingers, fish burgers and fish pickles. Concentrating on developing inherent skills in the farmers would increase confidence and

improve income. Applying improved farming practices like administering supplementary feeds in a specified ratio, polyculture practices using compatible species in a ratio specified by aquaculture experts and using genetically modified crop varieties that claimed high growth rate could lead to better production and income, as mentioned by Yu *et al.*, (2011) in China. So extension agents, coordinators and BTMs should focus on extending improved farming practices to fish farmers based on different pond characteristics like size of the pond, type of culture, fish species cultured and financial sustainability. A total of 16 per cent farmers opined that ATMA did not provide sufficient marketing support and, this may be because, women and farmers engaged in small scale ornamental fish culture in homestead ponds and glass tanks reported that ATMA did not contribute to increase income. This perception could be changed by advising the farmers to mobilise and organise fish farmer groups and thereby identifying marketing channels. Around 30 per cent of farmers opined that financial support is not provided according to the necessity to the deserved fish farmers. So a survey of resource poor fish farmers should be done through participatory methods while formulating BAP. Financial

support is to be given to the identified farmers to start aquaculture activities to increase their income and food security. Technology specific financing programs and micro financing efforts could be promoted as revealed by Fisher (2006). Farmers are to be made into groups to get more funds as funds are more for farmers groups. Farmers are not aware of forming groups to get more benefits and such farmers are to be educated by BTM on benefits of joining such groups. Brown (2002) added on Farmers' markets by saying that it could create secondary employment opportunities by supporting farming. If fish farmers were provided adequate support based on their farming requirements it could lead to increase production and income. Around 20 per cent of farmers did not agree with ATMA support based on farming needs, primarily because they perceived that officials seemed to be not interested in identifying their needs. So farmers should be motivated to approach resource persons and such visiting farmers should be identified as potential fish farmers for attending ATMA training programme, demonstration and exposure visit. Stoop *et al.*, (2002) suggested that production systems were to be developed, keeping in mind location specific production constraints, faced by farmers.

#### 4. Conclusion

ATMA provided support to aquaculture farmers through training, demonstration, exposure visit, farmer scientist interaction, farm schools, rewards and incentives, agriclincs, district level training institutions, farmer interest groups and farm information dissemination activities. It was observed that aquaculture farmers in the study area were in need of marketing and financial support and they gained considerable change with respect to knowledge on Best Management Practices through ATMA. Therefore, farmers should be made aware of adequate marketing channels. Ongoing as well as past studies conducted on different marketing channels and opportunities by researchers should be brought to the attention of farmers. The officials should timely intimate the farmers on different financial provisions they could avail through extension agents.

