



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 1761-1765
Received: 19-09-2018
Accepted: 21-10-2018

Paramveer Singh
Department of Applied
Aquaculture and Zoology,
Barkatullah University, Bhopal,
Madhya Pradesh, India

Balwinder Singh
College of Fisheries, GADVASU,
Ludhiana, Punjab, India

Kalyani Supriya
Department of Environmental
Science, Dr Y S Parmar
University of Horticulture and
Forestry, Nauni, Himachal
Pradesh, India

Mukta Singh
Department of Aquatic Health &
Environment, College of
Fisheries, Central Agricultural
University, Lembucherra
Agartala, Tripura, India

Correspondence
Balwinder Singh
College of Fisheries, GADVASU,
Ludhiana, Punjab, India

Collaborative approaches in aquaculture for the improvement of farmer's economic level through different integrated practices

Paramveer Singh, Balwinder Singh, Kalyani Supriya and Mukta Singh

Abstract

This study mainly focused on the distinct farming practices adopted by farmers all over India which is helpful in doubling income of fish farmer with the adoption of new technologies and strategies. The growth and output in aquaculture sector are surprisingly increasing and a number of farmers are engaged in these kinds of practices throughout the India. To increase the farmer's income is still a global challenge for aquaculture society. To overcome this problem, there is need to establish a different activities such as integrated fish farming in context of cattle, pig and poultry, and production and selling of hatchery seed of food fish & ornamental fish, Aqua tourism, application of bio-fertilizers and duckweed, and use of probiotics in the feed which give effective results and help to increase the farmer income. To initiate, such types of activities, government bodies, NGOs, and private companies play a primary role to encourage the farmers to implement new techniques in their farming system by providing the technical skills through seminars, campaigns, training programs and other awareness channels etc.

Keywords: Aquaculture, integrated, bio-fertilizers, aqua tourism

1. Introduction

Aquaculture is the farming of fish, crustaceans, bivalves and aquatic plants under controlled condition. The practice was first started in 1000 BCE in China to produce carp (family Cyprinidae) as a famed reared fish and later on, the other organism like a mussel, crustaceans, and oysters were cultured throughout the world to meet the demand of food. With advancement in the technologies from extensive to intensive culture, the global aquaculture production was reached 106 million tonnes in 2015 (FAO Aquaculture Newsletter. 2017) [3]. Besides this, Aquaculture in India has a long history, with references to fish culture in Kautilya's Arthashastra (321–300 B.C.) and King Someswara's Manasoltara (1127 A.D.). The traditional practice of fish culture in small ponds in eastern India is known to have existed for hundreds of years; significant advances were made in the State of West Bengal in the early nineteenth century with the controlled breeding of carp in bundhs (tanks or impoundments where riverine conditions are simulated). Fish culture received notable attention in the state of Tamil Nadu (formerly Madras) as early as 1911, and subsequently, states such as Bengal, Punjab, Uttar Pradesh, Baroda, Mysore and Hyderabad initiated fish culture through the establishment of Fisheries Departments and support to fishers and farmers for expansion of the sector (FAO 2014) [1]. In the context of India, the total fish production was 11.409 million tonnes (7.768 Mt in inland and 3.640 Mt in marine resources) in 2017 with topmost fish producing state was Andhra Pradesh followed by West Bengal and Gujarat [2]. Fish farming involve economics because fish farmers produce fish and sell them; other people buy the fish and eat them. The fish farmer is called producer because he grows the fish and looks after it just as he does with any other crop and animals. Reasons like better earnings from fish farming than agriculture, utilization" of inherited water areas, higher demand for fish, in addition to the opportunity to earn money from other jobs where the farmer lives have motivated people to go for fish farming (Williams, 1983) [4]. Number of government agency like Fish farmers development agency (FFDA), Brackish water fish farmer's development agency (BFDA), NFDB, CMFRI, CIFRI, CIFA, CIBA and other NGOs/ private organizations are involved in different activities of aquaculture (to maintain its Sustainability) by providing the new techniques, strategies and aware about the integrated Multi-trophic level approach to the farmers regarding improve production and its income. (Ponnusamy k & Devi M K, 2017) [9] In India, the farmers maintain different enterprises for their complimentary and supplementary nature and for ensuring sustainable livelihood from time immemorial. After the advent of green revolution in late-1960s and economic liberalization in early-1990s, the farmers gradually started focusing on a few enterprises due to several imposing factors including

