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RECIRCULATORY AQUACULTURE SYSTEM (RAS)

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Introduction

Recirculatory Aquaculture System (RAS) is a technology where water is recycled and reused after mechanical and biological filtration and removal of suspended matter and metabolites. This method is used for high- density culture of various species of fish, utilizing minimum land area and water. In this system fish are typically reared in indoor/outdoor tanks in a controlled environment. Recirculating systems filter and clean the water by recycling it back to fish culture tanks. The technology is based on the use of mechanical and biological filters and the method can be used for any species grown in aquaculture. New water is added to the tanks only to make up for splash out, evaporation and that used to flush out waste materials. The reconditioned water circulates through the system and not more than 10% of the total water volume of the system is replaced daily. In order to compete economically and to efficiently use the substantial capital investment in the recirculation system, the fish farmer needs to grow as much fish as possible in the inbuilt capacity. The management of recirculating systems relies heavily on the quantity and quality of feed and the type of filtration. Numerous filter designs are used in recirculating systems, but the overall goal of all filtration is to remove metabolic wastes, excess nutrients, and solids from the water and provide good water quality for the aquatic organisms. It is important to consider all factors when designing and investing in aquaculture systems.

Advantage of RAS

- Extended durability of tanks and equipment
- Reduced dependency on antibiotics and therapeutants hence, advantage of getting high quality fish
- Reduction of direct operational costs associated with feed, predator control and parasites
- Potentially eliminate release of parasites to recipient waters
- Risk reduction due to climatic factors, disease and parasite impacts
- RAS production can promote flexibility in terms of location for farming, proximity to market
- Enable production of a broad range of species irrespective of temperature requirements
- Feed management is considerably enhanced in RAS when feeding can be closely monitored for 24 hours
- Exposure of stock to stress on RAS can be reduced for some factors such as adverse weather, unfavourable temperature conditions, external pollution and predation
- Enable secure production of non-endemic species
- Judicial use of water and land areas

Disadvantage of RAS

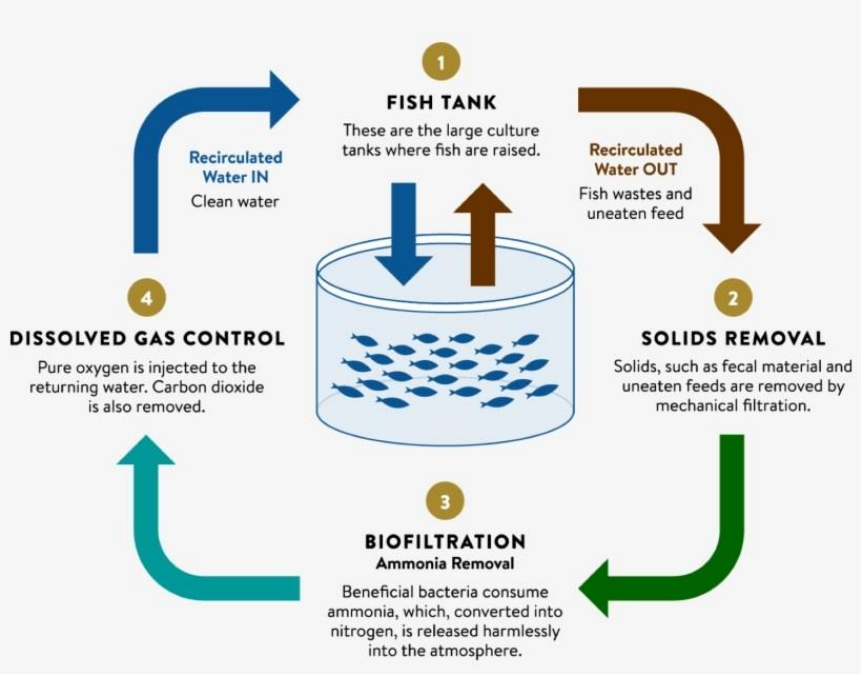
- Constant uninterrupted power supply is required if electric power fails than backup of electricity is required
- Capital cost of starting a recirculating aquaculture system is high as compared to ponds and raceways

