INTEGRATED FISH FARMING

Dr . G. B. CHAND

Associate Professor

Department of Zoology

Aquatic Toxicology laboratory

Patna University, Patna

Email : gbchand @rediffmail.com

INTEGRATED FISH FARMING

INTEGRATED FISH FARMING

Since last two decades, attention has been mainly concentrated on maximising protein production through optimum utilisation of available resources. On this context, multiple commodity integrated farming system involving crop farming, live stock rising and fish culture, which maximise production through recycling of wastes, optimum utilisation of resources and giving maximum return to the farmer, agriculturists, is a logical approach.

In India consistent efforts were made to develop low cost farming system suitable for Indian condition based on the principles of productive utilisation of farm wastes and a fuller utilisation of available resources and manpower. Fish culture in combination with live stock and crop integrated farming is a unique and lucrative venture and provides a higher farmers income, availability of cheap sources of protein for the rural dwellers, highest productivity among small land holders and an increase in the supply of feeds for the farmers live stock.

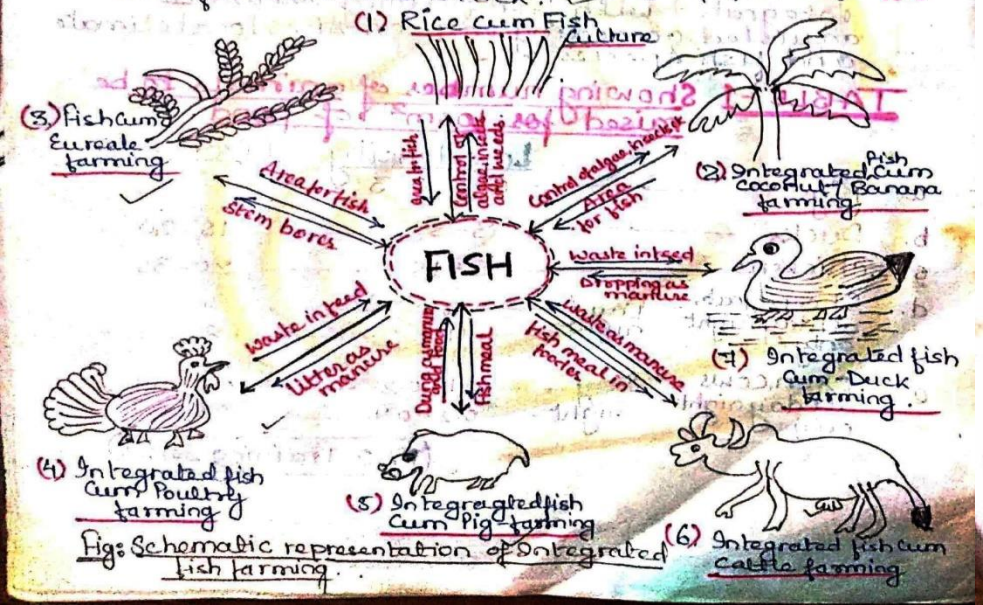


Fig: Schematic representation of Integrated fish farming.

Animal husbandry and fish farming relationship

For raising live stock in integrated fish farming some additional inputs are essential which can be summarised as —

(i). A proper analysis and monitoring of water quality, particularly if the animals are maintaining the ponds directly.

(ii). Integrated farming should be always started in small way with one or two ponds and few animals.

(iii). Initially concentration/attention should be paid to flattering of animals...

(iv). A proper least management of live stock should be taken.

(v). Animals should be confined close to pond during night.

(vi). Available land should be fully used to produce protein rich plant material for feed, erosion control and fencing.

(vii). The dissolved O_2 content of pond should be treated very often.

(viii). The numbers of animals which has to be integrated with fish farming should be adjusted according to pond size, local climate and fish species as —

TABLE-1 Showing numbers of animals to be raised for 100 m^2 of pond.

		Low density	high density
a.	Pigs	0.2-0.3	0.5-1
b.	Ducks	3-5	15-20
c.	Chickens	5-15	20-35
d.	Sheep/goats all day night only	Day 2	4
		night 4	8
e.	Oxen, cows all day night only	Day 0.1-0.2	0.3-0.4
		night 0.2-0.4	0.6-0.7

(FAO Training Series)

INTEGRATED FISH FARMING

While selecting a particular animal to be integrated with fish farming, local condition should receive priority particularly in concerning marketing potential availability of feeding ingredients and duration of each production cycle viz.

