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DUCK PRODUCTION IN KERALA

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Mannuthy

Productivity Enhancement of Ducks
National Agricultural Technology Project
Indian Council of Agricultural Research



English

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FOREWORD



Ducks are the second largest source of table eggs in India. It constitutes around 8.5% of the total poultry population in the country. Despite the importance of duck production in India, it remains neglected due to the lack of concerted efforts on the part of researchers, planners and developmental agencies. Though, Asia is considered as the home land of domestic ducks, elite breeds of ducks have been developed in Europe and elsewhere through the application of scientific programmes. More than 90% of the ducks available in India belong to desi type.

Coastal states of Indian union and some parts of Assam and Bihar constitute the major breeding tracts of ducks. Eventhough desi ducks yield less number of eggs in comparison to improved varieties, their usefulness in combating pests and eliminating weeds compensates for their low productivity. The duck eggs and meat are quite rich in nutrients. The duck manure is of high value as an organic fertilizer.

Lack of scientific efforts in indigenous varieties improvement has been a lacuna in increasing duck production in the country. It was in this context that a research project on "Productivity Enhancement of Ducks" was conceptualized under the National Agricultural Technology Project (NATP) in the Coastal Agro Eco-system with Centre for Advanced Studies in Poultry Science of the Kerala Agricultural University as the Lead Centre.

Under the project many studies were undertaken on various aspects of duck production and these have led to new technologies for productivity enhancement in ducks. The technologies developed in the project are being adopted by the farmers at the field level. The importance of conservation and propagation of desi ducks' germplasm is being considered actively. The intensive system of rearing ducks under cage and floor systems serve as an alternative to the existing extensive free range system of rearing.

I am happy to note that the results of research work conducted at the Centre for Advanced Studies in Poultry Science are being published as a book. I hope this book will serve not only as a reference book for farmers engaged in duck production but also will benefit Graduate students as well as extension workers of Development Departments. I would like to congratulate Dr. Jalaludeen and his colleagues for their untiring efforts in bringing out this important publication.

New Delhi
27-02-2004

Dr. S.L. Mehta
National Director
NATP

MESSAGE



I am happy to learn that the Scientists of the Centre for Advanced Studies in Poultry Science, College of Veterinary and Animal Sciences, is bringing out a publication, entitled “ Duck Production in Kerala”. In Kerala, a unique system of duck farming is practiced utilizing the indigenous ducks reared under nomadic system of management. This eco-friendly farming system is in vogue for more than a century in the State. Utilization of fallen and wasted grains, biological control of pests, manurial enrichment of rice fields and self employment of rural farmers make duck farming sustainable. Apart from the richness in nutrients of duck eggs and meat, they have been identified as food products with medicinal properties by the traditional people of the State.

The Kerala Agricultural University is in the forefront in carrying out research on duck production in the country. Though, much progress has been made in chicken production, research programmes in ducks are comparatively meagre in India. It is in this context the Indian Council of Agricultural Research has sanctioned a research project on ‘Productivity Enhancement of Ducks’ under the National Agricultural Technology Project. In this project, many research problems have been addressed for enhancing the productivity of native ducks. The scientific outcome of the project is noteworthy. I congratulate the Scientists of Centre for Advanced Studies in Poultry Science, especially Dr. A. Jalaludeen, Director, for their effort in bringing out this publication. This will definitely be useful for all concerned with duck production programmes in the country.

Vellanikkara
01-03-2004

Dr. K.V.Peter
Vice Chancellor
Kerala Agricultural University

MESSAGE



Ducks in India are mostly concentrated in the Coastal States. Of the total ducks available in the country, more than 90 per cent comprises of indigenous types. In the South Indian States, extensive duck farming gets integrated well with paddy cultivation. Majority of the duck farmers in the country belong to small and marginal farmers and landless labourers. Therefore, programmes in improving the productivity of ducks will improve the livelihood of such farmers.

The research scheme on “Productivity Enhancement of Ducks” is operated under the National Agricultural Technology Project of the Coastal Agro Eco-system. The Centre for Advanced Studies in Poultry Science under the Kerala Agricultural University was identified as the Lead Centre with two co-operating centres viz., Livestock Research Station (TANUVAS), Kattupakkam and Central Agricultural Research Institute (ICAR), Portblair.

The Project is under operation since five years and within this short period, the Scientists could develop many technologies for field/farm level adoption. The technologies developed include the starter feed for ducklings, cage system of rearing layer ducks and production of Duck Pasteurella vaccine. I am glad that the Scientists in the Lead Centre at Kerala Agricultural University have come out with a publication incorporating the outcome of this project. This will be of immense help in transferring the technology to the farmers of the country in general and of the Kerala state in particular. I appreciate Dr. Jalaludeen and his colleagues for this venture.

Thiruvananthapuram
05-03-2004

Dr. S. Edison
Director
Coastal Agro - Eco System

ABOUT THIS PUBLICATION

In India, the chicken production showed remarkable development while duck farming remained at a very low profile, probably because of its traditional nature as a rural backyard enterprise. The indigenous varieties and the farming practices are not properly documented in the literature.

The Mallards, popularly known as 'wild ducks' are considered to be the ancestors of modern breeds and varieties of ducks in the world. Although, Asia is considered as the homeland of present day duck breeds, well identified breeds have not been documented so far in India.

Lack of authentic publications on duck husbandry practices has been the major lacuna in chalking out duck production programmes effectively. It is in this context, we thought of preparing a monograph incorporating the traditional duck rearing practices in Kerala. It is amazing that many practices adopted by the farmers in the State during the past several decades are note-worthy examples of Indigenous Technical Knowledge (ITK) and wisdom. This awareness inspired us to make a publication of this nature and to place on record the duck rearing practises systematically to serve as an information bulletin for reference.

The observations highlighted in this publication are based mainly on the research findings of the National Agricultural Technology Project (NATP) on "Productivity Enhancement of Ducks" carried out by the Centre for Advanced Studies in Poultry Science, College of Veterinary and Animal Sciences under the Kerala Agricultural University.

We hope that this book will serve as a basic reference material for the researchers, academicians, students, extension workers as well as farmers in this field. In this context, we express our sincere gratitude to Dr. S. L. Mehta, National Director, NATP, ICAR, Dr. K. V. Peter, Vice Chancellor, Kerala Agricultural University, Dr.S.Edison, Director, Coastal Agro-EcoSystem, CTCRI, Thiruvananthapuram, Dr. E. Nanu, Dean I/c., COVAS, Mannuthy, Dr. R. Vikraman Nair, Dr.C.K.Peethambaran, Director of Research I/c., Dr. A.I. Jose, Director of Extension, KAU and Dr.N.N.Sasi, Director of Animal Husbandary Department, Govt. of Kerala and all our colleagues and well wishers for their sustained help in making this publication a reality.

We express our sincere gratitude to all the duck farmers of Kuttanad and Kole lands who co-operated with us in this endeavour.

