

# **The Role of Scavenging Ducks, Duckweed and Fish in Integrated Farming Systems in Vietnam**

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## **Abstract**

There are some 30 million ducks raised annually in Vietnam. Most are scavengers raised seasonally in rice fields during the early growth of the crop and immediately post-harvest; and in backyards or gardens of farm households throughout the year. Duck and fish production has been expanding and contributes to increased income and improved living standards of the farmers, especially for poor farmers in the remote rural areas.

Trials on using duckweed cultivated as a partial or complete replacement of protein supplement for feeding crossbred and Muscovy ducks gave encouraging results. The practice of using scavenging ducks to control insects and weeds in the rice fields contributes to decreased investment and brings more benefits for the farmers. Duckweed grown in the integrated farming system is also a high quality feed for fish.

**KEY WORDS:** Ducks, local, scavenging, rice fields, duckweed, fish

## **Introduction**

The duck industry in Vietnam is of long standing and plays a considerable role in providing meat and eggs in the diet of the people (Men *et al.*, 1991). Ducks are raised throughout the country but are concentrated in the Mekong and Red River Deltas, but also in suburban areas of the big cities.

Unlike the Northern countries, duck egg and meat consumption is expanding in Vietnam and they provide important and nutritious protein foods for people in both cities and rural areas, especially the poor farmers in the remote regions. The products are usually sold at a reasonable price that the poor can afford and they can be processed into many different traditional dishes and even special dishes in the restaurants of the big cities.

The farmers use many traditional systems for raising ducks, of which the rice-duck system is the most common. In this system rice production is enhanced due to the ability of the ducks to control insects and weeds and at the same time excrete manure which provides nutrients for the growth of the rice plants. There are also environmental benefits as chemical control of insect pests and weeds is not needed. Along with the improvement in rice, the farmers derive more profit from the ducks because they forage themselves on natural feeds and left-over rice in the fields which decreases the need for supplementary feed. Ducks are also commonly allowed to scavenge in the backyards or gardens of households in small flocks, receiving household waste or rice to supplement what they obtain by scavenging.

Today, ducks are also raised in partial confinement, either for table eggs in coastal areas where shellfish gathered from the sea are good mineral and protein sources for ducks, or in areas where they are bred for meat during the dry season in an integrated fish-duck system. Duck production makes good use of available labour in rural areas and increases the income of poor farmers, especially the landless. However, duck producers have experienced problems since the introduction of high yielding rice varieties because the time available for duck flocks to scavenge is limited. Also, the price of feeds, especially protein supplements, has greatly increased. Consequently, although consumer

demand for duck products is increasing, the income for farmers is reduced by the high input costs.

Duckweed (*Lemna* spp.), which is common throughout the country, is a tiny water plant that grows very well on the surface of stagnant ponds all the year round. It can tolerate high nutrient stress and is able to survive extremely adverse conditions, and appears to be more resistant to pests and diseases than other aquatic plants in tropical areas. It has a high content of nutrients in the DM, especially protein and carotene, which are necessary for growing animals. Duckweed is popular in Vietnam as a feed for fish and poultry, so it seems a useful candidate for development as a year-round feed resource for ducks and fish within the integrated farming system.

## Scavenging Ducks

### *Breed*

Several breeds of ducks are raised in the country. The two different species are the common breed and the Muscovy duck.

The common breed is estimated at 80% of the duck population of the country (Phuoc *et al.*,1993). They consist mostly of local and improved breeds and a few exotic strains (Cherry Valley).

Of the local breeds, the first type is the "Tau" or "Co" breed (grass ducks). This is a laying type that reaches mature body weights of 1.3 - 1.5kg for females and 1.5 - 1.8kg for males. Drakes can mate at 120 days of age. The females begin to lay at 140 days old and achieve an average of 180 eggs per layer per year with egg weights in excess of 60 g. This breed tolerates hard conditions of nutrition and management, so they are well suited to egg and meat production in the remote rural areas. Also, they are very good at foraging for food such as insects, water creatures and plants. The mating ratio of males to females is 1:20-25, but this achieves highly fertile eggs (over 90%) with high hatchability in traditional hatcheries in the rural areas, even without electricity. The prices of table eggs, ducklings and duck meat from these ducks are usually lower than those of other types because of lower production costs.

The second group, called "Ta" or "Bau" ducks, is a meat type that achieves a mature live weight average of 2.5 kg. This breed is low in reproductive ability and gives low profit to the producers so the population has been decreasing.

The local Pekin has been imported for a long time and is genetically poorly defined. It has degenerated into a dual purpose breed. They achieve live weight gains and finishing weights slightly higher than the "Tau" or "Co" ducks and the number of eggs laid appears to be equivalent to the "Co" breed.

There are several crossbred types which are a combination of the local and exotic breeds. These are used for meat purposes.

