duck) farmers facing problem in integrated system.

- Duck farming is an old agri-business, however, lack of organized marketing system caused difficulties in selling of duck- meat and duck- eggs.
- Increasing commercialization of smallholder enterprises, farmer is facing competition for marketing the duck products.

Major policy Recommendations

- Policy measures for easier loan and subsidies for adoption of RFDIFS. The Government is to establish official product standards to improve the market efficiency of duck products like meat and eggs; and establishing as well as developing a marketing network for farmers to sell their products in easier way and in fair prices.
- The Government may establish suitable duck and fish hatchery centers for easier, timely availability of fish fingerling and duckling to farmers. Provisioning and identifying suitable training center for duck management will be helpful for farmer for larger adoption of technologies.

Up-scaling of RFDIFS

In India, various type of region-specific farming systems with varied enterprise combinations in respect to topography and agro-climatic condition are available. Rice-fish-duck integrated models developed by ICAR-NRRI for enhancing productivity and profitability for small and marginal farmers has been validated and implemented in commercial enterprising modes. At present, Govt. of India operationalised various innovative schemes, like Rastriya Krishi Vikash Yojana (RKVY), Tribal improvement plan (Tribal sub-plan), SC/ST improvement plan, National Horticulture Mission (NAM) and other various scheme at State Govt. levels, which provide an opportunity for promotion and development of RFDIFS especially in improvement in livelihoods of poor farmers, tribal and SC/ST farmers of the country. Additionally, National Mission for Sustainable Agriculture (NMSA) is expected to transform Indian agriculture into a climate resilient production system through suitable climate adaptation and mitigation measures in the domains of crop, livestock husbandry and agroforestry with rational use of natural resources (conservation and sustainable use) through adoption of rice-fish-duck integrated farming systems.

Rice Fish Duck Integrated Farming System for Enhancing Farm Productivity

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Rice Fish Duck Integrated Farming System for Enhancing Farm Productivity

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Rice is grown in about 44 million hectares (Mha) in India, out of which 40% areas are rainfed lowlands, mostly located in eastern India. Productivity of rice in these rainfed lowland areas are quite low (around 1.5 t ha^{-1}) as it is subjected to a number of biotic, abiotic and socio-economic constraints. ICAR-National Rice Research Institute, Cuttack has developed a rice-fish duck integrated farming system (RFDIFS), which ensure sustain ability in production, nutritional, economic, employment and environmental security for farmers. The system integrates components like improved rice varieties, fish and ducks etc. that function in synergistic manner (Fig.1.), to enhance the productivity and income. This system provides regular income to small and marginal farmers especially in tribal dominated areas and improve the livelihoods.

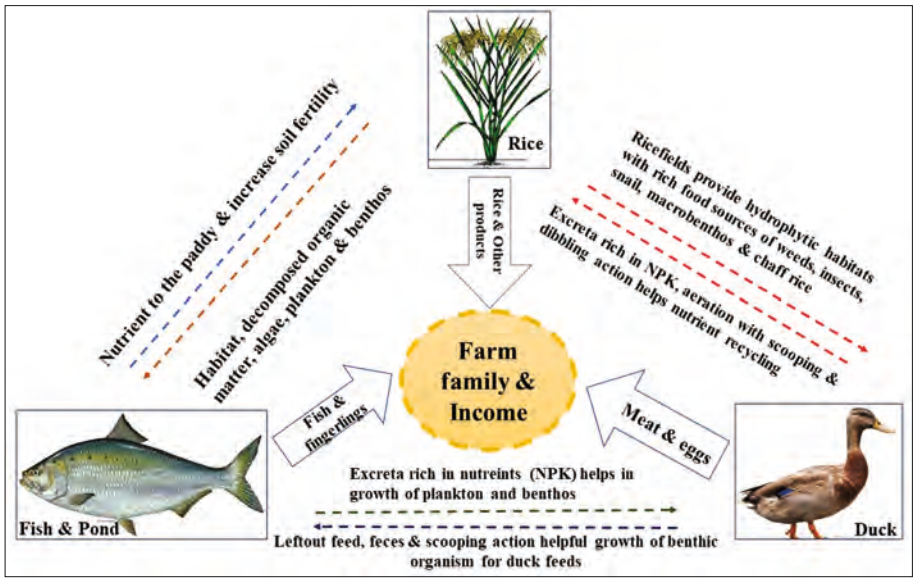

Fig.1. Conceptualization of rice fish duck integrated farming system.