Mannuthy

10.3.2004

Authors

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1

DUCK REARING SCENARIO IN KERALA

Duck egg and meat have become an important source of nutrients in human diet and these are gaining momentum as a food item in modern life. Ducks are reared mainly for eggs and meat, even though some might consider them as ornamental birds. In Europe and USA, ducks are reared for meat, whereas in Asian countries they are primarily meant for egg production.

Duck production gets along well with paddy cultivation in an integrated farming system. Duck farming is not only eco-friendly, but also plays a vital role in increasing soil fertility. Ducks are also helpful in the biological control of pests in agricultural fields.

According to 2002 estimate, the production of paddy in Kerala was 7.03 lakh tonnes. But, when analyzed critically, it could be seen that the area of paddy cultivation is decreasing by about 10 per cent every year. This situation poses serious challenges to the duck industry, since duck rearing is mostly integrated with paddy cultivation. Seventy per cent of ducks are reared in paddy growing districts of Kerala.

Duck rearing is also seen concentrated in low lying areas where fishing is an occupation of the people. Aquatic fauna, viz., snails, small fishes, crabs and oyster shells, forms the food of ducks. By controlling snails, crabs etc., ducks help to maintain a balanced environment. It is well documented that snails and mosquitoes act as intermediate hosts of certain parasites. By feeding on them, their number is controlled to a great extent and thus ducks take up the role of natural biological agent in the control of pests.

The world duck population is estimated to be 573 million in the year 2000 of which 75 per cent is concentrated in Asia. It has been recorded that ducks had been domesticated by 2500 BC. Thus duck farming has a history of about 4500 years and in India also it dates back to this period. Though, duck rearing offers promise economically, socially and scientifically, it is yet to gain popularity in India.

In Kerala, where in different types of farming and livestock production systems are

in vogue, the duck rearing puts forth tremendous scope and potential.

Kerala has a long coastal belt of about 500 km. The Kuttanad region of Alappuzha district is very rich in water bodies. The topography of Kuttanad is peculiar in that it lies 1 metre below mean sea level making it very much suited for duck rearing. Many households are practising duck rearing in a traditional manner, which is the major source of their livelihood. Since duck farming in this area suits well with the ecosystem, many villages in and around Kuttanad have opted it as a viable enterprise. As per 1996 livestock census, about 50 per cent of the total ducks in Kerala are located in Alappuzha district. It is the only district where ducks are reared round the year.

In short, duck rearing in Kerala is linked with paddy harvest seasons. During paddy harvest seasons in five districts viz., Thrissur, Kannur, Palakkad, Malappuram and Kozhikode, farmers move with their flocks of 500-1000 ducks every year for foraging. In other districts, this practice is noticed to a limited extent only.

Duck enterprise has to be remodelled scientifically so that it can continue to be a viable farming system. Most of the people engaged in duck rearing belong to the small and marginal farmers' group and from the socially backward sector. The major objective of this handout is to give an insight to the present duck farming system in Kerala and to identify the factors limiting the progress of duckery under the extensive system and to suggest remedial measures through scientific approach. The research findings of the Centre for Advanced Studies in Poultry Science of the College of Veterinary and Animal Sciences under the Kerala Agricultural University formed the basis of this publication.

PS

2

KUTTANAD DUCKS

Ducks belong to the family Anatidae and the subfamily Anatinae. Wild ducks are generally known as Mallards and the species name is *Anas platyrhynchos*. Domesticated ducks are known as *Anas platyrhynchos domesticus*. Native ducks of Kerala can be very well named as Kuttanad ducks. There are two varieties in Kuttanad ducks viz., Chara and Chemballi. These are identified based on the plumage colour. Kuttanad ducks are mostly propagated in Alappuzha district of Kerala and are mainly concentrated in and around Vembanadu lake. These ducks are bred and reared on a large scale in Thrissur, Palakkad, Malappuram, Kozhikkode and Kannur districts of Kerala. A few other varieties of native ducks that differ in the colour of feathers can be seen in these areas. In local groups of Tamil Nadu and Karnataka ducks, many cross breeds are also seen. The wide range of genetic variations in these varieties could be due to the extensive mating pattern among them. Such an irregular breeding pattern might spoil the breed characters and productivity of Kuttanad ducks.

The origin of Kuttanad ducks may be from wild ducks which existed centuries ago. These ducks resemble wild ducks in their shape, size and colour of feathers. The present Kuttanad ducks might have originated from these native domesticated ducks.

Feather Colour Variations

Many phenotypic variations are noticed among the indigenous flock. Black or partially black or spotted birds with white feathers intermingled are common. Females with brown chest and white rings on their neck can also be seen. Black ducks with white feathers on their chest could also be spotted in a group. Completely white ducks are rare.

Native Varieties

'Kuttanad ducks' are natives of Kerala. Mainly two varieties in Kuttanad ducks can be differentiated phenotypically. They are Chara and Chemballi. The general descriptions of the Chara and Chemballi ducks are:

Chara ducks

The 'Chara duck' is named by farmers based on their plumage colour. The typical Chara drakes are usually squat in posture and gait. The bill is dull orange with black spots and the feet are bright orange. The head is lustrous greenish black in colour. The neck is longer in drakes (21.1cm) than in the female (18.7 cm) and has brownish black plumage with a full or half white band on the front of the neck. There is no sexual dimorphism in body length. The drakes are usually bigger with a few tail feathers curled upwards and forward, one of the characteristic features used for sexing. The drakes produce a short hoarse and heavy voice.

The female 'Chara' ducks are erect in gait (height 21.48 cm) and squat in posture. The general plumage colour of 'Chara' female can be described as blackish brown in the back, tail and wings, wherein black is predominant over brown. The bill is shorter (6.02 cm) than that of the male (7.0 cm) and is yellowish black, yellow with black spots and sometimes only yellow in colour. The head is mainly brownish black. The major plumage colour of back and tail is blackish brown. The breast is primarily brownish black, but light brown and white are also observed. The ducks emit a louder, more acute quacking for a longer time. Females are observed to be more nervous than drakes. The average body weight at 20 weeks of age is 1643 g in drakes and 1538 g in female ducks.

Chemballi ducks

The 'Chemballi' duck is also named based on their plumage colour. The 'Chemballi' drakes are usually squat in posture and gait like 'Chara' drakes. The bill is longer in drakes (7.0 cm) than in the females (6.03 cm) and is usually yellow with black spots. The feet are bright orange in colour. The head is dull greenish black. The neck is longer in drakes (21.07 cm) than in the females (18.95 cm) and has brown plumage with full or half white bands. The body length in male and female (33.90 cm and 33.19 cm) is almost similar in measurement. The majority (66.67 per cent) of the drakes has brownish black plumage over the back region and the rest has light brown plumage. The usual plumage colour of tail coverts is blackish brown, while brownish black and brown coverts are also found. Wing feathers are mainly brownish grey with primary and secondary feathers being light and deep brown mixed with white. The total upright height of the 'Chemballi' drake is 22.36 cm from the top of back to base of toes. The breast plumage is similar to that of 'Chara' drake (light brown and brownish grey). The average body weight at 20 weeks of age is 1658 g in drakes and 1498 g in female ducks.