The exotic Cherry Valley type has been imported from Europe and gives high meat performance but, given the conditions in which they are bred and raised, productivity and profitability has declined and the population is decreasing. At present they are raised for crossing and for meat around some cities. The Khaki Campbell breed is a laying type imported from Asian countries which achieves poor performance under the conditions in Vietnam and the yield of eggs appears to be equivalent to the local laying type (personal observation).

Muscovy ducks are estimated at some 20% of the population and numbers have expanded throughout the country. These include both local and exotic types, and their crosses. The local breed achieves mature weights from 3-3.5kg for males and 1.8-2kg for females. The female lays on average 40-60 eggs per year and hatches them herself under extensive conditions. The Muscovies are suitable for smallholders with small flocks because they are easy to manage and can consume different feeds in the farming system. Also, the ducklings or table ducks are usually sold at a higher price than common ducks.

## **Scavenging Ducks in the Integrated Farming System**

### *Duck Raising Along with Growing Rice*

The ducks selected for this purpose are commonly the local laying type or local Pekin breed due to their small body size. They do not harm the plants, are active and forage well when herded. In the brooding stage,

after the first week of age, the ducklings are driven into the rice fields from 20 days after transplanting until the plants begin to flower. In the young rice fields, the ducklings can catch destructive insects such as white or brown hoppers, leaf insects, mosquito larvae, spiders, small shellfish and fish. During scavenging, the ducks consume weeds and stir and loosen mud around the rice roots with their beaks without harming the rice plants. In addition, they excrete manure to fertilize and stimulate the growth of the rice. Insecticide and herbicide inputs are rendered unnecessary, and labour for weeding is reduced. The reduction in chemicals is beneficial to the environment.

The ducks are supplemented with feed consisting of by-products of rice or rice grain, 3-4 times daily depending on feed availability in the rice fields.

After the rice plants start flowering, the ducks are driven from the rice fields to the canals, ditches, lakes and swamps to forage in the water. The duck raising season usually lasts for 3 months producing males for meat and females which continue to lay eggs in the post-harvest rice fields. The culled ducks are sold in the market.

#### *Duck Raising in the Post-harvest Rice Fields*

Along with laying ducks, the table ducks or ducks for meat are reared in the rice fields post-harvest. Generally farmers purchase ducklings from the hatcheries 3-4 weeks before the rice harvest. The ducks usually selected are the native meat type, local Pekin, crossbred local x Cherry Valley or Cherry Valley.

After 3 weeks of age when the ducklings can consume whole rice grains, they are permitted to enter the newly harvested rice fields. They forage the whole day on leftover or fallen rice grains, insects, shellfish, small frog and fish, and water plants. In the late afternoon, they are moved to pens or sheds on the dikes near the household until next morning. The ducks raised at this time are usually finished at 2.5-3 months of age, and achieve live weights of 1.6-2.0kg for the crossbred Cherry Valley.

Now, most varieties of high yielding rice are planted and harvested within a short period with only a limited time available for the duck

flocks to scavenge, so this traditional system is becoming less feasible. In order to solve the problem, a trial was recently carried out, feeding a supplement of broken rice and crushed, dried fish (CDF) to crossbred meat ducks (Cherry Valley hybrid x local Pekin) herded in rice fields post-harvest, in order to shorten the time to finish and improve the meat quality. Three supplements of 50g/duck/day of a mixture of broken rice (80%) and CDF (20%), 50g/day broken rice or 20g/day of CDF were given each evening to the ducks, and compared with no supplementary feed. The live weights at 70 days of age were 1855, 1749, 1659 and 1592g ( $P<0.001$ ) and daily live weight gains 34, 30, 28 and 27g, respectively (Men *et al.*1995).

The results of the trial show that supplementation with broken rice alone or a mixture of broken rice and crushed-dried fish to scavenging crossbred meat ducks significantly improved the daily gain and carcass quality, and would shorten the time to market. This trial demonstrates a strategy for improvement of the traditional method of the farmers in order to meet the increasing demands of consumers for high quality duck meat, and is consistent with today's rice cultivating conditions in the country.

#### *Scavenging Ducks in the Backyard Or Garden*

The system is common to most smallholders. Small flocks of ducks from 5-50 head, producing eggs for the table or fertile eggs for meat production or combining both, are allowed to run loose in the backyards and gardens, and are fed household wastes or rice 2-3 times per day and obtain other feeds from scavenging in the ditches, canals, ponds or part of the rice fields near the home. This system is very suitable for home consumption of the products by the poor farmers.

#### **Duckweed (*Lemna minor*)**

Duckweed is a small floating aquatic plant that grows very well on stagnant ponds and is commonly found throughout the country. It has a high content of nutrients, particularly protein and carotene, and tolerates adverse conditions such as nutrient stress and attacks by pests and diseases. Duckweed gives a high biomass yield as a result of rapid reproduction and growth. When effectively managed, yields of 10 tonnes

DM/ha/year are possible (Preston, 1995).