RFDIFS is especially suitable for the resource poor farmers to produce low cost organic rice. This technology has good potential in lowland rice areas and beneficial in terms of providing social, economic and environmental benefits.

Farm site selection

- Site should be a medium deep or deep-water low lands, free from heavy flooding having clay soil and prolonged water retention capacity are preferred.
- A rectangular or a square shaped field with half to one hectare or more area is desirable.

Field design, construction and other considerations

- Field design includes bund (dykes 0.5-1.0 m wide) all around (5% of the area), pond or water refuge connected with trench on two sides (10% of area) and rice fields (85% of the total area) and guarded with water outlet.
- Embankments should have a height of 40-50 cm or depending upon the deepness and water levels of the rice fields. The dyke should be sufficient to prevent fish from jumping over and escaping to the other rice fields. In the outlet guarded with wire mesh screen to prevent the escape of fishes from the rice fields and also prevent the entry of predatory fishes from outside to the rice field.
- All along the outer side of the bund area nylon net barricade (1.5 meter height) fixed with positioning bamboo poles to prevent foraging of ducks in the adjoining rice fields and to prevent entering of outside predators to the rice area.
- The duck sheltering house is constructed using locally available materials (bamboo, wood and wire net with straw thatching or asbestos top) on the bank of the bund projecting above the pond water refuge area.

Production methodologies

RFDIFS integrates components like rice, fish and ducks to achieve symbiotic and synergistic relationships among the enterprises. In rainfed conditions farmer can take wet season rice and dry season crops (seasonal vegetables, watermelon and/or mung bean cultivation), however, farmer can opt for both season rice in irrigated fields. The components of fish and ducks rearing mostly depends on natural feeds available in the rice fields, however, for maintaining higher growth and intensity of intensification requires supplementary feeding regularly or at least in the lean period of food availability in rice ecologies. For substantial reduction of feed cost, farmer can opt for introduction of *Azolla* in the rice fields or can be culture in creating an *Azolla* peat. Introduction of *Azolla* causes twin benefits, as it can be used as feed for fish and ducks and a nitrogen source for rice. The technology is very flexible and depending upon the available resources (especially, monetary conditions), farmer can opt for integration of rice-fish, rice-fish- duck or rice-fish-duck-*Azolla* systems. The suitability of species and their specific managements are given briefly for better understanding and wider adoptability by the small and marginal farmers and agri-entrepreneurs.

Rice

Improved high yielding, semi-tall, long duration photo-sensitive rice varieties with in-built tolerance to pest and diseases are mostly suitable. Rice varieties such as Gayatri, Sarala, Durga, Varsha Dhan and CR Dhan 506 are recommended in wet season. If irrigation facilities are available, farmer can opt for *rabi* season rice (rice varieties such as Naveen, CR Dhan 303, CR Dhan 304, CR Dhan 305 and CR Dhan 306 etc), instead of other dry season crops (mung bean or vegetables in the main fields). Farmer can select the rice varieties depending upon the agro climatic situation and local needs.

Management Practices

Wet season

- Apply FYM @ 5 t ha^{-1} at the time of land preparation.
- In irrigated lands, transplant healthy rice seedling with spacing of 20 cm × 15 cm.
- In rainfed lowlands, do dry seeding with line sowing before the monsoon (@ 75-80 kg seed ha^{-1} with a spacing of 20 cm between the rows).
- Apply fertilizer NPK @ 60:30:30 kg ha^{-1} with N in the three splits (50 % as basal dose, and rest in two equal splits during active tillering and panicle initiation stages) and entire P and K as basal dosages in transplanted rice. In rainfed conditions, apply fertilizer NPK @ 40:20;20 kg ha^{-1} as basal dose only. However, the requirements of fertilizers are substantially reduced in integrated farming system (rice with fish and livestocks).
- Use finger weeder in dry condition and cono-weeder in standing waters (5 cm to 10 cm) for weeding
- Avoid using insecticides and herbicides in integrated systems. Use of sex pheromone trap (control yellow stem borer), and neem based botanicals (Nethrin or Nembecidine @ 1%) for controlling stem borer.

