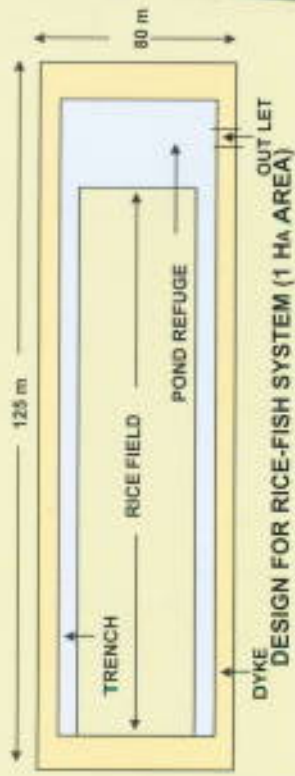


### Benefits

- Rice-fish system generates additional farm employment of around 250-300 mandays/ha/year.
- The system is ecofriendly as it promotes synergism between different components like rice, fish, prawn, birds, animal leading to recycling of wastes of one another. Such interactions result in enrichment of soil nutrient status, better crop nutrition and bio-control of weeds and other rice pests and ultimately increase rice yield by 5-15% besides, reduction in pesticides and chemical fertilizers use.

### Technology adoption

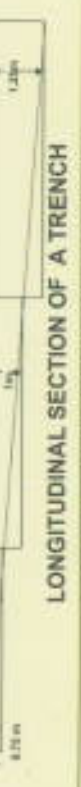
Rice-fish system has been adopted in small, medium and large commercial farms in some areas of Orissa state. This is a bankable technology and is supported by NABARD.



### CROSS SECTION OF FIELD, POND REFUGE AND DYKES



### CROSS SECTION OF DYKES, TRENCHES AND FIELD



### LONGITUDINAL SECTION OF A TRENCH

## Rice-Fish Diversified Farming System

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# Rice-Fish

## Diversified Farming System for Rainfed Lowland Areas

D. P. Sinhababu, P.K.Nayak and P. K. Sahu



In India rice is grown in 43.7 m ha of which about 40% areas are rainfed lowlands, mostly (14.6 m ha) located in the eastern India. The productivity of rainfed lowland rice largely cultivated as mono-crop, is around 1.5 t/ha due to different abiotic, biotic and socio-economic constraints. The Central Rice Research Institute, Cuttack has developed a rice-fish diversified farming system that can ensure food, nutritional, economic and employment security for farmers. The rice-fish diversified farming system integrates components such as improved rice varieties, fish, prawn, Azolla, duck and different crops after rice in the field and vegetables, fruit crops, agro-forestry, poultry, goatry, floriculture, apiculture and other components on the bunds. A substantial portion of about 6.0 m ha in the country (4.5 m ha in the eastern India) is suitable for the system.

### Site selection

- Site should be a medium deepwater (upto 50 cm water depth) low land. However, 10-20 cm excess water situations are also suitable.
- It should be free from heavy flooding.
- Farm having clay soil with prolonged water retention capacity is preferred.
- A rectangular or a square shaped field with an area of half to one hectare or more is desirable.

### Field design and construction

The field design for one hectare farm area includes construction of a micro-watershed in the form of a pond refuge of 10-12 m width and 1.75 m depth connected to two 3 m wide side trenches apportioning 13-15% of the field area, 2.5 m wide bunds (dykes) all around covering 20% of the area and a guarded outlet. The average depth of the trenches should be 1m. A gentle bed slope of 0.5% is provided in the trenches to ease the collection of water. Soil compaction, grass pitching and provision of 0.5 m to 1m wide 'berm' in between trenches/pond refuge and bunds should be made to avoid soil erosion.



- Construct low-cost duck, poultry and goat houses with straw thatching or asbestos top. Poultry unit made in a cage of wire net or bamboo is projected over the water of pond refuge to utilize the droppings as manure and also fish food. Use a floor space of about 2-3 sq.ft. for each duck and poultry bird and 10 sq.ft. for each goat.

• The cost of construction will be around Rs. 60,000/ha of farm area.

#### Production methodologies

##### In field

**Rice:** Grow high yielding, intermediate height or tall, long duration photoperiod-sensitive rice varieties with inbuilt tolerance to pest and diseases. Rice varieties such as Gayatri, Vanshasthan, and Durga for Orissa; Bhudev, Sabita and Jogen for West Bengal; Salyam and Kishori for Bihar; Madhukar and Barh Anwarodhi for eastern Uttar Pradesh and Ranjit and Jalashree for Assam are recommended.