The major difference between the 'Chara' and 'Chemballi' drakes is in the plumage colour of the head region. It is lustrous greenish black in 'Chara' and dull greenish

KUTTANAD DUCKS

Drakes



CHARA

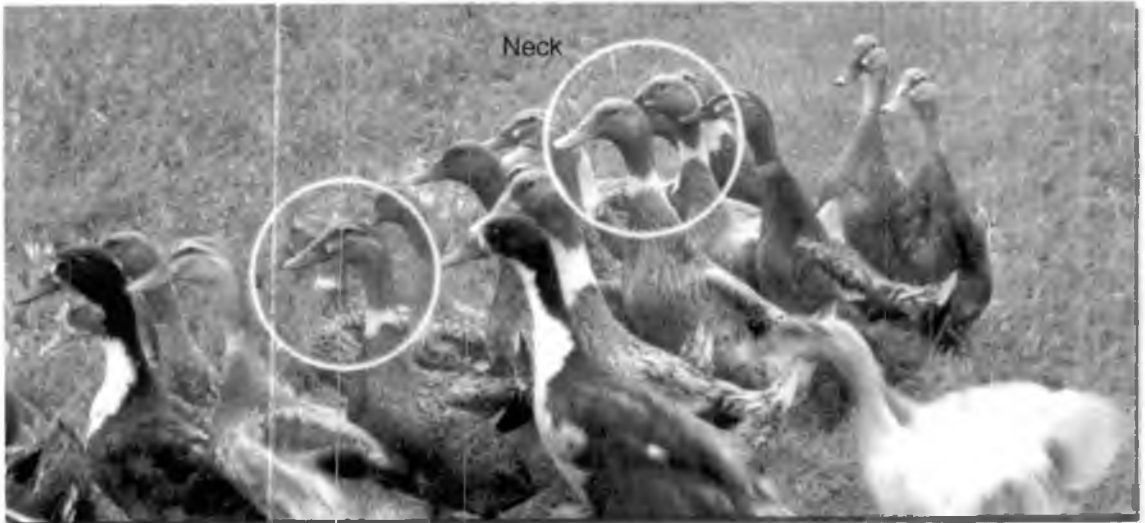


CHEMBALLI



Ducks

DUCK FEATURES



black in 'Chemballi'.

The female 'Chemballi' duck has erect gait (height 21.58 cm) and is little squat in posture. The general plumage colour of 'Chemballi' female is brownish black and brownish grey in back, tail and wings, wherein brown is predominant over black and grey. The bill is generally yellowish black, but yellow and yellow with black spots are also seen. The feet are dull orange in colour. The head is primarily brownish black and the neck is brown with or without white band. The back and tail coverts are mainly brownish black. The wing feathers are brownish grey with primary and secondary feathers being light and deep brown mixed with white. The breast is usually light brown and brownish black. The average body circumference of 'Chemballi' (34.43 cm) is comparatively lower than that of the 'Chara' (35.37 cm). 'Chemballi' ducks lay white shelled eggs. The average body weight at 72 weeks of age is 1417 and 1411 g in drakes and 1338 and 1403 g in females of chara and chemballi ducks, respectively.

Kuttanad varieties have distinct advantage over other indigenous types available in the country. Therefore urgent steps should be initiated to protect them for future development. Other indigenous varieties that have been identified from different parts of India are Pati, Deo, Nageshwari and Sythetemete. Some of them are capable of laying good number of eggs. However, systematic studies for the characterization and evaluation have not been conducted on these varieties.

Exotic ducks

Exotic ducks have been classified as egg type, meat type and ornamental type. Campbell and Indian Runner are the major egg type ducks. White Pekin, Aylesbury, Muscovy, Rouen and Cayuga comes under the meat type ducks. Ornamental ducks include Crested White, Carolina and Mandarin. Among the exotic varieties Khaki Campbell is the most popular one for egg production and White Pekin and Muscovy for meat production.

Though Khaki Campbell has excellent production potential, duck farmers of Kerala are reluctant to accept this bird mainly because of their small egg size, low resistance to diseases and less adaptability to climatic conditions. In spite of reported laying ability of 260-280 eggs per annum of the Khaki Campbell, the farmers express satisfaction with desi ducks which yield only about 180-200 eggs per annum because of their hardiness, ease of management and attractive egg size.



3

HATCHING EGG PRODUCTION AND INCUBATION PRACTICES

Hatching egg production

Farmers do not maintain exclusive breeder flocks. Eggs for hatching purpose are collected only from those flocks that are in lay for about 6-8 weeks. Proper breeding procedures and management aspects are not usually followed by the farmers. However, farmers adhere to the practice of using comparatively fresh eggs, not older than 7-8 days, for hatching. Many of the hatchery entrepreneurs are having their own flock for the production of hatching eggs. They also collect eggs from known farmers for obtaining maximum fertile eggs.

There is no separate breeder stock in the extensive system of management. Drakes guide the flock when moving around and while feeding in the field, drakes will be in the front row. As all flocks are maintained with 3-5 drakes/100 ducks, the eggs could be used for hatching. In this ratio, only 60-75 per cent of hatching eggs will be fertile. Some of the progressive farmers add more males in the flock during hatching seasons. In order to improve hatchability, the male -female ratio has to be narrowed. Generally, eggs are preferred from younger stock. As a customary practice, hatchery entrepreneurs use only eggs from Kuttanad breed for the production of ducklings.

When eggs are used for hatching, most of the farmers supplement their flock with feed ingredients such as wheat, jowar, groundnut cake and shell grit for improving hatchability. The eggs intended for hatching are collected clean without faecal matter. Provision of bedding material, early collection of eggs and more number of collections are also practiced. Since eggs are set in incubators once in every 5 days, much additional care is not required for holding the eggs. Most of the farmers adopt fumigation of incubators with potassium permanganate and formalin between hatches.

Incubation practices

In Kerala, duck eggs are incubated in three definite seasons, namely January - February (*Makaram*), August- September (*Chingam*) and November-December (*Vrichikam*) periods. These hatching seasons are apparently related to the paddy harvest in Kerala. Large scale hatching of duck eggs is being carried out synchronising with these seasons. The hatchability ranges from 50 -80 per cent.

Hatching of duck eggs in Kerala was carried out by natural incubation using broody hens till 1990's. It was a specialised feature centering around "Kuttanad" (Alappuzha District). Depending upon the size of the broody hens, 12 to 15 eggs were set under each hen. Experienced farmers claimed that they got 70-85 per cent overall hatchability. Many housewives in Kuttanad area were engaged in hatching duck eggs using broody hens. It was carried out in many households as a cottage industry in those areas. Usually about five to ten hens were broody at a time. For every duckling hatched out, the housewives were paid a fixed amount as remuneration by the duck farmers. Therefore, all efforts were made by those house wives to achieve maximum hatchability. The cost involved in incubation was only the cost of feeding the broody hen. The broody hens were fed mainly with cooked rice soaked in water overnight. They believed that the hen would remain in active broodiness for a long time if they are fed with cooked rice alone. The same hen was utilised for hatching a second set of eggs in continuation of the first. The hens are never used for more than two consecutive hatches in the same period of broodiness.