shrinking farm sizes, fluctuating commodity prices, livelihood diversification and shortage of labour during peak agriculture season. It had a severe impact on food and nutritional security of millions of poor farm households. Although suggestions are pouring in from experts and leaders of organization for strengthening the income base of farmers, the government cannot implement them entirely due to compulsions from socio-economic and political considerations. However, the Government of India has made an announcement about Doubling Farmers' Income by 2022^[9]. In this study we are revealing number of exemplary farmers in India; those are doubling their level of economy with the help of productive approaches towards distinct fish farming systems.

2. Material and methods

We visited at farmer's farm during this experiment in Punjab area only for collecting the information about their Aqua practices and economic level. We collected near about 3-5 farmer's data from each districts like Rupnagar, Mohali and other districts. This study is representing an overview about the different practices those will be helpful in doubling their income. On the other side, we collected all data of other states from various research papers.

3. Integrated farming system

In an integrated farming system, there are sequential linkages between two or more farming activities such as utilization of waste of one farming system to other farming which might help to clean the environment, reduce the production cost and increase productivity. Fish cum cattle is one of the common practices around the world. A healthy cow weighing 400-450 kg excretes 400-500 kg of dung and 3,500-4,000 litres of urine on annual basis and a unit 5-6 cows (provide average 9000 litres milk) can recommend for a one-hectare fish pond. Pig cum fish farming is also popular for production of meat and fish at cheaper feeding cost. A floor space of 3-4m² is required for a pig weighing 70-90 kg (attain slaughter size within 6 months) and produce 500-600kg of dung in a year with the good amount of phosphorus (limiting factor in the fish pond). 40-45 no. of pigs produce a required amount of manure to fertilize the one-hectare pond. Poultry fish farming provides a poultry dropping and litter into the fish pond and acts a fertilizer in the system. Poultry dropping has a high amount of nitrogen, phosphorus, and potassium which is required for the production of plankton and reduces the feed cost. For one-hectare water body, 1,000 birds produce sufficient manure with 90,000 to 100,000 eggs and over 1,500 kg of meat per year and 3,000-4,000 kg of fish could be harvested in this system. In an integrated system, nutritive values of different animal excrete are shown in Table no. 1. Moreover, other farming systems like growing vegetables, fruits trees, and paddy culture in the nearby pond are also beneficial and help to earn extra income. (Vibha V 2015)^[6] Besides this, Saha and his team took the work a step forward under the National Agriculture Innovation Project launched in 2007. Instead of combining just two techniques, they trained the farmers to combine as many as four techniques. For example, they combined agriculture with fishery, duck farming, rice cultivation and pig rearing. All these complemented each other. Production from fishery went up from 640 kg/ha before the intervention to 2,600 kg/ha in 2009-10 after the farmers used a combination of fish, fruit, vegetable and pig farming. While a farmer earned only Rs 13,000 after an investment of Rs 8,000 before the intervention, the income increased to Rs 53,500 after an investment of Rs16,701 respectively^[6].

4. Aqua tourism

Aqua tourism is one of the fastest growing tourism sectors in the world. Angling, the recreational catching of fish by hook and line (sport-fishing), is a principal component of aqua tourism activity. The species of fish pursued by anglers in different parts of the world vary very much. Some fishes are sought for their value as food; others are pursued for their fighting abilities or for the difficulty of pursuit. Angling for recreation in Kerala is more or less restricted to high ranges. The fishes used are principally trouts and mahseers (Sahadevan P 2017)^[17]. On the other side, Coastal towns and cities are often reliant on activities which can be supported by the marine environment such as fishing and coastal tourism and which contribute to their economic growth and wealth (Symes *et al.* 2009)^[18].

5. Hatchery seed production

To establish the Chinese circular or FRP carp hatchery for induced breeding and production of quality farm seed and selling to the other farmers at a valuable price are one of the excellent sources to improve the income of farmer. To initiate the hatchery, there is need to acquire the technical skills regarding breeding and production of the fish seed.

