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Fish Disease Management in Integrated Farming System

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Fish Disease Management in Integrated Farming System

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Introduction

Integrated Fish Farming (IFF) is a sustainable-agriculture technology practiced widely in Asia and other regions of the world. This is very popular, advanced and widely practised in China. Hence most culture methods have either been derived from Chinese methods or modified suitably as per the regional requirements. This integrated technology can offer farmers economic improvements while lessening the adverse environmental impacts of fertilizer based-farming. IFF systems typically involve a combination of fish polyculture, integration of agricultural production (livestock and/or crops) with aquaculture, and on-farm waste and wastewater recycling. Evolved on the principles of productive recycling of farm wastes, fish- livestock farming systems are recognized as highly assured technologies for fish cultivation. Actually in India, the concept of composite fish culture was developed and popularised by ICAR – Fishery Scientists in late seventies under a coordinated composite fish culture project. This comprises the culture of 3 indigenous species of fish viz. rohu, catla and mrigal and 3 exotic fish i.e silver carp, grass carp and common carp, keeping in view their different food habit and habitat. The system provides meal, milk, eggs, fruits, vegetables, mushroom, fodder & grains in addition to fish. It utilizes the pond dykes which otherwise remain unutilized for the production of additional food and income to the farmer. The possible integrated farming systems as commonly practised are : a) Fish cum Agriculture System : **i) Fish cum Paddy culture, ii) Fish cum papaya, iii) Fish cum Mulberry and iv) Fish cum Mushroom b) Fish cum Animal husbandry System: i) Fish cum Dairy, ii) Fish cum piggery, iii) Fish cum Rabbit farming, iv) Fish cum poultry and v) Fish cum Duckery**

Concept of Fish Health management in integrated farming:

Occurrence of disease in a fish population depends on interactions of variables defined for the host, the pathogen and the environment. Absence of pathogens would reduce the potential for adverse environment to influence disease outbreak. The dose or the number of pathogens, their route of entry to host and the duration of the exposure directly influence the severity of subsequent infection.

A.The environment

Poor water quality has been recognized as one of the main factors responsible for occurrence of disease problems in aquatic animals. Incidence and severity of infectious diseases are very often dependant on the quality of the environment in which the animal lives. In other wards the quality of environment can indicate the health status of animals. Thus, the first and foremost important step in controlling infectious diseases is by maintaining the best quality environment possible in the culture unit.

a) Removal of unwanted aquatic weeds : Unwanted aquatic weeds are needed to be removed from fish pond as it reduces the pond productivity. These unwanted aquatic weeds could be removed manually, mechanically, chemically and biologically. Manual removal method is better. Grass carp, java puthi, tilapia, etc. are good biological agent in removing aquatic weed from fish pond. Chemicals used in the removal of aquatic weeds from fish pond are: i) 1.2-4 D or 2-4 D Ester at the rate of 5-6 kg/Ha ii) Simazine at the rate of 0.5 tp1.0 mg/lit water for floating weeds like Eichornia, duck weed and Algae type, iii) Super phosdphate at 500mg/lit pond water for submerged weed like hydrilla, valisnaria etc. Some time a thick layer of algal bloom of brown or green colour is seen over the water surface of pond. This can be removed from fish pond by using a piece of split bamboo followed by liming based on water pH. Chemicals like copper sulphate @0.1- 0.5 mg/lit. of water also helps in controlling this bloom. Noxious gases and the effect of other substances of pond bottom mud can be reduced by repeated netting or by moving a rope through the pond bottom mud.

b) Liming : Liming helps in maintaining the pHof fish pond water. This helps in increasing the natural productivity of the pond. Liming also helps in maintaining the cultured fish stock disease free. It is done based on the soil and water pH.

c) Fertilization: Fertilization increases the natural food availability in the pond. It is believed that manuring alone can increase the production of the pond by 75%. Organic manure like cow dung, poultry dropping, etc are used commonly in fish pond. Since animal excreta is rich in nitrogen and phosphorous,, there is no need of using extra fertilizer as mentioned

above in this type of integrated farming.

d) Water quality management : The success of fish culture largely depends upon the water quality of the stocking pond. Water quality is defined as suitability of water for the survival and optimum growth of cultured fish. The higher the intensity of culture the will be the water quality problem. In water quality management we regulate the environmental conditions so that are within the optimum range for the cultured stock.