TABLE - 2 Showing duration of Production cycle

	Weight	Production cycle
a. Meat duck	50g to 1.5-3kg	2-3 months
b. Broiler chicken	30-40g to 1.2-1.7kg	3-4 months
c. Pig	15-20kg to 60-100kg	5-8 months.

(FAO Training Series)

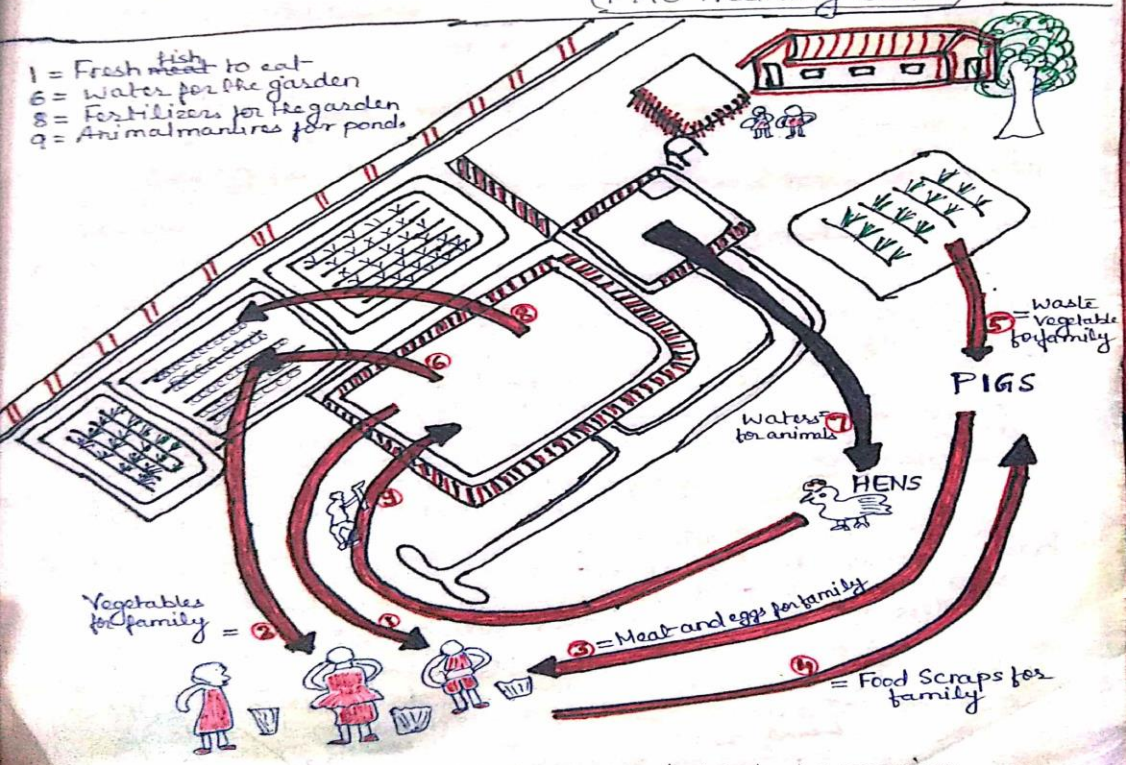


Fig: Animal husbandry and fish farming (After FAO Training Series 1997)

1 = Fresh fish to eat ✓
2 = Vegetables for family.
3 = Meat and eggs for family
4 = Food scraps for the animals
5 = Waste vegetables for animals.
6 = Water for the garden
7 = Water for your animals
8 = Fertilizers for the garden
9 = Animal manures for the ponds.

INTEGRATED FISH FARMING

POND MANAGEMENT

A scientific pond arrangement is essential for profitable fish culture. It includes the following →

1. Selection of ponds → Fish pond may be seasonal or perennial. Perennial ponds retain water throughout the year and usually selected for culture of table fish. The newly excavated ponds should be rectangular in shape and of managable size (0.4 ha) preferably with nearly source of water for replenishment as and when necessary.

2. Clearance of aquatic weeds → Undiserable weeds in small and large water bodies are controlled either of three ways — (i) Manual methods (ii) chemical methods and (iii) biological methods.

3. Clearance of unwanted, undiserable a weed fish → Since the predatory fish directly feed upon fingerlings where as weed fishes compete with them for food and oxygen. A complete erradication of such fishes from stocking pond is done either by repeated netting, draining out or by applying forms toxicants to the ponds.