Dry season

- Prepare the land with application of FYM @ 5 t ha^{-1} and do puddling for rice transplanting.
- Apply, NPK @ 80:40: 40 kg ha^{-1} with N in three splits (50 % during planting and the remaining in two equal splits during active tillering and panicle initiation stages) and entire P and K as basal doses.
- Avoid using insecticides and herbicides and manual weeding is the preferred methods.
- In the absence of irrigation facilities, *rabi* rice is not recommended, and farmer should practice alternate farming like water melon, groundnut, sunflower, mung bean, okra and pumpkin with limited irrigation from stored rain water in the micro-watershed.

Fish and Prawn culture

Successful integration of rice with fish farming equally depends upon the pre and post-stocking management of fish in rice-fish system.

Pre-stocking managements

- The weeds should be removed manually, while unwanted and predatory fishes and other animals like frog, snake, crab and water insects etc. should be eradicated by repeated netting in water refuge area. In absence of proper

drainage, application of herbicides i.e. 2, 4-dichlorophenoxy acetic acid, paraquat, aqueous ammonia or diruon etc. may be useful for weed control.

- Eradicate the predatory and weed fishes using bleaching powder (150-200 kg ha^{-1}, limited water refuge area) or sun drying or application of mahua oil cake (@ 2500 kg ha^{-1}, limited to water refuge area) and prepare the pond with application of lime (@ 200 - 250 kg ha^{-1}). However, rate of application of lime depends on soil pH (if pH 5.1 - 6.5 @ 1000 kg ha^{-1}, 6.6 - 7.5 @ 500 kg ha^{-1}, 7.6 - 8.5 @ 200 kg ha^{-1} and if soil pH is 8.6 - 9.5 then no need for application of lime), and apply cow dung slurry @ 5000 kg ha^{-1}, and inorganic fertilizers (30:15:15 kg ha^{-1} of Urea, Triple super phosphate and Muriate potash).
- After 15-20 days of transplanting in July depending on water availability in water refuge area, stocking of fish fingerlings (4 - 6 inch size, or preferably used stunted fingerlings) @ 6,000 - 7,000 nos. ha^{-1} with the ratio of 30:30:40 as surface feeder, column feeder and bottom feeder and prawn juveniles @ 2 - 4 nos./m^2 should be maintained.
- In rice-fish system, a combination of six fish species is ideal (*viz.,* surface feeder - catla (*Catla catla*) and silver carp (*Hypopthalmichthys molitrix*), column feeder - rohu (*Labeo rohita*), bottom feeder - mrigal (*Cirrhinus mrigala*) and common carp (*Cyprinus carpio*), and vegetation feeder- (*Puntius javonicus),* however, addition of *compatible* prawn juveniles (*Microbrachium rosenbergii and M. malcomsonii species)* are also recommended.

Post-stocking managements

- After release of fish fingerlings, supplementary feeds to be provided for 10 - 15 days within the water refuge area at a rate of 4 - 5% of their total biomass (total weight of fish fingerlings), and then allowed to roam inside the paddy field. At this stage there must be at least 6-10 inches water in the field. The supplementary feed should be given at the rate of 1 - 2% of total fish biomass.
- In rice-fish system, fishes mostly depend on natural feeds (phytoplankton, zooplankton, benthos and detritus) and decomposed organic matters, insect larvae etc. available in the rice fields. However, addition of supplementary feeds (combination of rice bran, oil cake and fish meal; 1:1: 0.5 ratio) @ 2 % of body weight is recommended for achieving better growth of fishes. Integration of rice-fish with poultry, duckery and/or goatery etc. reduces requirement of supplementary fish feed.
- After water recedes from the paddy field, fishes take shelter in water refuge area and can be harvested in month of November/December. In case of irrigated field, if farmer decides to cultivate *rabi* rice, fish culture can be continued without harvesting the crop or again initiated by releasing newer fingerlings.
- The average fish body weight achieved during wet season (July-December) under rice-fish system depends on period of water retention, introduction of suitable species and their composition in a mixed culture (Table 1).