B. The Fish :

Selection of suitable fish species for culture is very important aspect for integrated fish farming. Numbers of fish species are available for composite fish culture. But a species selected for culture should have the following characters- i) Fast growth rate ii) Ability to withstand changing physico-chemical and biological conditions of the pond water iii) Adaptability to crowded conditions and resistance to diseases iv) Good food conversion efficiency v) Acceptability of supplementary and natural food and vi) Good market value. Normally Rohu (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Silver carp (Hypophthalmichthys molitrix), Common carp (Cyprinus carpio), Grass carp (Ctenopharyngodon idella), Tilapia (Oreochromis mossambicus), Magur (Clarias batrachus),Java puthi (Puntius javanicus), Freshwater prawn (Macrobrachium rosenbergii), and in some cases Penaeus monodon etc. are cultured. The stocking density depends on the species, culture period, desired individual size and intensity of management. In composite fish culture in stocking pond fish seed of 10- 15 cm length (fingerling) is stocked at the rate of 7000- 8000 nos. / ha. (900- 1000 nos. / bigha). Normally followed 6 species combination are i) Catla (30%), Rohu (20%), Mrigal (10%), Common carp (5%), Silver carp (20%) and Grass carp (15%). In some cases Tilapia species are included by balancing Silver carp and Grass carp combination.

Methods

C. The Pathogens : Pathogens for common fish diseases and their control

From different pathogenesis, fish diseases are simply classified into i) infectious diseases, ii) invasive diseases and iii) Non-infectious Diseases or the diseases caused by other factors.

1) Infectious disease : This type of disease is mainly caused by the pathogens of virus, bacteria, fungi or unicellular algae. For instance, bacterial ulcerative disease, bacterial enteritis, bacterial gill rot/ fin rot and bacterial erytherma etc. The majority of bacteria causing disease in fish are normally present in fish (surface or gut) or its culture environment and cause disease when there is stress to fish. Most Gram-negative bacteria belonging to Aeromonas, Vibrio, Pseudomonas, Yersinia, Edwardsiella, Pasteurella, Cytophaga cause disease in fish. There may invariably be haemorrhagic septicaemia with or without skin ulcers. The loss of fish production from infectious diseases accounts for 60% of all diseased. Infectious disease can be divided into acute, subacute and chronic forms based on clinic picture. In acute form; it develops rapidly and soon reaches the high peak of mortality. It also goes off quickly. On the contrary, chronic form kills only a few fish per day, but it lasts a long time. Again bacterial pathogens of infectious diseases are not strictly parasitic microorganisms. If the condition for parasitism is unsuitable, it will lead a saprophytic life. Infectious diseases normally attack fish body through tissues and organs, such as skin, gill, intestine tract or excretory organ but fish have their own resistance against pathogenic microbes. Common invasive diseases which need attention are : Aeromonas species, Vibrios, Pseudumonas spp. Edwardsiella spp. etc. Aeromonas hydrophila and other Aermonas species are responsible for much of disease problems in fish, cause Aeromoniasis, haemorrhagic septicaemia and Epizootic ulcerative syndrome (EUS)

A. Bacterial disease : The symptoms of bacterial diseases include: the fishes become lethargic and float on the surface of the water, sometimes with the head projected out of water. Initially, the disease appears as red coloured lesions, haemorrhagic in nature. These red lesions spread and enlarge gradually becoming deeper and assuming the form of ulcers. With further advancement, scales fall off; ulcers become deep necrotizing or lesions. Histoathologically, EUS is characterized in having mycotic granuloma in epidermis. Role of suspected causative agents in EUS viz., virus, bacteria and fungus could not be established conclusively. In India, so far 20 species of pathogenic bacteria have been isolated from affected fishes of which A.hydrophila has been consistently found along with fungus Saprolegnia. The latest investigations point out the prime causative agent to be a fungus called Aphanomyces sp.