#### References

- [1] Ahmed, M. and Lorica, M. H., 2002. Improving developing country food security through aquaculture development- Lessons from Asia. *Food Policy*, 27: 130.
- [2] Ahmed, R., Shahabuddin, A. M., Habib, M. A. B. and Yasmin, M. S., 2010. Impact of aquaculture practices in Naogaon district of Bangladesh. *Research Journal of Fisheries and Hydrobiology*, 5(2): 56-65.
- [3] Ali, H. M., Hosain, M. D., Hasan, A. N. G. M., Bashar, M. A., 2008. Assessment of livelihood status of the fish farmers in some selected areas of Nagmara upazilla under Rajshahi district. *J. Bangladesh Agril. Univ.*, 6 (2): 368-369, ISSN 1810-3030.
- [4] Ali, H., Azad, M. A. K. , Anisuzzaman, M. , Chowdhury, M. M. R., Hoque, M. and Shariful, M. I., 2010. Livelihood status of the fish farmers in some selected areas of Tarakanda upazila\_of Mymensingh district. *J. Agrofor. Environ.*, 3 (2): 85-89, ISSN 1995-6983.
- [5] Boserup, E., 1993. The conditions of agricultural growth: The economics of agrarian change under population pressure, ISBN 185383159X, pp 124.
- [6] Bouis, H., 2000. Commercial vegetable and polyculture fish production in Bangladesh: Their impacts on household income and dietary quality. *Food and Nutrition Bulletin*, 21 (4): 482-487.
- [7] Brown, A., 2002. Farmers' market research 1940-2000: An inventory and review. *American Journal of Alternative Agriculture*, 17(4):173.
- [8] Chaminuka, P., Senyolo, G. M., Makhura, M. N. and Belete, A., 2008. A factor analysis of access to and use of service infrastructure amongst emerging farmers in South Africa. *Agrekon.*, 47(3): 369-70.
- [9] Chhachhar, A. R. , Hassan, M. S. , Omar, S. Z. , Soomro, B., 2012. The role of television in dissemination of agriculture information among farmers. *J. Appl. Environ. Biol. Sci.*, 2(11): 586.
- [10] DoF- Department of Fisheries, 2010. Kerala inland fisheries statistics. Government of Kerala. Thiruvananthapuram. [Online]. Available at <http://www.fisheries.kerala.gov.in/images/publications/Inland%20%20Statistics%202010%20Final.docx.pdf>. [Accessed on 19 July 2014].
- [11] Fisher. M., 2006. Income is development: KickStart's pumps help Kenyan farmers transition to a cash economy. [Online]. Available at <http://www.qatar.cmu.edu/iliano/courses/07F-CMU-CS502/papers/Fisher.pdf>. [Accessed on 14 February 2014].
- [12] Harikumar, G. and Rajendran, G., 2007. An overview of Kerala fisheries with particular emphasis on aquaculture. IFP Souvenir. [Online]. Available at <http://ifpkochi.nic.in/IFPS2.pdf>. [Accessed on 15 July 2014].
- [13] MANAGE, 2007. Agricultural extension approach for XI Five year plan. [Online]. Available at <http://www.manage.gov.in/extnref/XI-RECOMMENDATIONS.pdf>. [Accessed on 17 April 2013].
- [14] Martin, A. and Sherington, J., 1997. Participatory research methods-Implementation, effectiveness and institutional context. *Agricultural Systems*, 55 (2):195-216.
- [15] Molnar, J. J. and Hanson, T. R., 1996. Doing development by growing fish: A cross national analysis of Tilapia harvest and marketing practices. Fourteenth annual administrative report. Aquaculture CRSP. Corvallis. Oregon. [Online]. Available at <http://pdacrsp.oregonstate.edu/pubs/admin/admin14h/admin14toc.html>. [Accessed on 15 July 2014].
- [16] Planning Commission, 2007. Recommendations of working group on agricultural extension for formulation of eleventh five-year plan (2007-12) by Working group on agricultural extension constituted by Planning Commission, Govt. of India. [Online]. Available at [http://planningcommission.nic.in/aboutus/committee/wrkggrp11/wg11\\_agrext.pdf](http://planningcommission.nic.in/aboutus/committee/wrkggrp11/wg11_agrext.pdf). [Accessed on 17 April 2013].
- [17] Rahelizatovo, N. C., Gillespie, J. M., 2004. The adoption of Best Management Practices by Louisiana dairy producers. *Journal of Agriculture and Applied Economics*, 36, 1: 229- 240.

- [18] Stoop, W. A., Uphoff, N., Kassam, A., 2002. A review of agricultural research issues raised by the system of rice intensification (SRI) from Madagascar: Opportunities for improving farming systems for resource-poor farmers. *Agricultural Systems*, 71:249-274.
- [19] Tilman, D., Cassman, K. G., Matson, P. A., Naylor, R. and Polasky, S., 2002, Agricultural sustainability and intensive production practices, Review article. *Nature*, 418: 671-677.
- [20] Yu, Z. B., Shi, L., Qing-hua, 2011. Adoption of agricultural technology and increase of farmer's income: Taking farmers in Jiangxi Province as an example. *Commercial Research*, 2:10-12. Antai College of Economics and Management, Shanghai Jiaotong University, Shanghai, China.

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