Table 1. Growth performance of fishes in rice-rice system (320 days' periods with provisioning of supplementary feeds) during both wet and dry season in rice-fish-duck integrated farming system.

Fish Species	Weight of fingerlings at release (g)	Weight of fish at harvest (g)	Growth rate (g/day)
Catla (*Catla catla*)	55-75	750- 1100	2.68
Rohu (*Labeo rohita*)	40-60	600- 750	1.95
Mrigale (*Cirrhinus mrigala*)	30-60	400-600	1.42
Cyprinus (*Cyprinus carpio*)	30-60	700-1100	2.67
Silver carp (*Hypophthalmichthys molitrix*)	55- 75	1000-1300	2.92
Punti (*Puntius javanicus*)	15- 20	275-450	1.08
Prawn (*Microbrachium rosenbergii and M. malcomsonii* species)	1.5-4.5	80-90	0.26

Duck Husbandry practices

- Ducks' breeds : Indian Runner, Khaki campbell or their cross with indigenous local ducks are preferred. Khaki campbell (egg layer) and White pekin (meat type) are well adopted in rice fields, however, farmer can select and rear duck breeds depending on local availability and farmer's needs.
- Brooding of ducklings : Procure one-day-old disease-free ducklings from the reliable sources or Govt. agencies like duck breeding and hatching farms, and rear for 21 - 28 days (0 - 4 weeks for Khaki campbell and 2 to 3 weeks for White pekin) to avoid mortality.

- Ducklings may be brooded in wire floor, litter or batteries. A wire floor space of 0.046m^2/bird or solid floor space of 0.093 m^2/bird would be sufficient up to 3 weeks of age. For 100 ducklings, 1-2 sq. meter area *i.e.* average 150 sq. cms/ ducklings is convenient for brooding.
- Maintain temperature of 29 to 32°C (85 to 90°F) in the first week of rearing, and reduces about 3°C per week till it reaches 24°C (75°F) during the fourth week period. In case higher air temperature (summer) exists, then air circulation should be increased. In winter (air temperature is lower) season, for increasing temperature of the room, a 100 to 200-watt electric bulb needs to be glow within the room (1-1.5-meter height from the ground level or as desired) or hot air blower may put on for maintaining the room temperature.
- Duckling fed initially using water drinkers (5 to 7.5 cm deep), and fed with starter poultry feed (using feeder device), sprinkled with water. From 2nd day onwards ducklings are fed ad libitum. As the duckling grows bigger suitable size of feeders are used. After 28 days rearing, ducklings are released to water refuge area for 2 - 3 hour for one-week period and after acclimatization ducks allowed to forage in the rice fields during the day times.
- Duck shelter housing : Duck do not require any elaborate housing. The shelter house may be constructed with locally available resources (like bomboo, wood and patta, wire mesh, straw thatched or asbestos sheet on top etc.). For adult bird an floor space of 2 - 2.5 sq.ft (or 0.5 m^2) area per bird is required for night shelter.