Prophylactic : Treatment can be tried only in small culture areas, pond, lakes below 40 ha. During post-monsoon period, the disease prone water areas can be treated with lime, CaO @ 50 kg/ha followed by application of bleaching powder @ 0.5 ppm after one week. For therapeutic : at the initial stage of lesion formation, lime (CaO) is applied @ 100 kg/ha followed by application of bleaching powder @ 1 ppm after one week.

Treatment :

i) Gammaxene treatment @ 1 ppm.

ii) Benzalkonium chloride : used as a disinfectant and treatment of external bacterial infections. Dose : Bath treatment 10mg/l for 5-10 minutes, For prolonged immersions, 0.5-1.0 mg/l **Antibiotics given via water :** Oxytetracycline 20-120 mg/l, Oxolinic acid 10mg/l, Chloramphenicol 20-50 mg/l, Co-trimazine (80mg trimethoprim and 400mg sulphadiazine per ml) 1ml/100l, Neomycin 50mg/kg, Kanamycin 50-100mg/l

iii)Antibiotics given via food : Oxytetracycline at 75mg/kg, Amoxycilin 80mg/kg, Furazolidone at 75mg/kg, Co-trimazine at 30mg/kg, Oxolinic acid 10mg/kg.

B.Fungal Diseases : Only a small number of fungal species are pathogenic to fish. Mostly these are present in water and when the water quality is poor or fish are under stress or infected, they attack the fish causing skin lesions. The important fungal pathogen in freshwater fishes is Saprolegnia. It is usually a secondary invader of damaged or stressed fish and also infect fish eggs. The infection appears as raised white “cotton wool” appearance, may look coloured by trapped organic matter or sediment.

a) Saprolegniasis :: They belong to Family Saprolegniaceae, Class Phycomycetes. The common genera are Saprolegnia and Achlya. Mould is a coenocytic mycelium without cell wall wall. One end of the mould resembling root attaches to the wounded part of fish body. It has many branches that penetrate into skin and muscle, which is called mycelia, sucking nutrition from its host. The rest of the mould tufting outside fish body is called hyphae, which may be 3cm long and looks like white floccule. The mould on a dead fish can spread and cover the whole body within 12–24 hours. The symptoms and pathological changes include, no abnormal sign could be seen in the initial stage of the infection. When it is visible, it indicates that the mould has already penetrated and stretched on the lesions. Mycelia go deep into muscles, permeating into the fissure of tissue cells, and branching out heavily. Hyphae grow into grey flocky substance. A certain kind of ferment secreted from the mould is able to decompose the tissues of the host and fish secretes a great deal of mucus because of the irritation. The diseased fish shows an abnormal behaviour, and rubs itself against some solid materials. As the fish is overloaded, morbid muscle will rot, fish will loose its appetite and will move slowly and eventually will die.

Control:

i) To minimize the possible outbreak, disinfect the pond with quick lime.

ii) Select healthy fish as parent fish instead of injured fish. Smear the parent fish with 1% malachite green ointment or sulfa ointment.

iii)If the disease occurs in al culturing pond, sprinkle the infected pond with malachite green solution or methylene blue solution to a concentration of 0.15–0.2 ppm and 2–3 ppm respectively. If the effect is not apparent, do a sprinkling again with the same dosage 3–4 days after the first application.

iv) Prevention of saprolegniasis of eggs: Disinfect viscid eggs by immersing them with malachite green solution of 7 ppm for 10–15 minutes for two consecutive days. Afterwards, sprinkle the hatching shelf twice a day, in the morning and evening respectively with 10–15kg of malachite green solution at a concentration of 70–100 ppm until fry is hatched out.

v) It is helpful to prevent the infection by immersing the egg nests for 2–3 minutes with 3–5% formalin solution or 1–3% table salt (NaCl) solution for 20 minutes.