6. Ornamental fish culture in backyard

Ornamental fish keeping as a hobby in India is nearly 70 years old with a domestic ornamental fish market is worth around Rs. 500 million and demand is increasing at 20% annually. To establish the basic ornamental fish unit in the backyard of the fish farm for breeding and selling of ornamental fishes (Goldfish, koi carps, barbs, tetras) and aquatic plants (Cabomba, Acorus, LudwigiaSagittaria and Vallisneria). Further, to add on this, fabrication and selling of aquarium to the buyer are good sources of income for farmers. To run the ornamental fish farm, there is need a technical skill required for breeding of fish as well as fabrication of the aquarium.

7. Use of duckweeds and bio-fertilizers to reduce culture cost

Fisheries in Tripura form an integral part of the economy of the state. Indigenous technical knowledge in the field of fish farming is a practical knowledge of the local farmers of this district. This is based on intimate experience accumulated over generation after generation. Such traditional practices were sustainable in terms of land use, utilization of local available materials, labour, money, and could be easily operated without any specially skills (Ratan K S *et al.*, 2013)^[7]. Moreover, in an aquaculture system, the main cost is involved in the production of fish is feed. Duckweed such as Spirodela (Sources of protein), Lemna, Azolla, and wolfia etc. are commonly used as only feed or in combination with other feed components to polyculture of Chinese and Indian major carp species and tilapias especially for herbivorous and omnivorous fish such as grass carp (*Ctenopharyngodon idella*), and tilapias (*Oreochromis sp.*). Duckweed are good sources of N,P, K and contains about 40 different minerals, including vitamins A, B₁, B₂, B₆, C and E. In duckweed fish farming system, before the supplementary feeding, application of fresh duckweed and *Azolla* fed as feed for grass carp (herbivorous feeding habit) in pond which result to reduce the quantity of feed. The nutrient value of *Azolla* is Nitrogen (5.0%), phosphorus (0.5%), potassium (2.0-4.5%) and calcium (0.2-1.0%). In addition to this, other types of herbs like Aloe Vera (Masoud H *et al.*, 2014 and Ndakalimwe

NG *et al.*, 2015)^[14 & 16], Neem (Kaur Y *et al.*, 2017)^[15], Garlic (Muzaffar. F *et al.*, 2017)^[5] are also effective for fish in context of growth and act as an immunostimulant by applied in a small quantity in the feed.

8. Result and Discussion

In this study we are representing success stories of fish farmers throughout the whole India via adopting productive practices for their economic growth respectively. Firstly, at Chandel Khullen village of Chandel hill district of Manipur during 2010-11 to 2012-13. The average holding size of the farmer was 1.33 ha in 2010-11, 1.96 ha in 2011-12 and 2.21 ha in 2012-13. The tribal farmer adopted seven components like; crop production, vegetables, fruits, piggery, backyard poultry, fishery and water management as suggested by ICAR Manipur Centre. In 2010-11, the paddy yield was 3.5 tonnes/ha as compared to 4.79 tonnes/ha in 2012-13. It was mainly due to adoption of improved package and practices. The cabbage and onion yield increased by 103 and 54 per cent, respectively after adoption of improved cultivation methods under integrated farming system (Ansari M A *et al.*, 2014)^[8]. (Balusamy *et al.* 2003)^[12] Explained that rice + *Azolla*-cum-fish culture is one of the economical options in such type of area. Monoculture system relies mainly on external inputs while in integrated system, recycling of nutrients takes place that help in reducing the cost of production for economic yield. The fish in rice field utilized the untapped aquatic productivity of rice ecosystem as the rice bottom is highly fertilized on account of the production of zoo and phytoplankton and these resources are fully utilized by the fish. There are beneficial effects of *Azolla* on rice+fish. The gross income obtained in rice + *Azolla* + fish was 25.7 % more over the rice crop and 6.9 % more over the rice + fish. The net income followed the same trend. Thus rice + *Azolla* + fish on an average gave Rs 8,817/ha more over the rice monoculture and Rs.3,219/ha over the rice + fish. This model was proposed for extensive scale adoption in Tamil Nadu^[11 & 12]. Besides this, another study involving cropping, poultry, pigeon, goat and fishery was conducted under wetland conditions of Tamil Nadu conducted by (Jayanthi *et al.* 2001)^[13] three years results revealed that integration of crop with fish (400 reared in 3 ponds of 0.04 ha each), poultry (20 babkok layer bird), pigeon (40 pairs), and goat (Tellichery breed of 20 female and 1 male in 0.03 ha deep litter system) resulted in higher productivity, higher economic return of Rs 1,31,118 (mean of 3 year). Integration of enterprises created the employment opportunities where in comparison to 369 Mandays/year generated in cropping alone system, cropping with fish and goat created additional 207 Mandays/annum^[13 & 11]. On the other side, there are number of farmer in state of Punjab, India those are practicing distinct kinds of productive practices for doubling their income and status also. Firstly, a successful approach by Mr. Abjinder Singh Grewal lived in Nanoki village of Nabha, Punjab, to gain the attraction of tourists (local and foreigners) and earn extra income by converting his fish farming into aqua tourism (named as Gary Farms). He added numbers of Swings and cleaned the surrounding environment of the fish pond which is converted into a park with has huge numbers of fruit trees and organic vegetables. On the other side, he is conducting an adventures program in the village such as nature walk, boating, tractor riding, cycling, horse riding, and represent the culture of Punjab in superlative form. By adoption of this sustainable approach in every district might help to increase the income and clean the environment. Secondly, in Punjab at village