- Duck feeding managements : Ducks are allowed to forage in the rice fields during the day time and about 40 - 50% of their total feed requirement meets from the water refuge and rice fields areas. The forage in rice fields is restricted at the time of rice transplanting (15 days after transplanting) and during flowering to rice harvesting (30 days). Duck will feed on duck weeds (Lemna, Wolfia, Azolla etc.), aquatic weeds available in rice fields, and also consumed tadpoles, juvenile frogs, dragon fly larvae, insects and various other organic decomposed materials available in the rice environments.
- Supplementary feeds : Standard poultry feed or mixture of rice bran and choked etc. @ 2% body weight is provided daily during the time of night shelter. Care should be taken to avoid wet and left out feed to consume in the next day. Moist chaff rice, vegetable waste, horticultural waste and kitchen waste are well accepted by the ducks and helps to reduces the feed cost, however, culture of Azolla in the rice fields or culturing Azolla in the embankment (by creating pits)further reduces the cost of duck feed. Bird also allowed to feed on concentrate feed (purchased feed) or formulate with local feed ingredients. The feed should contain 16% protein for layer bird and 20% protein for broiler finisher bird. Starter ration (0 - 8weeks) & grower ration (growing period) should contain 24% and 20% protein, respectively.
- In RFD integrated system approximately 200 - 250 nos. ducks/ha either layers or meat type or in combinations (Khaki campbell or White pekin) can be raised in 1 ha of rice fields. The ratio of male and female is maintained as 1:10 to obtain fertilized eggs.
- Ducks lays eggs after attaining age of 24 - 28 weeks and continued laying until 360 - 380 days old. With provisioning of balanced nutrient supplementary feeds, Khaki campbell attain 2.2 - 2.8 kg body weight and lays average 300 eggs per year, and eggs weight varies between 60 and 70 grams. Meat varieties (White pekin) attain 3.0 - 3.5 kg yr^{-1} period.
- Each duck voided about 130 - 150 gm excreta per day. The duck excreta contain 81% moisture, 0.91% nitrogen, 0.54% phosphorus and 0.38% potassium, which act as organic fertilizer for rice and stimulate plankton growth for fish food, which in turn reduces the cost of production. Annual manure production from duck excreta will be around 45 - 55 kg $duck^{-1}$ $year^{-1}$, apart from around 10-20% of feed offered to ducks is wasted which is directly utilized as fish food. The fields receive 10000 - 15000 kg duck excreta (wet wt kg) per year when 250 - 300 ducklings stocked per hectare. About 17 kg of manure can be converted to grow 1.0-1.5 kg of fish.
- Ducks laying eggs at 16 -18 weeks. About 95 - 98% of eggs are laid by 9.00AM. One nest box of size 30 × 30 × 45 cm (12 × 12 × 18") to every three ducks should be provided. In case of laying breeds a mating ratio of 1 drake to 10 female ducks should be maintained.
- Extended light period (14 to 16 hours per day) is essential for optimum production. Increasing day length (Jan-June) brings sexually mature ducks into egg production, however decreasing day length (July-Dec) slows the egg production. The periodicity calendars of rice-fish-duck integrated farming system are explained in Fig.2.