During hatching season, some agents were actively engaged in distributing hatching eggs to households where broody hens were available. On the first day of the hatch, the agents collect all the ducklings after paying the remuneration to households for their services. Then, these ducklings were pooled at one place and reared together.

At present, natural incubation is getting replaced by artificial incubation using forced draft incubators for hatching large number of eggs. However, natural incubation using broody hen is being carried out in households. Artificial incubation is being practised only in Alappuzha district with about a dozen private hatcheries in operation. A few farmers still adopt custom hatching by giving eggs to hatcheries and are paying Rs. 4 to 5 per duckling as hatching charges. Majority of the farmers are purchasing day old straight-run ducklings from hatcheries at the rate of Rs. 8.50 to 10/- per duckling.

The incubation period of duck egg is 28 days . Selection of hatching eggs is made by visual examination based on size, cleanliness and soundness of the shell. Wet and soiled eggs are not used for hatching. Eggs can be incubated in forced draft incubators with the same temperature for chicken. However, the humidity requirement is higher. This can be achieved by sprinkling warm water from the second day to 23rd day of incubation.

Eggs should be turned at least 4 times daily. On 24th day of incubation the eggs are transferred to hatcher. Hatching is completed usually by 28th day.

Hatching conditions

For successful hatching, eggs require specific conditions of temperature, turning and ventilation. Temperature and Relative Humidity to be maintained in the setter and hatcher for good hatching results are given below.

Incubation period	Temperature (°C)	Relative Humidity (%)
1-24 days	37.2-37.5	70-75
25-28 days	36.7 – 37.0	80-85

After transfer on 24th day, eggs are put on their sides in the hatching trays. The loss of water by evaporation during incubation occurs at a considerably lower rate in duck eggs than in chicken eggs. During the last twelve hours before the hatch, the humidity should be reduced to facilitate the ducklings to dry off.



4

DUCK NURSERY

In Kerala, the hatching of ducklings is carried out in three specific seasons viz., January- February, August-September and November- December months. These seasons synchronise with paddy harvesting in different areas in Kerala. Generally, ducklings are taken to the paddy fields when they attain 4-6 weeks of age. Till then they are reared and maintained in nursery sheds. The management of ducklings during this period is considered as *Nursery management*. Nursery sheds are usually thatched sheds. Dry sand forms the floor. The brooder shed is exclusively a temporary structure meant for rearing the ducklings for one month.

The sheds are made near water channel, lagoon, pond or river. The size of the shed is variable depending upon the 'size of operation'. Usual flock size is 2000 to 6000 ducklings per unit. The floor area requirement for raising 5000-6000 ducklings is 6.6 m x 5.2 m. The height of the shed is kept low. Height of the roof at the center is about 2.25 m and at the eaves 1.25 m. Though thatched roofs are common, some of the farmers use plastic sheets as roofing material. The sides of the shed are covered with bamboo mat or plaited coconut leaves.

The shed is divided into 3 or 4 partitions lengthwise and or breadth wise. Plaited coconut leaves are extensively used for making these partitions. These partitions are provided to prevent death of ducklings due to huddling. In addition, ducklings are disturbed periodically and monitored during night hours to prevent mortality due to huddling.

Temperature and ventilation are the two major conditions to be satisfactorily controlled in nursery sheds.

Temperature

It is quite surprising to note that no supplementary heat or artificial warmth is given to brood the ducklings. The practice of brooding of ducklings is entirely different from that of chicks and more or less a natural method is adopted by the farmers. Temperature of nursery shed is maintained by adjusting the height of sheds, spread of sand on the floor and by increasing the stock density.

Ventilation

Nursery owners always take utmost care in getting sufficient air movement inside the brooding shed. Sides of the sheds are covered with bamboo mat or plaited coconut leaves only for about 30 cm height. The rest is covered with plastic wire nets. Sheds are made usually in a comparatively open area. Farmers take keen interest in maintaining cleanliness in and around the nursery sheds.

Feeding and watering

Ducklings are fed from the second day of age onwards. They are let out to an enclosed or fenced open area for feeding and watering. The partitions in between the shed and the enclosed area are removed for the ducklings to enter the feeding area. Average run area provided for the ducklings for this purpose is 150 cm².

Chick feed is used as the starter feed, for the 1st week. Feed is given as *wet mash*, spread on a plastic sheet. In the second week, fish meal is also included in the feed mixture. The quantity of feed is increased as ducklings grow. Feeding and watering are done three times a day.

Usually, there are 2-3 caretakers employed to feed, water and to take care of ducklings during swimming.

There exists a noticeable lack of a generally accepted standard feed mixture or feeding schedule for the ducklings during this initial period. Farmers follow different feed mixtures for obtaining maximum growth during the first month of age. The duck nursery farmers not only adopt different feed combinations but also keep it as a 'trade secret'. Many of them consider this as the basis for their success in maintaining a healthy, uniform stock. Cooked rice, rice bran, jowar, dried fish/fish meal, wheat etc form the major ingredients for the ducklings' starter feed. Experiments conducted at the Centre for Advanced Studies in Poultry Science under the NATP on Productivity Enhancement of Ducks revealed that ducklings could be successfully reared exclusively on duckling starter feed formulated by the scientists of the centre. Adopting a uniform feeding schedule with duckling starter mash may help in reducing the cost of feed to a tune of 10-15 %. It will also help to maintain uniform growth among ducklings. Though, some of the farmers are experienced with the benefit of duckling starter mash, it has not gained popularity due to many factors like traditional thinking, shortage of funds and ready availability of feed. In any attempt to improve extensive duck farming system, these observations should get due attention.

The ducklings are given drinking water in plastic basins. Some of the farmers also adopt a more natural way of making a shallow pit and providing water on plastic sheets spread over the pit. Progressive farmers give vitamin supplements through drinking water during the nursery period. There is a practice of giving indigenous medicated