4. Stocking → After proper detoxification the pond is stocked @ 8000 to 8500 fingerlings per hectare and a species ratio of 40% surface feeders, 20% of column feeders, 30% bottom feeders and 10% macro vegetation feeders is preferred for high fish yeilds. Mixed culture of Indian majors. Craps can be taken up with species ratio of 40% surface feeders, 30% column feeders and 30% bottom feeders. However a poly culture of major carps can be taken up with species ratio of 40% surface feeders. 30% column feeders and 30% bottom feeders.

5. Liming → Lime is applied to the fish stocking from @ 250–350 kg/ha/yr. depending upon soil and water condition. Half the quantity is applied before stocking the fish and rest in 2-4 installments.

6. Feeding of Grass Craps → Aquatic weeds such as Hydrilla, Naja etc or chopped green cattle fodder such as Bar seen Napier Grass, maize leaves etc. are provided to grass Craps. The cattle fodder is grown on the terraced embankment of pond and fed to grass crap / pig.

7. Use of pig wastes as manure → Pig dung, urine and Spilled from pig sites are channeled into the pond everyday. Pigs manures may be distributed to fish ponds by any one of the two ways -
   (a) Direct transfer either immediately or clearing an
   (b) Indirect transfer from a storage pit built near to pig sty. The required storage requirement volume is calculated as -
   (i) For 20–45 kg of live wt. pigs = 0.001 to 0.006 m^3/day per pig.
   (ii) For 45–90 kg of live wt. pigs = 0.008 m^3/day/Pig.

8. Periodical netting → Trial netting is done once a month to cheque the growth of fish. It also keeps in timely detection of positive infection. The netting also keeps in raking the pond bottom which results in release of germs from bottom of the pond as well as release of nutrients from bottom soil.

9. Control of algal blooms → In manure loaded ponds sometimes planktonic algae appears in great abundance specially during summer season. These weeds are usually removed by using herbicides like; Diuron or Simazine.

INTEGRATED FISH FARMING

The systematic techniques involved in integrated fish farming can be summerized as...

A. INTEGRATED FISH CUM- POULTRY FARMING/ Integrated chicken Rearing.

The dropping of birds rich in nitrogenous matter fertilize fish ponds for the production of fish food organism. Poultry shed when constructed above the water column using bamboos. will directly fertilize fish ponds.

Pond Management →

For this, pond management practices are fish rearing, stocking techniques are similar to the above discussed section.

Use of Poultry litter as manure:

The fully build up deep litter removed from the poultry pen is stored in suitable places and is applied to the pond @ 50 kg/ day morning. Application of litter is defined on the days when algal blooms appear in the pond.

Poultry Husbandry practices →

The egg and meat production in poultry raising depends upon multifarious factors such as breed, variety and strain of birds, good housing arrangement, balanced feeding, proper healthcare and other measures go along way in achieving the optimum egg and flesh production.

For integrated chicken rearing either one day old chick in to 10-12 weeks old broiler of 1-2 kg each or 4.5-5.5 months old laying hens which will be rearing for 12-18 months to produce eggs.

SELECTION OF BREED:

(i) For the production of broiler local breeds, improved breed (viz, Sussex or New Hampshire) or their hybrids are selected.

(ii) For the production of eggs improved breed (viz Rhode Island or White Leghorn) or their hybrids are usually preferred.

Housing of birds →

Poultry chicken are kept in three [illegible]

(i) Extensive system

(ii) Semi intensive and (iii) intensive system.

The intensive system may be of (a) battery (cage) or (b) Deep litter system. The deep litter system is preferred due to higher manurial value of the built up deep litter.

→ For small brooding house it should have the following characteristics -

a) Floor area of at least 2.5 m²/100 chicks to be reared / 0.125 m² floor space.

b) well ventillated but no air draughts at ground level.

c) Protected from strong winds i.e. orient into extent possible at right angle to dominent winds.

d) Shaded subdued natural light i.e. orient into the extent possible east west against direct sunlight.

e) well protected against predators.

f) Easily cleaned and disinfected.

g) close enough to house for food care.

h) wire mesh above 18 to 25 mm mesh is used. corrugated steel sheets or thatches for the roof with at least 50 cm over hang all around is used.

i) A tight fitting door is built.