##### Management

- Apply FYM @ 5t/ha at the time of land preparation.
- Sow in dry condition well before the monsoon using 75 to 100 kg seed/ha. Use a spacing of 20 cm in between rows. Line seeding, preferably dibble seeding using 4-5 seed is desirable.
- Transplant if required, early by using aged and healthy seedlings.
- Apply fertilizer @ 40:20:20 kg NPK/ha during sowing. However, in comparatively shallow water condition, apply 50% N at seeding and the rest after weeding.
- Do weeding with finger weeder in dry condition and/or with cone weeder in 5-10 cm standing water. Fill the gap with seedling in sparse areas.
- Avoid insecticides and herbicides. Use sex pheromone traps and light traps to monitor and control yellow stem borer and other insects. Use neem based botanicals such as Nethin or Nimbecidine @ 1% for controlling stem borer pest.

##### Fish and prawn

**Fish:** Release fingerlings (3-4 inches size) of catla, rohu, mrigal, common carp, silver carp and silver barb (*Puntius gonionotus*).

**Freshwater prawn:** Release juveniles (2-3 inches size) of freshwater giant prawn (*Macrobrachium rosenbergii*).

##### Management

- Release fish (carps) and prawn at 1:1 ratio at 10,000/ha of water area.
- Among fish species, maintain a ratio of 35% surface feeder (catla and silver carp), 35% column feeder (rohu and silver barb) and 30% bottom feeder (mrigal and common carp). However, in absence of prawn, release more bottom feeder (40-50%) along with 25-30% each of surface and column feeder fish.
- Apply cow dung @ 5-10 t/ha and 200-500 kg lime/ha of water area in monthly split doses.
- Feed the stock daily @ 2% of body weight of fish and prawn with a mixture containing 95% of oil cake + rice bran (1:1) and 5% of fish meal.
- Provide hideouts (earthen pipes, twigs) as shelter during moulting of prawn.
- Harvest periodically the bigger size fish and prawn from pond refuge after harvest of rice crop.

**Azolla:** Release live Azolla @ 1kg/10 sq.m. of water area in enclosures. Use phosphorus enriched Azolla inoculum. It can be used as feed for fish and birds (upto 10% of total feed).

**Pearl culture:** Fresh water pearl culture can be taken up in pond refuge of the system using the host mussel (*Lamellidens marginalis*) which are usually available in lowland rice ecologies. Around 2,000 implanted mussels/ha of farm area can be reared for pearl production.

**Crops after rice:** Grow crops such as watermelon, groundnut, sunflower, sesamum, mung bean, cowpea, okra, pumpkin, bitter gourd, pot (Bassella) with limited irrigation from stored rainwater in the micro-watershed.

##### Components on bunds

**Vegetables:** Grow location specific vegetables such as okra, gourd, radish, brinjal and leafy vegetables before and during the wet season. During winter grow vegetables such as tomato, french bean, radish, bitter gourd, cucumber, cauliflower, cabbage, brinjal, pumpkin and leafy vegetables in 50% of the bund area.

**Fruit crops:** Grow dwarf papaya (Pusa Dwarf, Pusa Majesty, Pusa Delicious, Pusa Nanta, CO-2, Coorg Honey Dew), banana (Carwendish, Robusta or tissue cultured plants), coconut (TxD) and arecanut in the remaining 50% of the bund area.

**Agro-forestry:** Plant *Acacia mangium*, *A. auriculiformis* and poplar 2-3 m apart east to west on northern and north to south on western side bunds. Prune the trees every year.

**On platform:** Grow different creeper vegetables such as snake gourd, bitter gourd, ridge gourd, bottle gourd and ash gourd. These crops are grown throughout the year.

**In shade:** Grow spices like turmeric and ginger and fruit crop such as pineapple.

**Floriculture:** Grow marigold, tube rose, gladiolus, rose etc.

**Mushroom:** Grow straw mushroom during March to September and Oyster mushroom during October to February in thatched or polythene enclosure.

**Apiculture:** Put two to three bee boxes and harvest honey at regular intervals.

**Poultry:** Rear 50 birds of broiler, layer or dual purpose birds (CARI Devedra, CARI Gold, Vanaraja, Gramapriya in each cage. For meat purpose, follow three to four cycles of birds rearing in a year. Maintain 20% male birds.

**Duckery:** Release 50 ducks of Khaki Campbell or improved native breeds in one hectare unit. Keep 10-15% male birds. Withdraw the ducks from the rice field and put in a pen after flowering of rice crop.

**Goatery:** Maintain 10 goats of Black Bengal or Ganjam breeds. Provide stall feeding with grass, weeds, leaves and crop residues available in the field.

##### Productivity and economics

• Rice-fish farming system can annually produce about 16 to 18 t of food crops, 0.6 t of fish and prawn, 0.4-0.7 t of meat, 8,000 eggs besides, flowers, fuel/fire wood and 5.2 t of animal feed as rice straw from one hectare of farm area.

• The net income will be Rs. 76,000 in the first year. This will increase to Rs. 1,30,000 or more in the sixth year. Thus, this system increases farm productivity by more than 15 times, and net income upto 20 folds.