EXTENSIVE DUCK FARMING



Duck Nursery

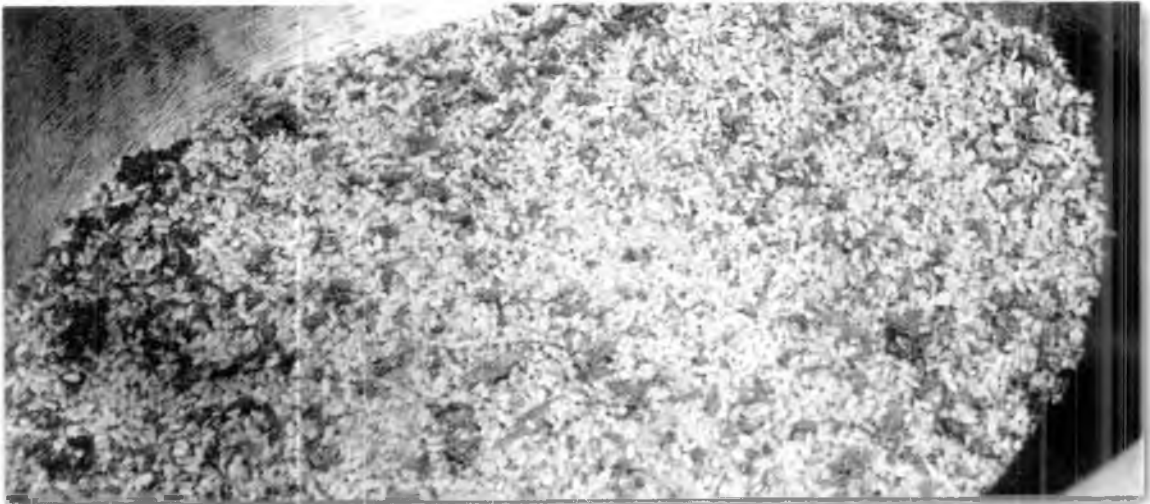


Ducklings Swimming

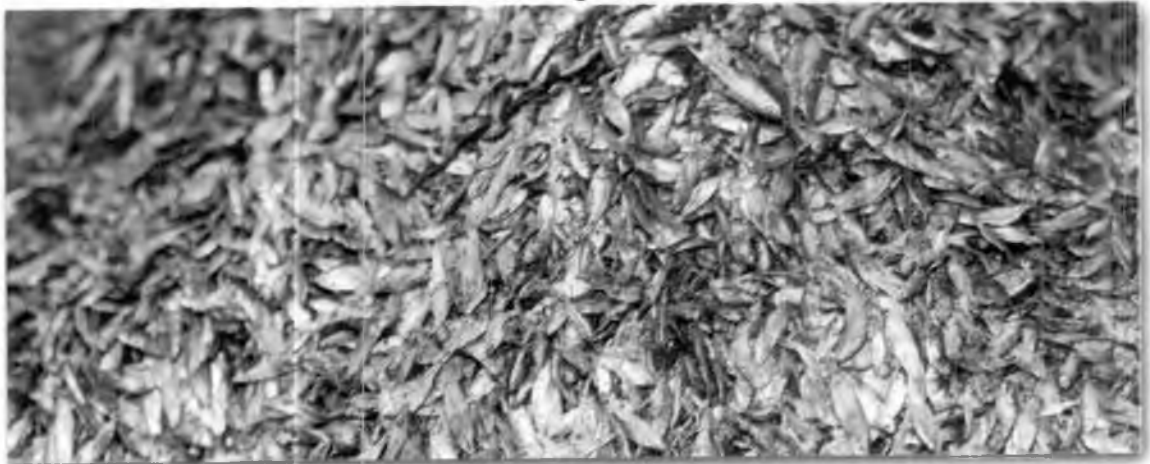


Young Farmer

FEED MATERIALS



Duckling Feed



Fish - Favourite Feed



Shell Grit Feeding

water during the first week. It consists of Vayambu (*Acorus calamus L*), Pepper (*Piper nigrum*), Turmeric (*Curcuma longa*) and Jaggery (*Borassus flabellifer*). Farmers believe that by administering medicated water, common ailments during brooding period can be minimised. Similarly, a few farmers give whole milk or reconstituted milk to ducklings during the first week. The usual mortality rate for the first week is less than 5 per cent.

Summary of feeding schedule of ducklings under extensive system.

First day	- No feed
From 2 nd day	- Cooked rice
2 nd week	- Cooked rice mixed with chick starter
3 rd week	- Cooked rice mixed with chick starter and dried unsalted fish/fish meal
4 th week	- Poultry feed, dried unsalted fish and rice bran. Boiled wheat and coconut cake are also fed by some farmers.

Swimming

The ducklings are allowed to swim in water from the 5th day onwards. The time allowed for swimming is increased daily. From the nursery shed, a pathway of about 1 metre width is made leading to a near by water body. The sides of the pathway are covered with plaited coconut leaves which would prevent the ducklings straying away while being lead to water.

Every day the ducklings are let out. This helps the ducklings to gain experience in moving in flocks and in swimming. Once the ducklings are taken to water, the time allowed to stay in water is enhanced usually by 30 minutes per day. When the ducklings attain 3 to 4 weeks of age, they are permitted to remain in water for the whole day except the feeding time. Even during night hours, they are allowed to stay either in canals or on canal bunds after 1 month of age.

During the nursery period ducklings are allowed in to paddy nurseries as they are effective tools in the biological control of pests. When paddy harvesting begins, ducklings are taken to the fields for foraging. The provision of starter feed is withdrawn during this period. Rice grains are incorporated in the feed for three days prior to the start of foraging to familiarise ducklings with its feeding. Usually last phase of nursery period synchronizes with paddy harvesting. If harvesting is delayed farmers have to continue to feed the ducklings and consequently production cost gets increased. If there is scarcity for sufficient feed materials from the field, farmers may supplement with grains or dried fish. However, most of the nursery owners sell their ducklings at 3-4 months of age.

5

GROWER DUCK MANAGEMENT

The ducklings upto one month of age are included in the *Nursery group*. After one month, they are considered as 'growers'. Ducks between 1 and 5 months of age come under this category. The productivity of ducks during layer phase is influenced to a great extent by the managerial practices adopted during grower stage. Hence, good attention must be bestowed on sound practices for the management of grower ducks.

Herded system/Open range rearing system

The herded system of management is an open range rearing system wherein ducks feed from the harvested paddy fields and swim in canals during day and night. At night, they stay back in water or rest on the canal beds. At growing period, feathers in the wings start growing and for this reason they are not confined inside the nets. During this time there may be high body temperature and the metabolic activity in the body is also high.

A major change adopted when the ducklings attain 3 months of age is that the restriction in allowing them to swim in water bodies is removed. By this time, growing ducks attain much experience in swimming so that they can be allowed to swim in canals, ponds and other water bodies. If the feed materials are not sufficient for foraging, farmers resort to hand feeding them with cereal grains on a limited scale. Ducks start laying as it approaches 5 months of age and when they start showing initial signs of laying they are confined inside nylon nets during night.

Semi intensive system

If ducks are reared under semi intensive system, a floor space of 1395 cm² per duck is allowed in night shelter. An outside run area of 929 to 1395 cm² per bird is also