General Treatment for fungal diseases:

The disease can be controlled by adopting good husbandry, removal of dead fish and use of topical fungicide such as malachite green. For treatment of fish eggs, use malachite green at 50mg/100l (2ppm) for 30-60 min, in flow thru. System. For bloodstock, 5-6g/100l (50 ppm) as dip treatment for 30 sec. For bath treatment 100-200mg/100l for 30-60min or 10mg/100l for prolonged (3-4 days) treatment.

2) Invasive diseases: Such diseases are caused mostly by fish parasites, like trichodinasis, ichthyphthiriasis, lernaesis, argulusis, etc. Fish carrying parasites or corpse of diseased fish are the direct sources of invasive disease. It is called the primary source. Objects accompanied with direct source, such as contaminated feeds, gears, pond water and silt, etc. are called indirect source, or secondary source. For examples matured oocysts of Eimeria or matured myxosporidia may enter water in large numbers together with fish, and precipitate onto the pond bottom, so the pond silt is the secondary source. The occurrence and spreading of infectious and invasive diseases often appear in different seasons, because the pathogens and fish are influenced by outside factors (such as place, climate, physicochemical property of water and farming skills, etc.) and inner factors (such as growth and physiological status), e.g. Saprolegnia may spread in winter and spring but may not in summer or autumn. Common parasitic diseases of importance are :

Ectoparasites

i)Protozoa : Oodinium spp., Chilofonrlla spp., Trichodina spp. and Ichthyophthirius multifiliis. The ichthyopthirius, a ciliate upto 1mm in dia, causes “ white spot” or “Ich” in most freshwater fishes.

Trichodina browse over gills and skin, damaging the host tissue and consuming the resulting dead tissues. Repeated chemical treatments are necessary to eliminate the parasites.

a) Trichodinasis & Trichodinelliasis : A number of species of the genus Trichodina and the genus Trichodinella, attache to the skin or gill of host with its adhesive disc. Sometimes it contracts its border membrane, moves its posterior girdle of cilia and keeps sliding on the skin and gill. The reproduction includes asexual longitudinal division and sexual reproduction by conjugation. Trichodina can cause infection to fish of any developmental stages, but mainly jeapodise juvenile fish and the infestation causes severe mortality. Trichodina of larger species mainly invade the skin of juvenile fish and live on the tissue cells of fish and destroy the delicate fish skin. Trichodinella chiefly parasitize the gill, and concentrate along the branchial periphery or between the gaps of gill filaments to destroy the gill tissues. When it is serious, the gill tissue rots and the cartilage exposed. The respiratory function of fish is thus seriously impeded and finally the fish is bound to die.

Control:

i) Disinfect fingerlings with copper sulphate solution at a concentration of 8 ppm for 20--30 minutes or with table salt water 1--2% for 2--10 minutes.

ii) It is promising to treat the pond with mixture of copper sulphate and ferrous sulphate at a concentration of 0.7 ppm (ratio 5:2)

iii) Formalin solution at a concentration of 30 ppm can kill the Trichodina on juvenile eel gill, but it brings in a disadvantage of deteriorating water quality and affecting the appetite.

b) Monogenian trematodes : i) Gyrodactylus spp. These are commonly knows as skin flukes, attached to the body surface, fins and gills by a hook, 1mm in length, ii) Dactylogyrus spp., known as gill flukes. Repeated chemical treatments are necessary to eliminate parasites produced from newly hatched eggs. Good husbandry, cleaning and sterilizing the facility, help to eliminate the eggs.

c) Crustaceans : Most important is i) Lernae spp., adult upto 22mm long, attach to the surface of the skin. ii) Argulus spp., the freshwater louse, large, flat, upto 1cm long, mostly found on head of the fish or behind the fins. Repeated treatments with organophosphorus is effective to destroy juvenile stages. Draining and drying will kill all stages, including eggs. Periodic removal of vegetation with attached eggs will help to reduce the parasite numbers.