The preparation and facilities in chicken house based upon the size of chicken and the duration as follows: →

A. Two weeks before each batch of chicks arrive:

I. Clean, repair and disinfect the brooding house.

II. One feeder tray (length 1m) for 50 chicks.

III. one drinker per 50 chicks such as 5- to 8 tin cans buckets or a shallow bowl supplied with water from up side down bottle. etc

IV. Additional heating to keep the chicks warm without crowding together. A Kerosene storm lanterns protected by netting.

V. About 6m of chicken wire 60 cm high to make a circular pen of about 1.80 m in diameter, enough to rear 100 chicks.

INTEGRATED FISH FARMING

B. **Ten days before the chicks arrival:**

Following necessary supplies are prepared —

a. About 900 to 1000g of special chick feed (chick starter) is needed to feed the chicks. In addition it also need some Vitamins and minerals supplements.

b. Procurment of drugs and Vaccine for future use.

C. **ONE day before arrival:**

a. A good dry litter such as wood shavings are added in the brooding area. Have sure that kerosene lampsare functioning properly.

D. **On arrival day and for the 1st Week:**

a. Place suitable feed in trays.

b. Place water in the drinker.

c. Bring the air temperature of the brooding area up to 34°C by lighting the kerosene lamp and protecting them well within fine netting.

d. Check on the fence and its cover against air droughts.

e. Gently place one day old chick in the breeding area.

f. During night temp. is maintained at 34°C.

E. **Second Week after arrival of chicks:**

a. Reduce air temp. to 32°c in brooder. Remove the barrier encircling the brooding area. Add some feeding trays and drinkers and add small tray with very small gravel and one tray with lime-stone grit (calcium).

F. **Third Week:**

a. Reduce air temp. to 30°c.

G. **Fourth and Fifth Week:**

a. Reduce air temp. to 28°c to allow the chicks to slowly adapt to local temperature variation.

H. **Sixth Week:**

a. Transfer the young chicken to an outside rearing house.

Nutritional Mangement

The chick under deep litter system is fed regularly with balanced poultry feed according to their age.

Table:6 Three types of mixed feed (in percentage fresh weight) to be used as chick feed (Brooding Hours)

S.No.	Ingredients	Types of feed I (0-6 Weeks)	II (7-12 Weeks)	III (13-18 Weeks)
1.	Maize and millets	60	56	60
2.	Groundnut cake	25	29	—
3.	Wheat middlings	—	—	25
4.	Blood meal	10	—	—
5.	Bones / calcinated ground	4	—	—
6.	Salts	1	—	—
7.	Concentrated rice (protein / Vitamins / minerals)	—	15	15
	Total	100	100	100

FAO (1999).

CHICKEN HOUSE

Chicken house is constructed close to the fishpond in one of two ways —

i. Over a fish pond → The house must have wooden slatted or wire mesh floor, allowing wastes to drop directly in to pond.

ii. On one of the pond dikes → The house should have well drained floor made of compacted soil, gravel, wood or concrete. Some dry litters may be used according to need of pond to collect the droppings.

INTEGRATED FISH FARMING

In the chicken house following equipments are provided:-

- Feeding trays → One or two 1m-long trays per 20 animals
- Drinkers → One or two 5-10 l bowls per 50 animals.
- Trays with small gravel and lime stone grits
- Perches, preferably placed length wise along the centre of the house should be about 3.5cm in diameter and fastend to solid stands about 60cm above the ground. Provide 10 to 15cm of perch per animal.
- A manure collecting deck of about 20cm underneath is attached to perch.

To produce broilers successfully:

When the broilers chick are 5 weeks old, a batch of young birds is transferred from brooder's house to chicken house —

- 8 birds per m^2 or less density
- Supply a good drinking water.
- The broilers are feed with followings —

(a) Sixth week → Similar food as for chick (Table-6) @ 50 g per day per birds.

(b) From the 7th week onwards → broiled feed at an increasing ratio of 78 to 140 g. per day per bird and 2 ml of vitamins and minerals supplements/ to birds in drinking water is added.

Food conversion rate should remain under 5:1.

TABLE-7 Three possible types of broiler feed (in percentage of total fresh wt.)