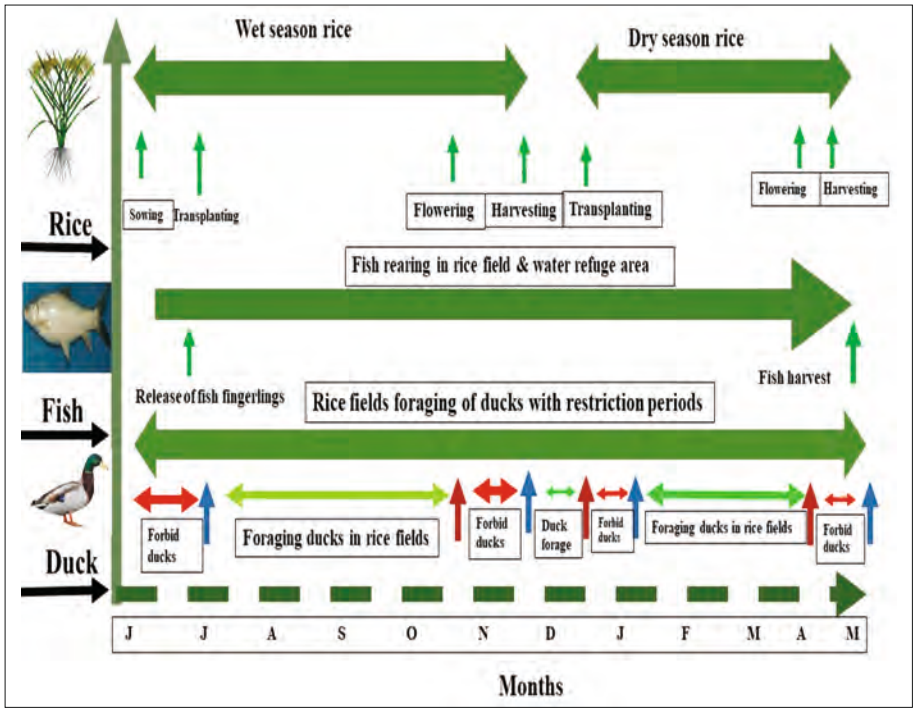

Fig. 2. Periodicities of fish and duck foraging in rice-rice farming system

Azolla cultivation and production

- *Azolla* is a free-floating aquatic fern, having unique capabilities of fixing atmospheric nitrogen through symbiotic association with cyanobiants, and used for bio-fertilizer, feeds for livestock and bio-fuel.
- Ideally, *Azolla* grows at temperature 20-28 °C with 50% of sunlight, relative humidity 65 - 80% and water pH 5.0 - 7.5. For culturing, *Azolla* bed is prepared by constructing 2 m x 2 m x 0.3 m rectangular or 1.5m radius circular area by digging soil (spreading silpauline sheets for water retention) or constructing with cemented structures.
- Ten to fifteen kg of sieved soil is uniformly spread over the pit or tank. Fill the tank with water and add cow dung (4-5 kg raw dung) slurry.
- Then, inoculate with 0.5-1.0 kg of pure mother *Azolla* culture seed material, spread uniformly over the water of the pits and sprinkle with fresh water over the *Azolla* immediately to make the *Azolla* plants upright.
- After 7 -10 days, *Azolla* growth will form a thick mat, and can be harvested. It should be washed thoroughly and mix with table salt for making well palatable and fed to livestock's (ducks, poultry birds, goats and dairy).
- The technology is well suited to farm women to feed livestock's and generate additional income for farm women and also to improve their livelihoods.
- Using *Azolla* as livestock's feed reduces the cost of supplementary feed requirements. Excess *Azolla* production can be sold to market (Rs. 10 kg^{-1}), for additional income. Additionally, *Azolla* can be cultured in rice field and helpful in the processes of supplementing nitrogen requirements of rice.

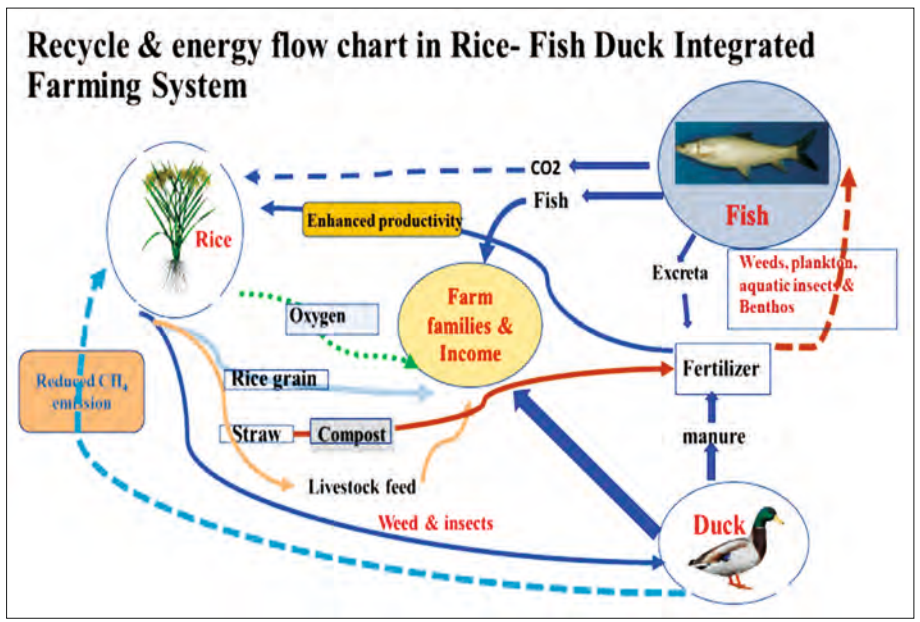

Fig. 3. Nutrient recycling and energy flow chart in rice-fish-duck integrated farming system.