Kandola, Roop nagar district, here is a fish farmer famous with Mickys Fish Farm. He started farming instead of running behind a job. He had a piece of 5 acres land that had been lying vacant for the last 100 years because the land remained waterlogged for 11 months in a year, so no one ever tried of doing anything on that land in the past he started fish farming on that 5 acres of waterlogged land in the year of 1985 because of compulsion, and currently he has extended 30 acres of land for fish farming. He has number of fish breeds like common carp, catla and rohu. Fish farming is a business of this farmer and day by day he is approaching for innovative ideas. Besides this, he was awarded with best fish farmer award in 2011 and many other also because of his achievements in fish farming not only on state level but also on national level respectively. Lastly, at National Highway 64, Punjab Mohali lives a fish farmer with name of Dalla fish farm. He is also practicing integrated fish farming like; fish cum poultry, fish cum olericulture and fish cum horticulture respectively. On the other hand, he has well developed circular carp hatchery and nursery ponds also. Now a day, he is doubling his income level with the help of seed selling and integrated farming. Average price of rohu 1-2 inch sailing price is 20-40 paisa/peace of fish respectively and his production of seed in one breeding season is near about 5-10 lakh respectively. (Gill M S *et al.*, 2005)^[21] In traditional Chinese system, the animal houses were constructed over a pond so that animal waste fell directly into the water fueling the pond ecosystem, which the fish could then feast on for food. Not only were the fish harvested but the pond water, now with extra nutrients was used for irrigation in crops. The maximum return (Rs 79,064/ha) was earned from fisheries + piggery + poultry as compared to Rs 5,33,221 from the rice-wheat system and registered 48.6% gain. This also generated additional employment of about 500 man days/ha/annum. (Kumar S *et al.*, 2012)^[19] In Maharajanj district of Uttar Pradesh, farmers are having a fish farm with a hatchery and rice-fish with the area of 1.2-3.6 acres. Rice-fish seed (fingerlings) is mainly practiced in irrigated and shallow lowlands. The rice varieties are Shambha, Masuri, Basmati, Hybrid (PA 6201) with the yield of 22 q/acre. The fish spp. are catla, rohu, mrigal and common carp and the productivity is up to 300 kg ha⁻¹ season⁻¹ with income of ` 30,000. Fish farming can also be integrated with sugarcane. On the bunds pigeon pea, teak, and siso trees are also grown^[19].

On the other hand, if we are talking about Aqua tourism and Ornamental fisheries then there is a huge scope of Aqua Tourism in southern states of India like Kerala, Goa and Andhra Pradesh also (Sahadevan P 2017)^[17]. Angling for recreation in Kerala is more or less restricted to high ranges. The fishes used are principally trouts and mahseers. Though there is very good scope, Kerala has paid little attention for the development of recreational fisheries, in mid land and in the coastal regions. In the present study pearl spot, *Etroplus suratensis* (Bloch) is considered as a candidate species for use in angling in these regions. The potential of the species for use in recreational fisheries and its role in development of aqua tourism in the state are also discussed. After South India, at Northern India Aqua Tourism is very famous in many states like; Uttrakhand, Himachal Pradesh, Jammu & Kashmir and Chandigarh respectively. (Singh P *et al.*, 2018)^[20] Sukhna Lake is famous for recreational activities like boating, sightseeing, food plaza, traditional boat race, canoe polo, canoe marathon and sport fishing also. Sukhna Lake comes under Department of Animal husbandry and Fisheries Sector Chandigarh UT and Forest Department respectively. On the