Species suitable for RAS

- Baramundi/ Asian Seabass/Bhetki (*Lates calcarifer*)
- Cobia *(Rachycentron canadum)*
- Silver/Indian Pompano *(Trichinotus Blochii/ Trichinotus mookalee)*
- Tilapia *(Oreochromis niloticus)*
- Pearl spot/Karimeen *(Etroplus suratensis)*
- Pangasius *(Pangasianodon hypophthalmus)*
- Rainbow Trout *(Oncorhynchus mykiss)*, especially in Hilly/cold water Region

Components of RAS

- Insulated shed/ Building
- Store cum office for feed and accessories
- Pump house
- Grow out tanks: Circular cement tanks/ FRP tanks, including inlet, outlet central drainage
- Settling tanks for sludge
- Water Storage (sump) tanks
- Overhead tanks
- Mechanical (Hydraulic) filters, Drum filter, Glass wool/ muslin cloth filter
- Pumps and motors
- Power generator
- Sludge collector, settable/ dissolved solid collectors
- Biofilters, UV units
- Electrification
- Automatic feeder (wherever required)
- Aeration system (air/ oxygen), Carbon dioxide trapper system (degasser)
- Water testing kit
- Water supply system, bore well etc. (wherever required)
- Inputs such as Seed, Feed, additives and supplements, electricity/ Diesel, man power etc.



How does a Recirculatory Aquaculture System (RAS) work ?

Feed

- A high protein feed, containing all the essential minerals and vitamins
- Species specific feed
- Feeding can be done @ 3-5 % of the body weight of the fish depending on the quality and protein content of feed
- More frequent feedings (several times per day) shall result in better growth rates and thus improved feed conversion ratio

Model Technical Specification for GIFT Tilapia culture in RAS

S.No.	Title	Description
1	Name of Species	Nile Tilapia (GIFT)
2	Tank size	6.7mX 6.7m X 2m
3	Total volume	90 m^3
4	Stocking size	Fingerling
5	Stocking density/tank	6000
6	Survival rate	90%
7	FCR	1:1.3
8	Culture period/crop duration	6 months
9	Cost of Seed	Rs.4/pc
10	Cost of feed	Rs.30/kg
11	Total feed required	3.51 MT
12	Size at the time of Harvest	500g
13	Expected total Biomass	2.7 MT
14	Sale price	Rs.140/kg

Cost estimates for GIFT Tilapia culture in RAS

Sl. No.	Components	Amount (Rs. in lakh)
A	**Capital Cost**	
1	Fish Tank Construction	1.50
2	Procurement & installation of pumps, filters, aerators, pipes, valves, etc.	4.50
	Sub-Total (A)	**6.00**
B	**Input Cost**	
1	Seed (4500 fingerlings @ Rs.4/each)	0.18
2	Feed (28-30% protein; floating pellets)	0.77
3	Probiotics	0.05
4	Electricity	0.40
5	Miscellaneous	0.10
	Sub-Total (B)	**1.50**
	Total Cost (A+B)	**7.50**

Economic feasibility for 1-year production

S.No.	Particulars	Amount (in lakhs
1	Capital cost	6.00
2	Operational cost	1.50
3	Total project cost	7.50
4	Gross income from 1st crop	3.78

S.No.	Particulars	Amount (in lakhs
5	Gross income at the end of 1st crop after deducting the recurring cost for the 2nd crop	2.28
6	Gross income from 2nd crop	3.78
7	Gross income at the end of 2nd crop	6.06
8	Depreciation cost @15% of capital cost	0.90
9	Interest @ 12% of TPC	0.90
10	Repayment @1/7th of TPC	1.07
11	Recurring cost for next year	1.50
12	**Net profit = (6.06)- (0.9+0.9+1.07+1.5) 6.06-4.37**	**1.69**

Cost Breakup for Large RAS (with 8 tanks of minimum 90 m3 /tank capacity) model

S.No.	Particulars	Total amount (in Rs. lakhs)
A. Capital Cost		
1	Construction of tank including the pump, aerator, biofilter, Net, water quality testing kits and accessories @Rs.4.5 lakh/unit	36.00
B. Input Cost		
1	Seed cost @ Rs.4/pc for 48000	1.90
2	Feed cost	8.00
3	Electricity charges	3.00
4	Manpower	0.96
5	Miscellaneous	0.14
	Sub total	14.00
Total		**50.00**

Conclusion

Aquaculture holds an immense potential, especially for the marginal farmers, to improve their financial condition. RAS system which has less area requirement at the same time higher monetary can be a good fantastic option for future fish farming.

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