

# Backyard fish-based pig farming using low-cost feed in Arunachal Pradesh: A success story

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*Hillside pond for integrated pig-fish system at Sonajuli, Papumpare District, Arunachal Pradesh.*

It has been accepted across the globe that sustainable development is the only way to promote rational utilisation of resources and environmental protection without hampering economic growth. Integrated farming systems (IFS) are a viable option in this regard as waste is minimised, the by-product of one system becoming an input for others and thus, optimising the use of resources while reducing pollution. IFS are low waste, low cost and low energy production systems in which various compatible agricultural enterprises are blended together to form a unified whole farming system for the purpose of sustainability. IFS can provide a reasonable rural livelihood, a clean environment and adequate food and

products with a greater degree of stability in the production process by spreading the risk of production over several activities.

In the north-east hill region, integrated fish farming is one of the best alternatives for improving livelihoods as most of the houses in rural areas have access to ponds and livestock. Among livestock, pigs are a popular choice, particularly for the tribal population of the region, who account for a major portion of the population. Pigs are one of the best feed converters amongst the all domesticated livestock with a feed conversion ratio of 3.0-3.5 kg feed per kg of live weight



gain and can fit into diverse systems of management. Pigs can be reared on kitchen wastes, industrial or agricultural by-products, slaughter house offals or commercial feed. Dressing percentage is also very high (65 to 70%) and a sow can produce 16 piglets in a year with short generation interval. These advantages coupled with demand in lieu of changing food habits of Indians, framed integrated pig farming with fish as an attractive venture for rural livelihoods.

Attempts have been made by ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar through its Kalyani centre, to disseminate integrated fish farming technology (fish farming with livestock, high-value horticultural crops, etc.) to different parts of the north-east hill states of India, along with technical support. As a part of that effort, integrated pig-fish farming technology has been demonstrated at remote places of Arunachal Pradesh. A progressive fish farmer of Sonajuli, Papumpare District, Arunachal Pradesh, Mr Tana Nikam Tara, started pig-fish farming under ICAR-CIFA guidance in 2014 in a 0.12 ha pond and six of piglets of the Yorkshire variety, along with his other aquaculture ventures. With persistence guidance of ICAR-CIFA and with

knowledge gained over time Mr Nikam modified the traditional pig culture system to an improved one, adding components such as a 'swimming pool for pigs' (as he calls it) and low-cost feed.

### Management of pigs

Growth of pigs depends upon many factors including breed and strain, but, good management contributes to the achievement of optimum production.

### Housing pigs

The pig house was initially constructed with locally available materials such as bamboo and *Licuala peltata* leaf, but the floor was roughly cemented with slight slant towards a drainage canal connected to the pond. With the passing year, side bamboo wall was replaced with a cemented wall and iron fencing. Height of the pig-sty is 1.9 m with sufficient provisions for free movement of air to take care of the thermal requirement of the pigs as they don't have a heat regulating mechanism. An enclosed run (pen) is also provided with a



Pig sty constructed over a pond dyke.





*Compartment within pig sty (improved) for keeping male pigs separately from females.*

wallowing tank to facilitate the pigs to get enough air, sunlight and space for dunging; and enjoy the shade on hot summer days. Feeding and drinking troughs are constructed both inside the house and inside the pen. On average the pigs were provided with around 5.35 m<sup>2</sup> inside the pig house with pen area of 3.2 m<sup>2</sup> per pig.

### **Feeding management**

Although feed requirement depends upon the types of pig in rearing i.e., dry or pregnant, boar or lactating sow, grower or finishers, etc.; on average it accounts for 65-70% of the total cost of pig farming. Pigs were fed with balanced pig mash @

2 kg/adult pig/day; twice a day i.e., morning and afternoon. However, as balanced feed is costly raising pigs with that feed was found to be economically unsound. So, he started 'swill feeding' to the pigs, providing leftovers of human food, vegetables, rotten wild fruits, etc. Under technical guidance of ICAR-CIFA, one pig feed has been developed which is well accepted by the pigs and also gives better return on investment from the venture.

To prepare the feed, the ingredients listed in Table 1 (except for the rotten wild fruits) are mixed together, boiled and then cooled. After that, the finely smashed/chopped wild fruits are mixed with the above boiled food and served to the pigs. Green weeds/grasses or sugarcane leaf are provided fresh, separately or sometimes along with prepared feed. Mineral mixture @ 1% is also added periodically with the feed to overcome mineral deficiency. Pigs are fed with this prepared feed twice daily @ 3.5 kg/adult pig/day. This reduced the cost for ration for feed, without any significant impact on growth of the pigs.

### **Health care**

Pig houses and open pens are washed daily to keep the pigs healthy and disease free. Disinfection of pig houses is done with potash (KMnO<sub>4</sub>) every 15 days while washing the pig house. As pigs often suffer from diseases like swine fever,



*Enclosed run (pen) with a wallowing tank attached to pig sty to facilitate the pigs' thermal comfort in hot summer days.*



**Table 1: Composition of pig feed prepared using locally available, cheaper ingredients**

| Ingredients   | % share in feed |
|---|-----------------|
| Kitchen waste and spoiled / fresh vegetables & fruits (potato, green vegetables, banana, jackfruit, etc.)           | 30%             |
| Rice bran/broken rice   | 20%             |
| Rotten tree bark/branches / roots, parts of banana tree, wild arum, etc.  | 20%             |
| Maize   | 12%             |
| Rotten wild fruits ( <i>Ficus glomerata</i> ), etc.   | 5%              |
| Low-cost dry fish / spoiled fish/ fish or poultry intestinal waste  | 5%              |
| Green weeds / grasses (milfoil / water lettuce / duckweed / tapioca / water hyacinth / any green grass) / sugarcane | 5%              |
| Tea leaf waste  | 2%              |
| Common salt   | 1%              |

swine plague, swine pox and may be infested with parasites; regular vaccination especially against swine fever (IVRI vaccine) has been conducted.