other hand, Lake also declared as a national wetland of India and Department of Animal husbandry and Fisheries Sector Chandigarh UT also providing daily fishing licenses on different terms and conditions like for angling activity @ 40 rupee daily, 300 rupee for 10 days and 800 rupee for one month^[20]. Use of duck weeds as feed for fish very effective in prospective of economics as well as productive for fish growth and fish health also. *Azolla* is aquatic fern which is very good as fish feed after dry.

In the field of ornamental fisheries, India is blessed with a rich diversity of freshwater fishes both in the North-Eastern hills and Western Ghats. Among the 300 species of freshwater fishes in the Western Ghats, 155 are considered ornamental; of which 117 are endemic to the Western Ghats. At present, only a small fraction of the endemic fish diversity is utilized in ornamental fish trade in the domestic market and major share of ornamental fishes marketed in India are exotic varieties. Even though there are quite a lot of indigenous fishes, having high potential as ornamental fishes, they have not been properly exploited. The fish fauna of the Western Ghats include variety of barbs, rasboras, killifishes, glass fishes, catfishes, catopra, hill trouts, and danios, which are suitable candidates for ornamental fish trade. More than 100 varieties of indigenous freshwater ornamental fish species are known in Indian waters. Some of the species fetch high price in the world market and support trade outside the country. This ornamental fishes due to the nature of breeding are broadly classified as live bearers and egg layers. Molly, platy, guppy and swordtail are typical examples of live bearers. Gold fish, barbs, koi carp, gouramies, fighters, oscars, discus, chichlids, gouramies, etc are egg layers. India possesses rich resources of marine ornamental fishes such as the lagoons and coral reefs of Lakshadweep and Minicoy islands, Andaman and Nicobar islands, Gulf of Kutch, Coast of Kerala, Gulf of Mannar and Palk Bay are abound with highly attractive and varied species. The potential with regard to the freshwater ornamental fishes inhabiting the hill streams, major river systems, reservoirs and lakes are immense. Commercially important ornamental fish species and trade mainly indigenous freshwater species, collected from rivers, streams, wet lands, etc. About 90 per cent of ornamental fish is traded from Kolkata port followed by 8 per cent from Mumbai and 2 per cent from Chennai (Pramod K. Pandey and Sagar C. Mandal. 2017)^[2].

9. Conclusion

Aquaculture is continuously growing and widely popular all over the world. With the advancement of technologies and effective research, the production and income of the fish farmers increase and more people are gradually engaged in this activity. The integration of two or more farming system and utilization of both the waste in each other in the form of fertilizers like cattle cum fish farming, pig cum fish farming, and poultry cum fish farming are more beneficial towards production and environmental health. Furthermore, Ornamental fish culture, Hatchery seed production, Aqua tourism and use of duckweed could give the effective results in term of income. Nowadays, the aquaculture becomes also possible in salt-affected waterlogged areas for the production of shrimp (*vannamei* culture) in Haryana and south-west district of Punjab which is unsuitable for agriculture crop. To sum up, there is need to establish the more beneficial schemes and Subsidies programs by government bodies, NGOs and private organization and encourage the farmers with help of training programs, Seminar, Campaigns and to know about

the adoption of effective techniques which enhance the production as well as income in aquaculture.