i) Lernaesis (anchor worm) : The appearance of the female parasite is slim, like a needle. The body measures 6--12.4mm in length, consisting of head, thorax and abdomen. There is no distinctive demarcation between the three sections. On the head, there is a pair of dorsal horns and a pair of abdominal horns. They are like anchors that enable the parasite to fix itself into the host musculature. So it is also named “anchor worm”. After living on fish, the female parasite develops into three phases: “baby parasite”, “matured parasite” and “old parasite”. The baby parasite looks like fine white hair, without ovisac. The matured parasite has a transparent body. At the initial stage, the sick fish shows uneasy, poor appetite, thin body and slow movement. The surrounding parts where Lernaea penetrates are inflammated and swollen, and tissues are necrosing. The wounds are often invaded by Saprolegnia. 4–5 individual Lernaea on a juvenile fish of 6--9cm can cause death. 1–2 parasites on a young fish are even able to retard the growth or deform the host.

Control:

i) Bathe the fingerling attacked by Lernaea with potassium permanganate solution at a concentration of 10–20 ppm for 1.5--2 hours before stocking.

ii) Treatment with potassium permanganate: for the diseased Grass carp, bathe the fish for 1.5–2 hours with solution at a concentration of 10- 20 ppm

iii) Change the water quality suddenly, e.g. apply 400kg of fermented cow dung or pig manure.

General Treatment of parasitic diseases :

i) Application of lime @ 100 kg/ha.

ii) Chloramine T : It is most useful against Myxobacteria, Costia, Trichdina, white spot, **Gyrodactylus and other parasites. Dose :** Bath treatment 50-200mg/100l

iii) Copper sulphate : Good for ectoparasitc infections but now not used., 0.1mg/l for long term bath treatment.

iv) Dichlorvos and Trichlorphan : Dichlorvos is effective for sea lice while Trichlorphan is effective against Argulus spp. , Lernaea spp., gill flukes and skin flukes(Dactylogyrus and Gyrodactylus spp.).Dose : Dichlorvos : Bath treatment at 1mg/l for up to 60 min. against sea lice. Trchlorphon : 0.1- 2mg/l (0.1-2 ppm) long term exposure, which may be repeated.

v) Formalin (34-38% formaldehyde) : widely used for ectoparasite infection, at 160-250 ppm for 1 hour, i.e 20-25ml/100l for 30-60min. For prolonged treatment, 2ml/100l for 12-24 hours.

vi) Leteux-Meyer Mixer (Formalin-Malachite green Mix) : Add 3.68g malachite green to 1lit formalin. Use 2.5ml/100l for 1 hour or 1.5ml/100l as prolonged treatment, which is to be repeated 3 times at 3-4 days interval.

vii) Potassium permanganate : For treatment of protozoal amd monogenean parasites. Dose : For bath

treatment use 500mg/100l for 1 hour, for dip 100g/100l for 30 sec. The dose may be increased or treatment is repeated, if organic load in water is high.

viii) Sodium chloride : Good for treatment of ectoparasites. Dose: For bath : 1.0-1.5kg/100l for 20 minutes, for dip: 2-3 kg/100l for few seconds. For prolonged treatment use 500g/100l.

Results

"Prevention is better than treatment" has been a radical theory in medical science. Fish are schooling animals in water which brings up difficulties in observation, diagnosis and treatment. Apart from this, some effective drugs and measures to cure certain fish diseases are still unknown up to now. General practices for control include :

(i) Clearing and repairing: Regulating pond is an effective measure to improve the pond environmental condition, to prevent diseases and raise fish yields. It includes two aspects: one is the pond trimming, the other is pond disinfection.

(ii) To better the rearing management: Carefully observe the variations of water quality. According to the observation, timely apply the fertilizers or fill the pond with fresh water or even change water all over. Not only does it minimize or avoid the disease outbreaks, but also benefits fish growth.