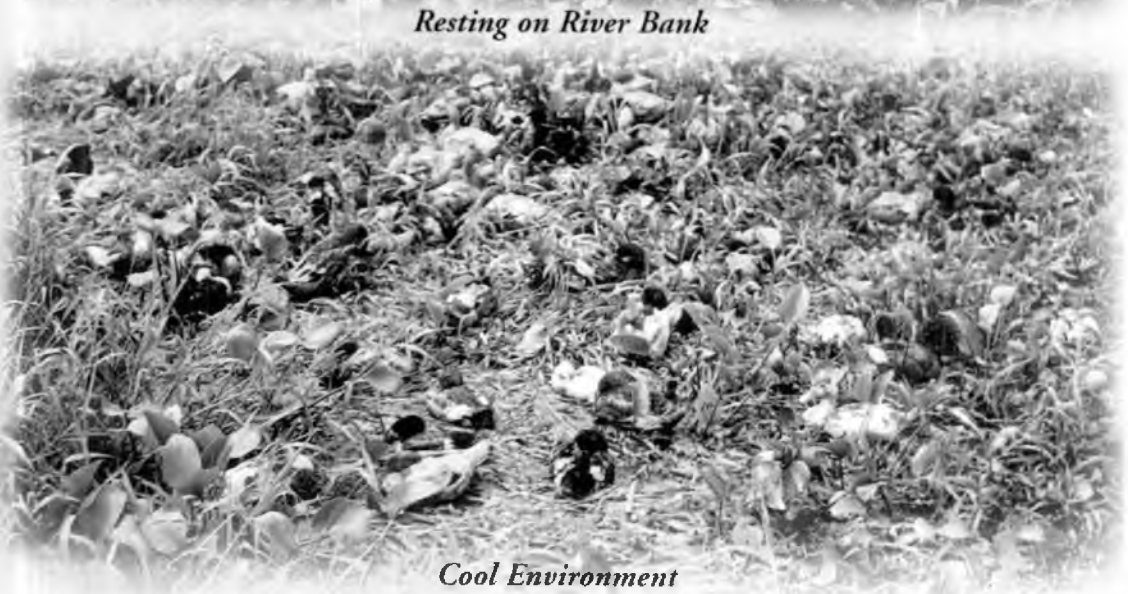
GROWER DUCKS



Foraging



Resting on River Bank



Cool Environment

INTENSIVE SYSTEM



Inside the Pen



Feeders and Waterers



Pool Outside the Pen

provided upto the age of 16 weeks . The run should be gently slopped from the house to provide effective drainage. Depending upon the climatic conditions, ducklings are released to the run at the age of 3 to 4 weeks. In semi intensive system, the ducks should have easy access to outside run as they prefer to be outdoors during the day time, even during winter or rainy seasons.

Presently duck farmers are adopting only open range rearing and therefore informations on other managerial systems like semi intensive and intensive will be useful as alternate methods for rearing ducks.

Deep litter system.

Ducklings can be reared on deep litter system without access to water, similar to deep litter rearing of chick on floor. Under floor brooding and growing, they may be fed starter and grower feeds, respectively. Average growth rate attained on a duck starter feed upto 8 weeks of age in Kuttanad ducks is presented below.

Age in weeks	Weight (g)	Feed consumption (g/day)
1	77	7.2
2	131	14.4
3	259	50.6
4	433	58.1
5	683	87.0
6	857	87.5
7	1086	117.0
8	1200	102.3

At present, the extensive duck farming practice is restricted to the paddy harvest season in South Indian States. By the adoption of deep litter system of housing and management, it can be taken up round the year. However, its economic viability has to be ascertained before recommending this system on a large scale.

Age at sexual maturity

The females begin to lay eggs at 18 - 20 weeks of age, ie. 126-140 days of age, onwards. The age at sexual maturity (age at first egg) in a duck flock is determined greatly by the feed and disease management during the grower period.

Male ducks

At three months of age farmers separate the males based on dark colour of head, the voice produced and *drake feather*. Drake feather is seen on the tail which is curled upward and inward. It is a distinguishing feature of male ducks except in the Muscovy breed. Surplus males are sold after retaining 5-6 drakes per 100 females. Drakes are meant not only for breeding purpose but also for maintaining a social order in the flock and for guiding the females during foraging in the field. The surplus males are used exclusively for meat purpose and are sold individually or on whole sale basis. During festival seasons in Kerala, male ducks are sold in the local markets.



6

LAYER DUCK MANAGEMENT

Daily routine

The activities of layer ducks in a day begin at least two hours before the sunrise. Egg laying starts as early as 3'O clock in the morning.

During night hours ducks are housed in nylon net enclosures of one metre height. Ducks show a general tendency of laying eggs nearer to the nylon net circle. In order to protect the ducks from predators, farmers make use of two net enclosures in such a way that one encircles the other. Early in the morning, some farmers remove the inner circle so that ducks move adjacent to the outer circle and lay most of the eggs there. This practice facilitates to get eggs comparatively cleaner and less soiled with droppings and mud. Most areas of inner circle usually have droppings. In order to collect cleaner eggs, some of the farmers use bedding materials such as wood shavings, paddy straw etc. This is often practised if the eggs are meant for hatching. The use of two nylon net enclosures also help to safeguard the flock from predators during night hours.

Egg collection

Caretakers collect the eggs around five o'clock in the morning and by six o'clock egg collection is completed. The eggs are collected in bamboo baskets. Some of the eggs are soiled and dirty which may deter a few people from using duck eggs. Though, the disadvantage of washing fresh eggs may not be scientifically known to the farmers, almost cent per cent of the farmers do not wash eggs. Washing removes the bloom or cuticle present on the shell. Bloom is a natural protection preventing the entry of microbes through innumerable pores on the shell surface. The presence of bloom invariably increases the shelf life of the eggs. The eggs once collected are temporarily transported to nearby collection centres well before the sun rise.

Old and experienced farmers believe that the eggs should not be exposed to sunlight. Eggs exposed to sunrays get deteriorated early and if they are fertile the hatchability

gets lowered. When eggs are exposed to sunrays, the cuticle on the egg surface dries up and as a result numerous micro pores open up. Consequently, the microbes easily enter the eggs through these pores. Moreover, water content of the eggs may be lost as vapour and atmospheric air enters inside. Ultimately, this will lead to some negative changes in the egg albumen and yolk. It may also affect the viability of embryos in the eggs. Eventhough, the farmers may not be equipped to analyze these factors scientifically, experienced farmers always insist that eggs once collected should be immediately moved to store house without exposure to sunrays.

Immediately after egg collection, caretakers start preparations for taking the flock to field/water bodies. Any delay in this process leads to restlessness among the flock. Around 6.30 AM ducks are let out from the net. They move in line in a disciplined manner according to the directions and movement of the *guord* of the caretakers. Guord is used not only for controlling the flock but also for directing the next journey. It can be easily followed by observing the movement of ducks according to guord movement. In general, groups of ducks move as long ribbon like bands and this shows their social behaviour. Literally, groups of ducks are called as '*bands*'. Flock movement in long ribbons and their relationship could be the reason why they are termed as '*bands*'. They swim and move in flocks and travel from one place to nearby places through water or field. On the other hand, for long distance trips, specially designed trucks are used.

Bathing

Ducks get into water mainly for bathing. Usually they take much time for bathing. During bathing time plenty of characteristic body movements peculiar to ducks could be noticed.

The major purpose of such a long bathing process is to keep the body clean. During the feeding activities as well as night hours much mud, droppings and other dirty materials might stick on to the body, feather tips and toe nails. By swimming in water, mud clots in the toe nails get dissolved and removed. Moreover, dirt that adheres or accumulates on the face, on the sides of the bills and eyelids will be cleaned by swimming in specific ways and body movements. Conveniently, they may also get fish or other aquatic creatures, during swimming.

Ducks are allowed for bathing for nearly one hour daily and it is considered as an exercise too. The caretakers will be watchful in the nearby places either in boats or on the canal beds for protecting and directing them. After cleaning and bathing they are let out on to the field. They feed on left over paddy grains and grass seeds. If the fallen paddy grains are not utilized by ducks, they get wasted. They also feed on small fishes, crabs, snails, water plants and such other materials.