### Fish culture integrated with pigs

Pig houses for use in integrated pig-fish farming were constructed at the embankment of a pond with area 0.12 ha and water depth of 1.6 m. Clearance of unwanted fishes, de-weeding and liming (250 kg/ha) of the pond was done prior to stocking of the pond with fish seed as in the case of composite fish culture systems. After initial fertilisation, the pond was stocked in June 2016 with 1,200 carps (@ 10,000/ha) with a species ratio of 30% catla (*Catla catla*), 30% rohu (*Labeo rohita*), 15% bata (*Labeo bata*), 15% common carp (*Cyprinus carpio*) and 10% silver carp (*Hypophthalmichthys molitrix*). Washings of the pig house containing pig dung, urine and spilled feed were added to the pond. Pigs under 50 kg body weight on average produce 3.0 kg dung per day and 50 to 90 kg pigs produce 5.5 kg per day with 20 to 25% dry matter. This material acted as an excellent fertiliser and raised the biological productivity of the pond water and consequently increased fish production. Moreover, undigested solids of pig dung served as a direct food source for fishes. No supplementary fish feed or pond fertiliser was provided. To hasten organic decomposition, lime @ 62.5 kg/ha was applied in the pond at two month intervals.

### Harvesting of fish and pig disposal

Due to the availability of natural food in the fish-pig pond, a good percentage of the total fish attained marketable size within 6 months. From 6 months onwards fishes were partially harvested from time to time depending upon the size of fish, prevailing market rate and demand of fish in the market. After harvesting partially, stock was replenished with the same number of fingerlings of harvested species. Final harvesting was done after 11 months of rearing. Fish yield ranged 3,700-4,500 kg/ha/year.

Pigs are generally sold out after 5-7 months when they attain slaughter size (70-90 kg weight) and a new lot of 2- 3 month old weaned piglets are brought to the pig house for rearing. As fish raising is done for 10-12 months, two lots of pigs are sold out along with one lot of fish.

### Economics of pig-fish integration

Economic return obtained in integrated pig-fish farming in first year in terms of input-output ratio was 1.0 : 1.40 (when balanced pig mash was used as pig feed). In the second year onwards with reduction of feed cost for pig (pigs were fed with

feed prepared using locally available cheaper ingredients) input-output ratio from the venture raised to 1.0 : 2.30, and the farmer is getting the same steadily with minor fluctuations.

### Rules of thumb for optimum production of fish in pig-fish integrated farming system

- Maintain optimum water level in pond (1.5 m or above).
- Apply lime at regular intervals to hasten organic decomposition.
- Instead of draining pig house waste directly into the pond, it is better to collect the waste in a cemented pit and spread the same in different parts of pond.
- Add washings of pigsties into the pond after sunrise to avoid oxygen depletion; the amount added must be carefully regulated (see below).



Yorkshire variety of pigs and piglets in pig sty.



Feeding of pigs with wilted sugarcane.





*Chopping and shredding a banana tree for pig feed.*



*Cooking locally available, cheaper ingredients to feed the pigs.*





*Harvesting fish.*

- If algal bloom conditions appear on water surface (especially during the summer season) do not add pig dung to the pond; keep it in the cemented pit.
- Monitor water quality periodically, particularly dissolved oxygen (DO) in the morning of summer months. If DO falls below 3.5 mg/ litre, stop further application of pig dung. Exchange water and provide aeration (by aerator/ sprinkling water over pond surface through pumping/ splashing water with split bamboo, etc.).
- As excreta of 30 adult pigs (above 50 kg weight) per ha pond is required to properly fertilise a pond of 1.0 ha, number of 2- 3 month old weaned piglets that are brought to the pig sty for rearing must be doubled (60 per ha water area) to maintain pond productivity. That is, adjust the number of pigs based on their age or looking at the pond condition to maintain a uniform productivity level.
- Stop loading/draining pig manure to the pond a few days (2-3 days) before harvesting of fish.
- De-silt the pond as necessary, or at least at 3-4 years intervals.

## Conclusion

Integrated fish farming is the blending of various compatible agricultural enterprises into a functional or unified whole farming system for the purpose of sustainability. It is a low waste, low cost and low energy production system in which the by-products of one enterprise is recycled into another as input. While maximising land use, integrated farming approach reduces cost of input, diversifies food production, and encourages enterprise combination to improve profitability and therefore farmers' socio-economic status. The results of the present study clearly show that integrated pig-fish farming can be a well profitable venture, especially if the feeding cost for pig is reduced through the supply of locally available feed materials. It is a suitable model for villages where pig farming is common and sufficient quantity of pig feed ingredients are available locally.

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