Functional mechanism of RFDIFS

- In rice-fish-duck integrated farming system (RFDIFS), ducks and fish reared simultaneously in rice fields, creates a symbiotic and synergistic relationship between rice, fish and duck yielding mutual benefits among all the entities.
- Duck and fish eats and keep control over harmful insects and weeds in the rice field is averting the use and application of chemical pesticides and herbicides in the rice fields. The dropping of fish and ducks acts as a natural fertilizer and spread evenly throughout the rice fields, thus, reducing the use of chemical fertilizers demands for rice plant growth.
- The activities (continuous movement, scooping and churning of soil and continuous loading of droppings) by fish and ducks in the rice fields provides natural stimulation and aeration which increases the nutrient recycling and availability of nutrients (nitrogen, phosphorous and potash etc.) to the rice crops leading to enhancement of productivity and profitability (Fig 3).
- The activities enhance the bio- diversity and abundance of biological variables, as aerobic conditions prevailed in RFD, which promotes decomposition of organic matters leading to rapid mineralization and increases the release and availability of nutrients, leading to better growth, production and productivity.
- The soil and water nutrient status are improved in RFDIFS as compared to the conventional rice farming system, and in long run gradually transformed to eco-efficient and sustainable farming system.
- Integration of *Azolla* as a component in RFDIFS, used as one of the feed components for animals (fish, duck and other livestock's such as poultry, goat and diary etc.) and provides substantial amount of nitrogen for rice growth.
- The system accelerate the biodiversity, reduces the emission of methane gas from the rice fields (due to prevailing of aerobic condition) and substantially reduces the demands of chemicals (inorganic fertilizer, pesticides, herbicides etc.), thus, mitigate the global warming potential.
- The RFDIFS utilizes the maximum ecological niches, increases soil and water nutrient and fertility status, and provides healthy ecosystem services along with reduction of GHG emissions, hence, increasing the farm productivity and sustainability. RFDIFS technology reduced the cost of cultivation and minimizes the cost of production, increasing productivity, providing sustainability, economic, employment and environmental security to the farm families.

Productivity and Economics

- The rice-fish duck integrated farming system in rice rice cropping can annually produce 9-10 t of food crops, 7- 8 t of straw, 0.7 t of fish and prawn. 0.6- 0.9 t of meat and 25,000 eggs from one hactare field.
- The benefit cost ratio is varying from 2.5 - 2.8 and addition of *Azolla* as a component in the RFDIFS further increases the benefit cost ratio to 2.7 - 3.0, however, the net income and profits depend upon the extent of integration and their effective managements.
- Comparison of output value to cost of cultivation (OVCC) ratio of different