Duckweed can be collected daily when grown on ponds manured with effluent from biodigester systems and home waste, and produce an average of 100g (38.6% CP of DM) fresh weight per square metre (Men, 1995). Duckweed protein has a better composition of essential amino acids than most vegetable proteins and closely resembles animal protein (Culley, 1978).

Duckweed has long been used in poultry diets (Lautner, 1954). Fresh duckweed (26.3% of DM) was used to replace soya beans at levels from 19-27% in diets for fattening ducks at Cantho University in Vietnam. There were no adverse effects on health, but the reductions in growth rate and feed conversion efficiency were considerable when duckweed replaced more than 20% of soybean protein (Becera *et al.* 1994).

Recently, an experiment was carry out on crossbred ducks fed roasted whole soya beans replaced by duckweed (38.6% CP in DM) at levels of 0, 30, 45, 60 and 100% in the diet (Men *et al.*, 1995). Daily gains of ducks fed duckweed were higher than those of ducks fed a conventional diet because the duckweed, which was grown and managed well, had high nutrient concentrations, especially of CP and carotene.

If duckweed is grown and collected by household farmers, the feed cost could decrease 48%. However, feed conversion ratios tended to be poorer on the diets with duckweed due to their low energy compared to the control diet. In another experiment, local Pekin were fed fresh duckweed *ad libitum* (40% CP in DM) in limited broken rice diets at levels 80 and 60g/day compared to *ad libitum* feeding (Men *et al.*, 1995). Results obtained showed that the ducks with live weights of 1.5-1.6 kg can consume an average of 870g fresh duckweed per day in the growing stage. The final weights and weight gains of the ducks fed 80g broken rice were slightly lower than those fed rice *ad libitum*, but the difference was not significant.

Muscovy ducks are known to like duckweed very much. In 1994, a trial was carried out on growing exotic female Muscovies at Cantho University, where 15 and 30% of the dietary protein was replaced by fresh duckweed from 28 to 70 days of age and compared to a conventional diet (Men *et al.*, 1994). At finishing, daily gains were 37,

36 and 34g ( $P < 0.001$ ) and feed conversion rates were 3, 3.3, 3.5, respectively. Correspondingly, the cost of feed decreased by 15 and 26% compared to the control diet.

In another trial, Men *et al.* (1995) fed local female Muscovies on duckweed *ad libitum* with a limited amount of broken rice at levels of 80 and 60g/day compared to *ad libitum* feeding from 28 to 70 day of age. Results achieved showed that local female Muscovies consumed fresh duckweed less than the local Pekins (325 vs 817g) and daily gains were 25, 20, 18g, respectively.

### **Fish in the Integrated Farming System**

Fish is a common food for Vietnamese people. Wild freshwater fish are caught in many ways. At present, because of indiscriminate exploitation, environmental damage caused by overuse of agricultural chemicals and serious pollution caused by humans, the precious food source is becoming impoverished.

In order to solve the problem, many farmers raise fish profitably in ponds, even rice fields, in the integrated farming system. The main feed sources for fish continues to be based on natural aquatic creatures and plant feeds that grow and develop themselves in the pondwater. In some regions, farmers raise fish on feeds such as grass, weeds, leaves, by-products from agricultural processing or animal manure and obtained good results with fast growth of the fish. However, the feeds only contribute about 20% of the requirements of the fish (personal observation).

### **Duckweed As A Feed for Fish**

Many trials have been carried out using duckweed as the major feed to raise fish, with good results (Journey *et al.* 1991), but, so far, this is fairly rare in Vietnam. The farmers in the Mekong and Red Deltas and around Ho Chi Minh city use duckweed as a partial or complete feed for growing fish and get excellent results. The farmers in the Mekong Delta feed duckweed to breeding fish to increase reproductive performance.

Most of the fish species living in fresh water are known to like to eat duckweed very much, especially Tilapia, carp, catfish, Mekong catfish,



gourami, etc. Duckweed is convenient and fairly easy to manage because it is grown in the ponds on stored waste water. It utilises the nutrients and contributes to a clean environment. Children or women in the households can take part in managing and collecting duckweed to feed fish. The farmers can control the amount of feed to the fish easily by observation and prevent excessive growth, thus protecting the fishes' environment (personal observation).

### **Conclusions and Suggestions**

There is no doubt about the role of scavenging ducks, fish and duckweed in the integrated farming system in Vietnam today. They produce truly sustainable economic benefits to the smallholder farmers. The results achieved in the experiments and practices show that the development is based on scientific logic under natural and social conditions that avoid damage to the living environment and improve living standards of the people, of which 80% are working in the agricultural domain.

Development of scavenging ducks and fish, based on renewable local feed resources such as duckweed in integrated farming systems, is an actual revolution and is consistent with the strategy to eliminate hunger and reduce poverty in the country. However, in order to make further progress, the detailed parameters of using scavenging ducks and their influence on the environment, soil fertility, and other effects, need to be investigated. There is also a need to look at which species of fish are most suited to feeding on duckweed.

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