(iii) Conduct medical prophylaxis yearly during the epidemic seasons from May to September. Fingerling disinfection is helpful to the prevention of diseases to disinfect fingerlings for transference or just before restocking into larger water bodies. For feeding platform disinfection: Hang small bamboo baskets with bleaching powder or cloth bag with mixture of copper sulphate and ferrous sulphate (ratio:5:2) placed round the feeding place or platform. When fish come to the place or platform for feeding, their skin will be automatically disinfected. The method of hanging bag (mixture of copper sulphate and ferrous sulphate ie., 100g of copper sulphate and 40g of ferrous sulphate each bag.) are similar to that of bleaching powder container. The chemicals ooze out of the bag of fine cloth slowly (the best duration of drug dissolving is 3--4 hours in the bag), hang the bags once a day.

iv) Disinfections of feeds, feeding platforms and gears : Feeding dirty or spoiled feeds may bring in pathogenic bacteria to the pond. If the leftover of feeds decompose in water, they are good for the pathogenic bacteria to multiply rapidly, which will lead fish diseases to spread rapidly in pond. For this reason, feeds and manures must be disinfected before application; As for application of plant feeds, bleaching powder solution at a concentration of 6 ppm is used to immerse the aquatic grass for 20--30 minutes before supplying, and as for organic manures, blend 120g bleaching powder with 500kg manure before application.

v) Pond treatment: Spreading the whole-pond with drugs is one of the most common practices to prevent diseases. Before or shortly after stocking fry, diluted 1g of 2.5% dipterex should be sprayed all over the pond. It is more particularly needed for those ponds with weeds. Three months later, treat the pond again with 0.7 ppm solution of copper sulphate and ferrous sulphate (ratio, 5:2). After June, spray bleaching powder to make the pond water at a concentration of 1 ppm once or twice a month. To improve the deteriorated pond water, it is recommended that 20–25 kg quick lime be used for a water depth of one meter. Such method can better the water quality and prevent diseases.

vi) Prevention with medicated feeds: during epidemic season, medicated feed is more helpful. Use 1–2 kg garlic per 100 kg of fish once a day for six consecutive days. Pulp and blend the garlic with fish feeds for feeding, preventive result would be better if 40g of table salt is added for every 5kg of food. For adult fish, mix the pulped garlic with some adhesive, and spread onto tender grass which can be applied after it is dry, or medicated feed may be given in pellet form.

Discussion

Fish is a common food for many people in India and f ish farming is an age old activity and in practice from ancient times. Wild freshwater fish are caught in many ways. At present, because of indiscriminate and over exploitation, environmental damage caused by overuse of agricultural chemicals and serious pollution caused by humans, the precious food source is becoming impoverished. In order to solve the problem, many farmers raise fish profitably in ponds, even rice fields, in the polyculture and integrated farming system. The successful fish culture requires ploughing of pond, addition of manure, stocking of fish seed; eradication of unwanted aquatic plants and animals, watering the pond; harvesting the crop and marketing of the produce. One of the main aspect being health management of cultured species and possible health hazard to the consumers. The fish culture technologies and economics are simple and understandable to the fish farmers. Integrated Fish Farming can offer farmers with economic developments and enhanced food production

improvements while lessening the adverse environmental impacts of farming. Maximum production in these system is dependant upon many factors in the final analysis including water quality, environmental conditions and the incidence of infectious diseases. For sustainable farming, the health management programme should focus on two main approaches like Ecosystem management: environmental management with optimum water, soil quality maintenance, with proper stocking density, devoid of stress to animals and Disease management. The main principles of fish disease control should be based on “all-round prophylaxis and prevention is better than treatment” approach as the treatment in such systems become impractical and uneconomic.

Abbreviation(s)

IMC-Indian Major Carps, EUS- Epizootic ulcerative syndrome, IEF- Integrated Fish farming

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