10. References

1. Ayyappan S. National Aquaculture Sector Overview. India. National Aquaculture Sector Overview Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome, 2014.
2. Basic Animal Husbandry, Fisheries Statistics. Department of Animal husbandry, Dairy and Fisheries statistics, India, 2017.
3. FAO Aquaculture Newsletter. Rome, 2017, 56.
4. Williams C. Simple Economics and Book Keeping for fish farmers FAO Fisheries circular, 1983, 763.
5. Farwah Muzaffar, Meera D Ansal, Asha Dhawan. Effect of Garlic (*Allium sativum*) Supplemented Feed on Survival and Growth of Common Carp (*Cyprinus carpio* L. Indian Journal of Ecology, 2017. DOI10.5958/2231-6744.2017.00015.9
6. Vibha Varshney. Nath How to increase earning from fisheries (Team from Tripura's College of Fisheries show the way) Down To Earth, 2015.
7. Ratan K Saha, Dilip Nath. Indigenous Technical Knowledge (ITK) of fish farmers at Dhalai district of Tripura, NE India. Indian Journal of Traditional Knowledge. 2013; 12(1):80-84.
8. MA Ansari, N Prakash, LK Baishya, Punitha P, PK Sharma, JS Yadav, *et al.* Integrated Farming System: An ideal approach for developing more economically and environmentally sustainable farming systems for the Eastern Himalayan Region. Indian Journal of Agricultural Sciences. 2014; 84(3):356-62.
9. Ponnusamy K, Kousalya M. Devi. Impact of Integrated Farming System Approach on Doubling Farmers' Income. Agricultural Economics Research Review. 2017; 30:233-240.
10. Samra MS Singh JS Gurbachan. Integrated farming system for realizing high productivity under shallow water-table conditions. Research bulletins, Department of Agronomy, PAU, Ludhiana, 2005, 1-29.
11. Manjunatha SB, Shivmurthy D, Sunil A Satyareddi, Nagaraj MV, Basavesha KN. Integrated Farming System- An Holistic Approach: A Review. Research and Reviews: Journal of Agriculture and Allied Sciences. 2014; 3(4):30-38.
12. Balusamy M, Shanmugham PM, Baskaran R. Mixed farming an ideal farming. Intensive Agric. 2003; 41(11-12):20-25.
13. Jayanthi C, Rangasamy A, Mythili S, Balusamy M, Chinnusamy C, Sankaran N. Sustainable productivity and profitability to integrated farming systems in low land farms. In: Extended summaries, (Eds: A.K. Singh, B. Gangwar, Pankaj and P.S. Pandey), National Symposium on Farming System Research on New Millennium, PDCSR, 2001, 79-81.
14. Modipuram. Masoud Haghighi, Mostafa Sharif Rohani, Maysam Samadi, Maysam Tavoli, Maryam Eslami, *et al.* Study of effects Aloe vera extract supplemented feed on hematological and immunological indices of rainbow trout (*Oncorhynchus mykiss*). International journal of Advanced Biological and Biomedical Research. 2014; 2(6):2143-2154.
15. Yadwinder Kaur, Asha Dhawan, Shanthanagouda Admane Holeyappa. Effect of Neem Leaf Extract Incorporated Diet on Survival, Growth and Flesh Quality

- of Common carp (*Cyprinus carpio*) Indian Journal of Ecology, 2017, 44(4).
16. Ndakalimwe Naftal Gabriel, Jun Qiang, Jie He, Xin Yu Ma, Mathew D Kpundeh, Pao Xu. Dietary *Aloe vera* supplementation on growth performance, some haemato-biochemical parameters and disease resistance against *Streptococcus iniae* in tilapia (GIFT). Fish & Shellfish Immunology. 2015; 44(2):504-514.
 17. Sahadevan P. Aqua tourism: Evaluation of pearl spot as a candidate species for angling. International Journal of Fisheries and Aquatic Studies. 2017; 5(2):85-89.
 18. Symes D, Phillipson J. Whatever Became of Social Objectives in Fisheries Policy? Fisheries Research. 2009; 95(1):1-5.
 19. Sanjeev Kumar, Dey A, Ujjwal Kumar, Chandra N, Bhatt BP. Integrated Farming System for Improving Agricultural Productivity. Book: Status of Agricultural Development in Eastern India, Publisher: ICAR Research Complex for Eastern Region, 2012, 205-230.
 20. Paramveer Singh, Mukta Singh, S Harihara Sudhan, Gohil Kaushik Bharatbhai. Comparative study of sport fishing and water quality parameters between Siswan dam and Sukhna Lake. Comparative study of sport fishing and water quality parameters between Siswan dam and Sukhna Lake. International Journal of Fauna and Biological Studies. 2018; 5(6):84-86.
 21. Gill MS, Samra JS, Singh Gurbachan. Integrated farming system for realizing high productivity under shallow water-table conditions. Research bulletins, Department of Agronomy, PAU, Ludhiana, 2005, 1-29.
 22. Pramod K Pandey, Sagar C. Mandal. Present status, challenges and scope of ornamental fish trade in India. Conference: Aqua Aquaria India, At Mangalore, 2017.