Ingredients	Types of feed I	II	III
1. Maize or millet meal	71	60	60
2. Rice polishing	—	20	20
3. Brans (wheat and rice)	—	—	—
4. Groundnut cake milled	20	7	7
5. Copsah cake milled	—	5	—
6. Blood meal	—	—	—
7. Bones/calcinated ground	3	—	—
8. Salts	1	—	—
9. Concentrated vicel (Protein Vitamins and minerals)	—	13	13
Total =	100	100	100

Broilers usually killed when they reach about 1.5 kg in age weighing 1-1.7 kg (tropical), when the chicken House is empty, it is cleaned (Sub tropical disinfected and left for 15 days and may forced for next Crops.

TO PRODUCE EGGS LAYING HEN Successfully

Chicken house is designed according to the Initial Act plans for 12th week old broilers with exception to the more floor space i.e; 0.33 m^2 per bird is required to rear laying hens. However chicken house must be equipped with following —

(a) Feeding trays → Two 1m-long trays per 20 hens using the same model as that for broilers till 5 months and then replacing it with a standing trough (2m).

(b) Drinkers → Two 10-15-l buckets on a stand/20 hens.

(c) Perches → Same as that of broiles fish at the age of 5 months and then replacing them with Larger perches (Preferably 2.5 x 4cm Section or 5cm diameter bamboo) producing 25cm of perch per bird.

(d) Nest boxes to lay eggs → one single nest for every 5 birds with 10cm of dry litter (Maize leaves, grass, rice straw) in each nest.

(e) Gravel tray → One 80cm tray containing 4 to 6mm gravel to help the hens digest their food better.

Rearing Practices:

- At the age of five weeks old, a batch of young birds is transferred to chicken house with max° density of 8 birds/m^2 of floor space.
- Feeding — early morning as noon @ —
  - 55g per day per bird — from 6th to 9th week.
  - 70-95g/day/bird — 10 to first laying —
  - 105-125g/day/bird — first four weeks after egg laying and then 125-130 g/day/bird constantly.
- The bird density should be reduced gradually as —
  - max° 8 birds/m^2 or, 0.125 m^2/bird from 6th to 9th week.
  - " 6 birds/m^2 or, 0.165 m^2/bird from 10th week to 1st egg laying.
  - " 4 birds/m^2 or, 0.25 m^2/bird for egg laying period.

*

INTEGRATED FISH FARMING

→ Eggs are collected several times each day in
→ Warm weather, twice in morning and day in
→ Cool weather morning and evening.
→ During the first year the average laying rate should be at least 60 percent of the total. In the second year, the laying rate normally decreases.
→ Usually laying hens produce eggs for 2 years and they should be culled when they are old.

B. FISH CUM CROP INTEGRATION

The agricultural components usually incorporated in an integrated fish farming system are palatable, nutritious, resistant to diseases, strong adaptability and easy to manage, strong and well developed roots. The terrestrial agricultural components integrated are usually Alfa alfa, Rye grass, Sudan grass, Kermain lettuce, Brunch grass, Hybrid grass, elephant grass, Lactuca tentaculata, Barnyard grass, guinea grass, wild grass, soyabean, barley, Zea mays, Sweet potato, Cabbage, Banana, papaya, Cucurbita, water melon, sugarcane, Banana, Mulberry, Wheat, Rice, Jute, pineapple, coconut, orange, poi, Ipomea, Brinjal, cow pea, tomato, pumpkin, bean and fruit plants etc.

* Besides the aquatic plant components are usually water hyacinth, water lettuce, water peanut, wolffia, lemna in China, Trapa birdpinasa (aquatic chestnut) and Euryale ferox (makhana) in Bihar (India).

* According to Ahmad and Singh (1999) the cultivation of makhana and aquachestnut with fish culture by the majority of farmers of Bihar has provided healthy additional income credits to their overall profit.

* A Combination of two Indian major carps such rohu, mrigala and exotic carp ie; Cyprinus carpio in the ratio of 20-30 : 20-25 and 40-50 is recommended for stocking at the densities of 1200 fingerlings per hectare for a production level of 1000 Kg per hectare. Among Indian major Carps — Rohu (columnar periphyton feeder), and mrigala (omnivorous bottom feeder), and Cyprinus carpio (omnivorous and detrivorous bottom ...) ... combination for such cultural ...

However, Catla (Surface 200- plankton feeders), Silver Carp (Surface phytoplankton feeders) and Grass Carp (macrovegetation feeders) are not suitable to thrive well in this condition.

According to Jhingran (1991), in mixed culture of magur, Rata and Koi at the stocking density of 70,000 nos/hectares along with makhana yielded a production equivalent to 1200kg/ha in 8 months in addition to yield of 320.0kg of makhana seeds.