LAYER DUCKS

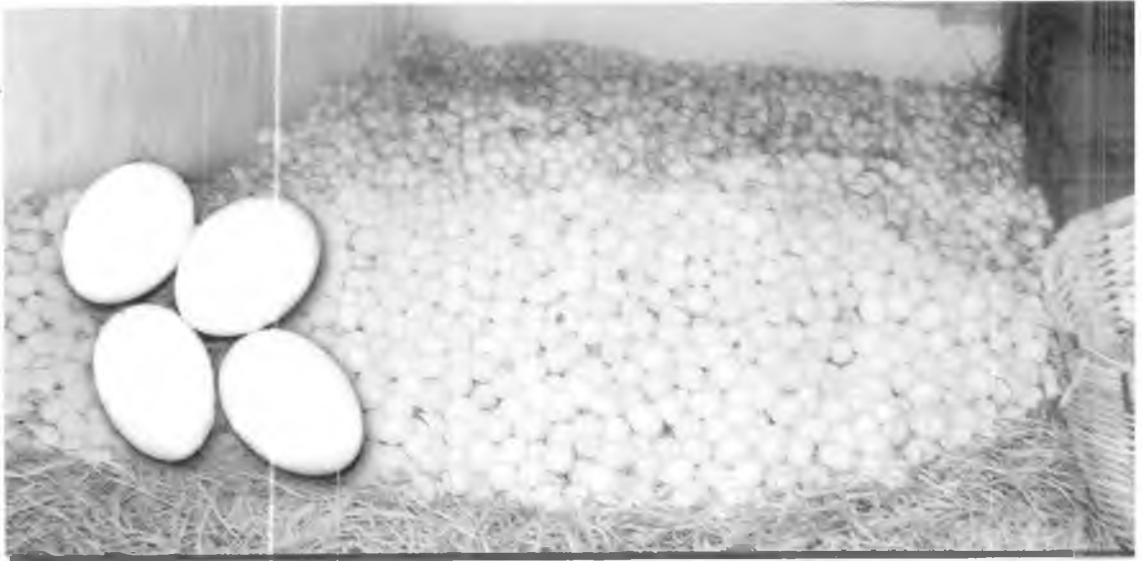


Ducks Lay before Sunrise



Fresh Eggs

EGG PACKING



Egg Godown



Packing Eggs in Wooden Boxes

The beaks of ducks are called *Bills* and are peculiar in shape which enables them picking fishes from water or field. Lamellae situated on sides help to separate mud from feed. They may continue feeding for about 3-4 hours if the field is rich enough with feeding materials. The feeding may extend upto 11.30 a.m. At this time, ducks are led to nearby shaded areas which are adjacent to paddy fields and they rest in shades. The resting period may extend upto 3 p.m. They are again taken in to the field and allowed to remain there till 5.30 to 6.00 p.m. In one day they will utilize the feed sources in a sufficiently large area. Availability of feeding material in the field is adjudged by the egg production percentage. If the production declines the ducks are shifted to another field which was identified by farmers sufficiently early.

Farmers classify the field areas into first, second, and third field and accordingly they use these for rotational foraging. As the name indicates, first field is the fresh post harvested paddy field. Second field is the one in which the area has been utilized once for grazing. The same flock may move to the first field after a gap of sufficiently long interval.

In the evening, ducks are returned from field and are supplied with shell grit. This is a very cheap source of calcium which is essential for eggshell formation. Provision of shell grit is very important since egg shell is made up predominantly of calcium carbonate.

Evening bath

After 6 in the evening, ducks have an evening bath too. If there is a pond, lake or canal nearby the foraging area, they are let out for bathing. This helps to clear the mud or dirt accumulated on the body during the feeding time. By 6.30 p.m., ducks are herded on a raised open land area adjacent to the canal or paddy field. Before leading them inside the net enclosure, some time is allowed for drying their feathers by shaking the body and cleaning with bills. The area used for confining ducks during night is utilized for many days depending upon the distance between night herding and foraging areas.

Night Shelter

A separate shelter is not provided during night. Instead, they are kept inside a circular nylon net enclosure put up in open areas. Usually no further feed is given in the evening. However, if the feed from the foraging area is limited some of the farmers offer a little quantity of wheat or jowar as whole grains. This is specifically done for maintaining optimum egg production. Water is provided in plastic basins during warm season.

Duck may take a full night sleep. Except the light of torches put on by the caretakers to check the birds at frequent intervals, no other light source is provided. Caretakers also sleep near the flock in small tents. One of the caretakers will observe the flock when the other sleep on rotation. If any peculiar or unusual noise is heard, all the

ducks will make warning quacks so that their protectors can take necessary steps.

Nutrient Availability in Foraging Ducks

Layer ducks are being maintained under foraging conditions in harvested paddy fields, canals, ponds and swampy areas regularly for feeding. The availability of nutrients for desi ducks under the extensive system was assessed critically. For this purpose, crop content studies were carried out in layer ducks randomly selected from Alappuzha, Thrissur and Palakkad districts which represented South, Central and Eastern regions of the State respectively. These regions maintain layer ducks in large flocks. After foraging in the field for a minimum of two hours, ducks were selected at random and were sacrificed in the field. The crop along with its contents were collected, tied both ends properly and preserved in ice boxes and transported to the laboratory for detailed analysis.

Gross weights of the crops with contents were recorded. The average weight of the crop with contents was 40.13 ± 4.41 g. Then the crops were opened and the contents were examined thoroughly. The contents were paddy grains, crabs, snails, worms and muddy items. The average weight of paddy grains was 17.5g and that of crab was 8.75 g. The snails and worms were 0.5 g each.

The contents were dried in a hot air oven and subjected for proximate analysis. Crude protein, ash, fibre and ether extractives were estimated. The average weight of dried contents was 22.5 g and the crop sac weight was 8.22 g. The average moisture level in crop contents was 41.28 %. The proximate composition (per cent) of the crop content was estimated and the results are furnished below.

1.	Crude protein	-	14.30
2.	Crude fibre	-	27.82
3.	Ether extractives	-	2.77
4.	Total ash	-	9.72
5.	Nitrogen free extractives	-	45.39

The above results indicated a high fibre content in the crop materials. This might be due to the ingestion of paddy and chaff from the post-harvest paddy fields. The level of crude protein available can be considered as optimum for layer ducks at one meal considering the comparatively low production potential of 200 eggs per year in indigenous ducks.

In chicken layers, it is stipulated that crude fibre content in the diet should not exceed 8%. In routine foraging, indigenous ducks consume materials that contain more of fibre. It is a generally accepted fact that foraging ducks maintain 80-85 % production if paddy fields after harvest are available for regular foraging. Therefore it is assumed that indigenous ducks on foraging have the capacity to utilize more fibre unlike chickens.

LAYER FEEDING



Harvested Paddy Field



Foraging Ducks



Feed Items Inside the Crop

KUTTANAD FARMERS



Wisdom of Experience



Farmer with Ducklings



Transfer of Technology

This area of duck nutrition research requires elaborate studies.