Table 2. Common duck diseases, symptoms and their control measures

Sl.	Diseases	Causative factors	Susceptibility	Symptoms	Prevention and control
1.	Duck plague or Viral enteritis	Herpes virus	All age groups	Listless with drooping wings, ruffled feather, no desire to walk, dull cornea, nasal discharge, laboured breathing, greenish yellow diarrhoea, conjunctivitis and drop in egg production	No treatment available, except vaccination with Duck plague vaccine and should be administered at the 8-12 weeks.
2.	Aflatoxicosis	Ingestion of aflatoxin, the toxic metabolite of the fungus *Aspergillus flavus* from infected maize- meal, soya meal, and groundnut cakes. 4 types of Aflatoxin (B1, B2, G1, G2) of which B1 is the most toxic.	All age groups	Poor growth, loss of appetite, falling of feather, lameness, purple discolouration of feet and drop in egg production etc. If aflatoxin present in high concentration in feeds it leads to death.	Quality feed ingredients to be checked for aflatoxin. Replace the infected feed with good quality feed immediately
3.	Botulism	C-type toxin produced by *Cl. botulinum*.	Food borne poisoning for both young and adult birds	Dullness, ruffled feather, lameness, coma and death.	With low infection levels of toxin, sick bird removed and providing the rest with fresh and clean water. Avoid ducks scavenging on decaying plant materials. Epsom salt in drinking water can be used.
4.	Aspergillosis	Respiratory disease caused by *Aspergillus fumigatus*. It may be transmitted through the air.	All groups	Loss of appetite, laboured breathing, and emaciation.	No treatment available for prevention the hatching eggs should be properly cleaned and disinfected. Moldy litter should be immediately removed.
5.	Colibacillosis	Caused by *E. coli*.	Young duckling from 2-3 week.		Both sulphonamides and broad-spectrum antibiotics are useful. Maintenance of good hygiene is essential.
6.	Ornithosis	*Chlamydia psittaci*. The disease is transmitted through the egg and contact.	Young ducks are more susceptible than adults.	Conjunctivitis, blindness, general weakness, watery diarrhea and emaciation.	Broad spectrum antibiotics control the disease. Infected flock needs isolation.
7.	Duck viral hepatitis	Hepatitis virus	Mainly affects duckling of 2 to 4 week of age.	Characterized by an acute course and primarily hepatitis.	There is no treatment. The day-old duckling may be protected with attenuated virus vaccine.
8.	Duck cholera (Pasteurell-osis)	Infectious disease caused by *Pasteurella multocida*	In ducks over 4 weeks of age.	In peracute form death occurs without any symptoms. In acute form the bird show loss of appetite, increased thirst, and mucous discharge from mouth, high body temperature, and diarrhoea. Liver and spleen are enlarged.	Prevention and control with sulpha drugs. Vaccinate the birds (Duck Cholera (Pasteurellosis)) first at the age of 4 week and again 18 weeks.
9.	Parasites	Ducks are resistance to internal parasites (flukes, tape worm, and round worm). The infestation is prevalent only among those ducks which have access to stagnant water, overcrowded ponds. The external parasites include lice, mite ticks and ticks.	All groups	Reduces growth	Prevention and control with use of different types of anathematic drugs.

farming system indicated higher return in rice-fish -duck *Azolla* integrated farming system.

Duck diseases and their Management

In general, ducks are less susceptible to diseases than chicken. The bad environmental conditions or using contaminated food materials may cause diseases to duck, hence one should be very careful to protect ducks from various type of diseases. The details of commonly prevailing diseases, symptoms and control measures are given in table 2.

Regular vaccination is essential for prevention of diseases in duck. Purchasing disease free stock, maintaining sanitation, mineral & vitamin supplementation, periodic used of coccidiostate, de-worming are important steps for prevention of diseases. Some other common medication to be followed; (i) Electral [10g lt^{-1} water] at the time of arrival of duckling, (ii) Stresroak @20g lt^{-1} water at the time of arrival and once in week, (iii) multivitamins like Vimeral 5ml lt^{-1} water should give 5 days continuously every month, (iv) Amprolium [Anti-coccidiostate] @ 1g lt^{-1} water in normal bird starting after 3 weeks of age continued for one week and repeat every 2 month, (v) Tetracycline @5g lt^{-1} water for 5 - 7 days control the diarrhea.

Benefits of RFDIFS

1.Ecological benefits
- Increase biodiversity & ecosystem stability
- Control weed & pests
- Enhance carbon sequestration and reduces GHG emission
- Reduces chemical uses in agriculture & organic

2.Economic Benefits
- Enhances production sustainability and soil health
- Reduces use of non-renewable energy i.e. Labor, inorganic fertilizer. Pesticides & Herbicides
- Increase farm income & higher market price of organic & green products

3.Social Benefits
- Provide the food materials rice, fish & ducks meat
- Provides animal proteins

4.Cultural Benefits
- Traditional varieties of germ plasm's protected and conserved
- Agricultural waste recycled & generation of agricultural waste minimized
- Clean water availability

Constraints in adoption of RFDIFS

- Rice- fish -duck integrated farming system model has been adopted in small and medium farmers in some areas of Odisha and West Bengal.
- Implementation of RFDIFS needs substantial amount of investments regarding land shaping and procurements of various inputs, farmers need easier bank credit, which are some extent restricted and require cumbersome paper processing etc.
- Lack of scientific knowledge in fish and duck husbandry and non-availability of suitable fish fingerling and ducklings in timely, and within the reach of farmer.
- Non availability of suitable quality feeds for duck raising.
- Lack of proper Bio-security measures, i.e. outbreak of the diseases (fish and