Paddy Cum Fish Culture, was advocated in many South east Asian countries. The low lying and wet land paddy fields, where severe waterlogging occurs, serves as natural habitat as well as breeding ground for various kinds of fishes.

In this fresh water low lying area, it is possible to raise two paddy crops and one fish crop every year in high rainfall deep water areas. Approximately, 1/3rd of the plot area is depended for the fish culture as well as for the irrigation of 2nd Rabi Crop in the irrigated system.

Since paddy cultivation, during kharif is monsoon dependent, so after fertilization, deep variety of paddy are selected. Some of the important varieties in different states of India are as follows —

I.	PLA-2	Andhra pradesh
II.	EB-1, EB-2, Ar-1, Are 353-146	Assam
III.	BR-14, Jaisuria	Hisar
IV.	As-61, 25-B, Pt b16	Kerala
V.	TNR-1, TNR-2	Tamil Nadu
VI.	Jalmagn	U.P/ Bihar
VII.	Jaladhi-1, Jaladhi-2	West Bengal
VIII.	Thu thabi	Manipur

The Variety 'Monohorsali' is commonly showed in paddy fields with fish in Assam during kariff season. Usually paddy plot is made ready during April and May. Deep water variety are sowed after the first monsoon directly. This kharif crop harvested during November and December, when water recedes from the paddy plots. The production of deep water variety ranges from 8-12.00 Kg/ha.

INTEGRATED FISH FARMING

Now, after harvesting kharif crop same plot is used for second crops of rabi, The field is fertilized once again according to the need of rabi crops and then high yeilding varieties of paddy like – Ratna, Jaya and pusa are cultivated. The seedlings grows in specially prepared Nursery beds are transplanted in January. This paddy is irrigated regularly from the perimeter trunch by 'Bonga' or 'Doon' commonly used. The crop gets ready for harvesting within four months and production ranges from 4000 – 5000 kg per ha.

For the fish culture in paddy fields, on the set of monsoon, weeds and production are removed from the fields.

Pond management for fish cum paddy crops are as follows –

1. Selection of ponds → Fish pond may be seasonal or perennial, and it retain water throughout the year and usually selected for culture of label fish. The newly excavated ponds should be rectangular in shape and of managable size (0.4 ha) preferably with nearby source of water for replenishment as and when necessary.
2. Clearance of Aquatic Weeds → undiserable weeds in small and large water bodies are controlled by either of three way (i) Manual method, (ii) chemical and (iii) Biological methods.
3. Clearance of undiserable weed fish → Since the predatory fish directly feed upon fingerlings where as weed fish compete them for food and Oxygen. A complete eradication of such fishes from stocking ponds is done either by repeated netting draining out or by applying toxicants to the pond.
4. Liming → lime is applied to the fish stocking pond @ 250 – 350 kg/ha/yr depending upon soil and water condition. Half the quantity is applied before stocking the fish and rest in 2–4 installment
5. Manuring → Manuring may be distributed to fish ponds by any one of the two ways –
   (a) Direct transfer either immediately or clearing and (b) Indirect transfer from a storage kit built next to pig sty.

In month of July, rain water starts accumulating in paddy fields and when depth of water in ways (1ft or 1½) becomes sufficient, fish like Catla, Rohu, mrigala, common Carps are stocked at the rate of 4000 – 6000 kg/ha. Species ratio Surface feeders, Column feeder and bottom feeder is maintained as 25% : 30% : 45% for proper growth after harvest of kharif crop, conventional supplementary feed @ 3.5% fish biomass is given. In this way survival upto 60% can be achieved.

With the reduction of water level in trenches during Nov – Dec after the kharif season partial harvesting is done. Fishes are harvested fortnightly and in final harvesting fishes are Hand picked. In this system, production of 700 – 1000 kg/ha/yr is normally achieved. The dykes constructed for preventing escape of fish may be used for growing vegetables and fruits bearing plants like papaya, Banana etc.

C. FISH CUM COW INTEGRATION

Starting; pages 1 – 4 →

I. Cows can provide dung to be used as manure and left over matted grass of cow shed etc. can be used for mushroom and earth worm culture.

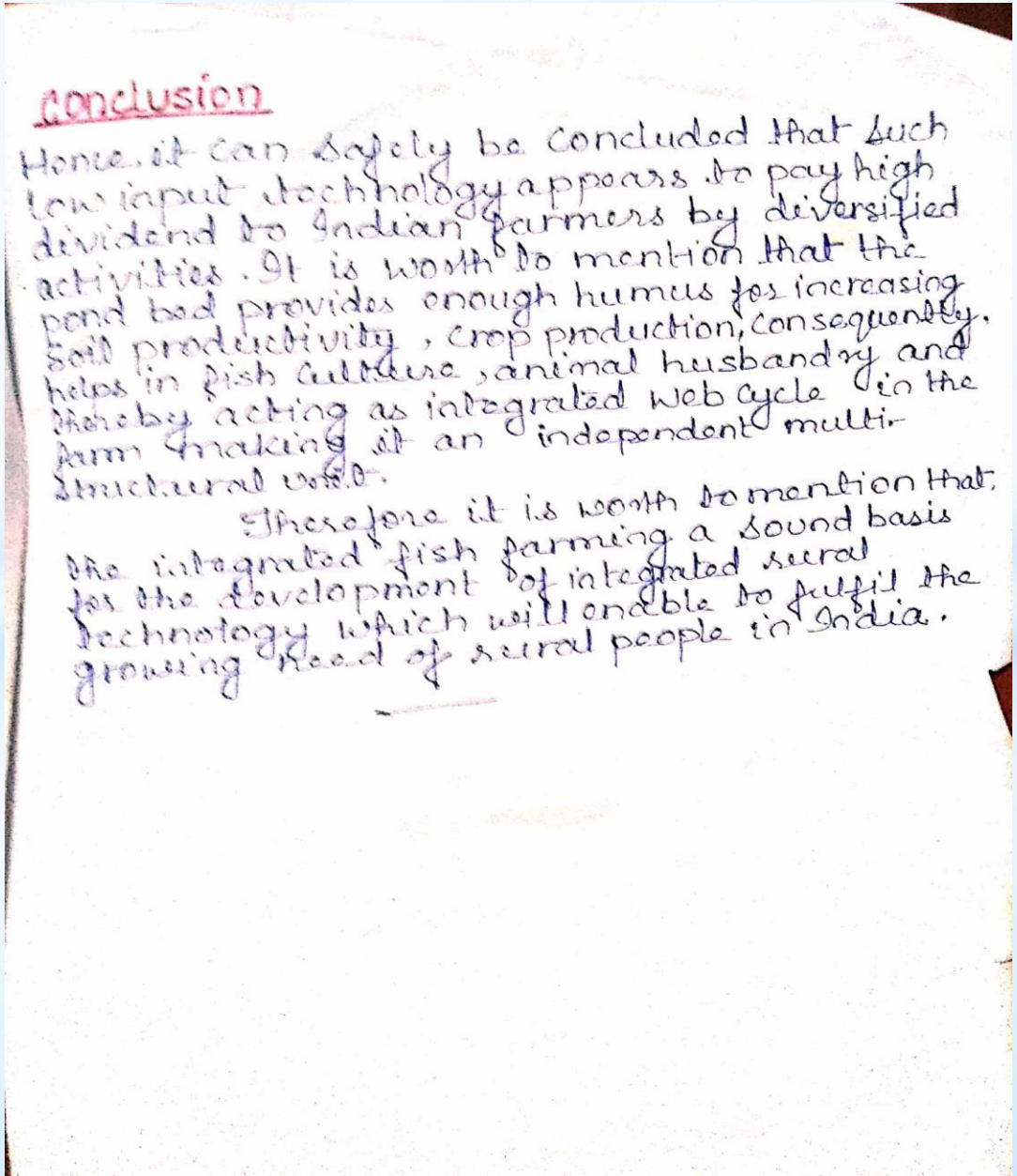
II. Cow manure is nutritively rich and levels of N and P are congenial for plankton's multiplication.

III. The output of cultivated carps in cow manured pond is 2–4 times more in relation to different species, composition than the output in unmanured pond.

IV. Cow manure is very fine due to repeated digestion in stomach of cow, therefore it can suspended longer in water. This enable fish to get more feeds but also reduces O_2 consumption, caused by manures and also avoids the formation of harmful gases.

V. The B.O.D of cow manures is relatively lower than other live stock manures because the cow forage has already been decomposed by micro organism in cow's body.

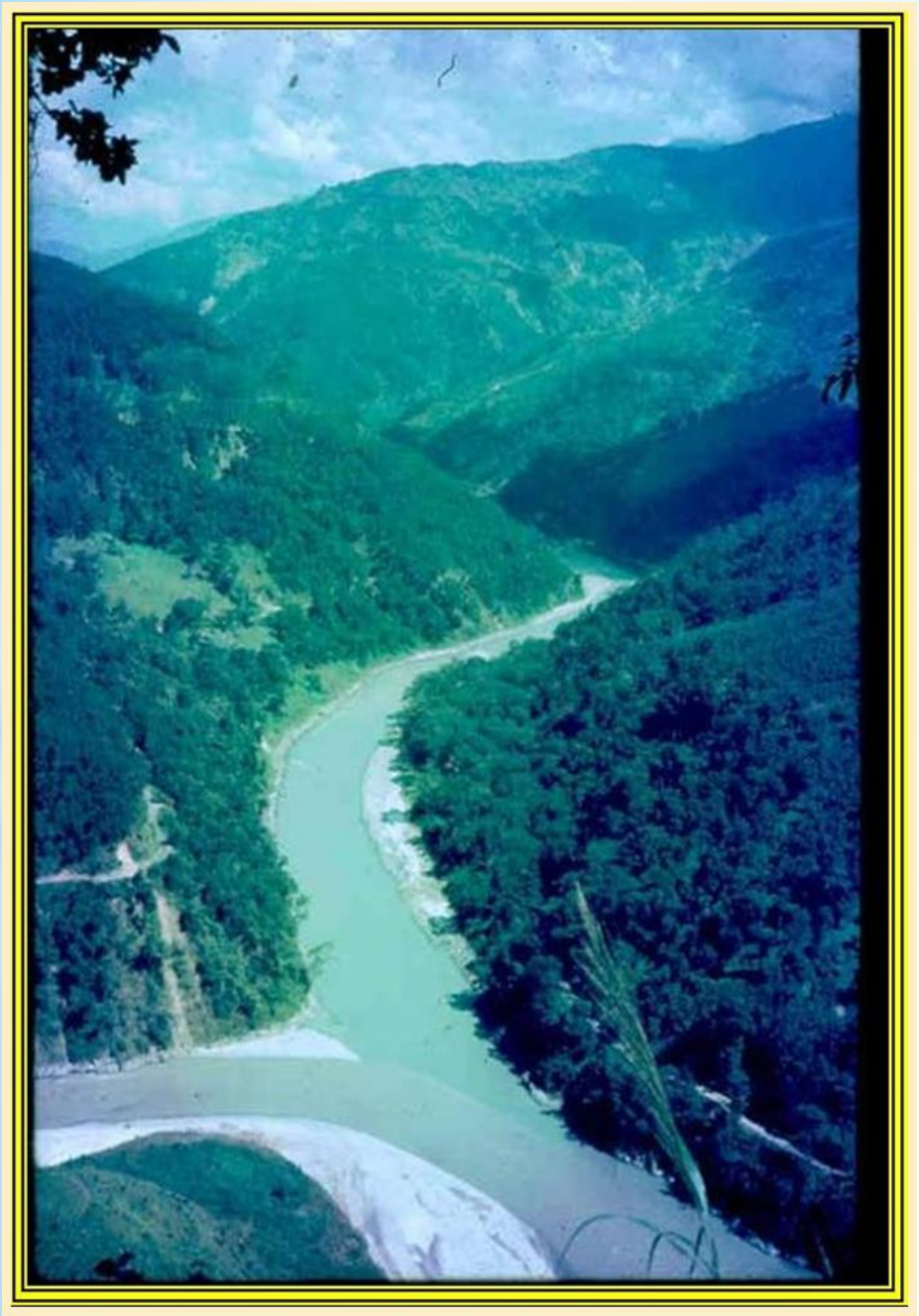
INTEGRATED FISH FARMING: CONCLUSION



Conclusion

Hence, it can safely be concluded that such low input technology appears to pay high dividend to Indian farmers by diversified activities. It is worth to mention that the pond bed provides enough humus for increasing soil productivity, crop production, consequently helps in fish culture, animal husbandry and thereby acting as integrated web cycle in the farm making it an independent multi-structural unit.

Therefore it is worth to mention that the integrated fish farming a sound basis for the development of integrated rural technology which will enable to fulfil the growing need of rural people in India.



THANK YOU