Pesticide residue in crop contents

There is a general belief among duck farmers that the indiscriminate use of pesticides in paddy fields adversely affects the health status of ducks ultimately leading to mortality in ducks. In order to ascertain the severity of this problem, the crop contents collected from layer ducks reared under foraging conditions were screened for residues of organochlorine compounds. The sum of the values of various compounds ranged from 0.00026 to 0.0017 ppm in crop contents indicating the presence of OC compounds in traces and the level of contamination was within safe limits.

The presence of pesticide residues in the crop contents prompted for further screening in the adipose tissue of ducks since there is a chance for accumulation of OC compounds in fat tissues as cumulative toxins. The organochlorine pesticides could be detected in fat samples and the sum total of the values of various compounds ranged from 0.00018 to 0.00055 ppm. These were well within the maximum residue limits (MRL) permitted. These levels can be considered well below the accepted daily intake (ADI) level for human beings.

Indigenous Technical Knowledge

During the course of the field orientation programs, the scientists could identify several indigenous techniques that are being followed by the farmers successfully in duck rearing for the past several decades. Some areas of the Indigenous Technical Knowledge (ITK) identified are listed below:-

1. Rearing of ducklings without supplementary heat
2. Bill branding for identification of flocks
3. Feeding palm pith during lean seasons
4. Specially designed trucks for transportation of flocks
5. Packing duck eggs in wooden boxes
6. Flocking of layer ducks in open fields during night
7. Biological control of pests using ducks
8. Indigenous Medication for maintenance of flock health



7

LEAN SEASON FEEDING

Lean season feeding

Rearing indigenous ducks under foraging condition is possible only for a period of seven to eight months in Kerala, since the availability of post harvest paddy fields are limited to the above period. The remaining period is considered as the lean season for duck farming. Lean seasons in Kerala include both monsoon and summer months and this constitute about four to five months in an year. Availability of water to a depth of 1-2 inches in the paddy fields is essential for effective foraging. If water is not available in the fields, ducks cannot utilize these fields even if fallen grains are available. In effect, 1-2 months come under this category. Similarly during monsoon the paddy fields may be flooded with water, so that ducks may not be able to get enough feed from the fields. This condition may prevail for two to three months. Therefore, for a period of 4-5 months, duck farmers have to resort for hand feeding. This is one of the major problems faced by duck farmers since they have to bear additional expenses for feeding ducks. Moreover, they may not get any income through the sale of duck eggs since the egg production will be minimal.

The duration and period of lean season may vary from place to place. For hand feeding many feed items are tried by farmers depending upon their availability, cost and regional variations. The major feed components used by duck farmers of Kerala during lean seasons are

1. Jowar
2. Wheat
3. Rice (either whole or broken)
4. Paddy chaff
5. Unsalted dried fish (small fresh water fishes which cannot be utilised for human consumption)
6. Rice bran/polish
7. Palm pith

Some of the feed ingredients used by farmers were collected from the field and subjected to proximate analysis to determine their nutrient contents. The results provide valuable information for computing least cost rations which can be recommended during lean season as well as for ducks reared under intensive conditions.

Proximate composition of feed samples collected from the field

(Per cent on dry matter basis)

Feed Sample	Moisture	Ash	Protein	Fat	Fibre
Palm pith	42.1	1.6	10.9	13.1	8.6
Rice	12.0	1.4	10.5	5.6	1.4
Dried fish	11.4	19.8	50.4	11.1	3.1
Paddy	15.9	4.9	11.8	3.9	6.2
Chaff	10.5	9.5	12.9	3.0	3.0
Husk	10.8	17.2	7.0	1.43	30.2

‘Kodappana’

Among the hand feeding items, the major cheap alternate feed for hand feeding in ducks is the chopped pith of ‘umbrella palm’, popularly known as “kodappana” in these regions. This palm is scientifically known as *Corypha umbraculifera* of the family Palmae. It is also known as talipot palm. It is originated in India and is now distributed in Sri Lanka, Africa, Java and West Indies. In Kerala, this palm is seen in hilly areas of Middle Travancore, especially in Palai regions and some areas in North Kerala. It grows up to a height of 70 feet in these areas. It has a massive trunk, upto 3.5 feet in diameter, which is covered with old leaf bases. On the thick, erect, trunk grows bunches of large, fan shaped leaves of 6-12 feet in diameter. People use these leaves for making tents, umbrellas, and crackers.

This palm is a monocarpic plant. It blooms only once in life. This palm has an enormous inflorescence. After the fantastic bloom and fruiting, the plant dies. The flowers are cream and fruits are olive in colour. The palm trees intended for feeding ducks are sold before the onset of blooming. The palm owners opined that when it blooms, the quality of starch in the pith declines and fibre content increased and thus would adversely affect the nutritive quality of the pith. Hence, the duck owners collect the palm before the onset of blooming.

The average cost of a palm tree is Rs. 1000/-. The cost of the palm varies depending on its location and facilities available for transportation. Palm trees are usually

transported from Palai and Kozhikode to Kuttanad. One average truck carries four numbers of palm trees after cutting into pieces of five feet length and the average cost of one load is Rs. 10000/-. When it reaches the duck owner's premises the price of the individual palm is substantially high ranging from Rs. 2500 to 3000 due to the escalation of charges. The palm trunks are usually kept at roadside and this is commonly seen in Kuttanad. During rainy seasons, the chopped pith is mixed with other feed items such as rice polish, wheat, dried fish etc. and fed to the flock. One load is sufficient for 800 ducks for two months.

The feed samples collected from the field were subjected to laboratory tests for detecting the presence of mycotoxins. Most of the samples were free from this toxin. But paddy chaff, the cheap hand feed item collected from the field from Alappuzha region was contaminated with aflatoxin at a level of 100 ppb. During lean season, hand feeding is offered at the rate of 100-140 g per bird, depending upon the production status of the flock.

Artificial moulting

In certain seasons, scarcity of feed in paddy fields is experienced and then farmers resort to 'artificial moulting'. Hand feeding is withheld for 3-4 days, but drinking water will be provided *ad libitum*. Egg production drops drastically and within a week, feathers start dropping. Artificial moulting is completed within 6-8 weeks.

There are advantages and disadvantages for artificial moulting. When there is a drop in egg prices in the market, egg production can be temporarily stopped by adopting this technique. After moulting, egg production begins and higher production percentage will be attained when egg prices are better. Eggs laid after moulting will be larger in size. Moreover, the same stock can be utilized for the next year cycle also, if required. By adopting the above procedure, economic stability of the farmers can be maintained. As ducks may not lay during the moulting period, farmers have to find other sources of finance for meeting the expenditure towards feeding. Many of the duck farmers belong to low income group and hence it would be difficult for them to manage the situation. Low egg shell thickness and reduced internal egg qualities consequent to moulting are considered as other disadvantages of moulting. In addition to feed withdrawal, provision of water and light can also be adjusted for artificial moulting. In other methods, restriction or withholding of water is applied. However, water restriction is not practical during extreme summer seasons.

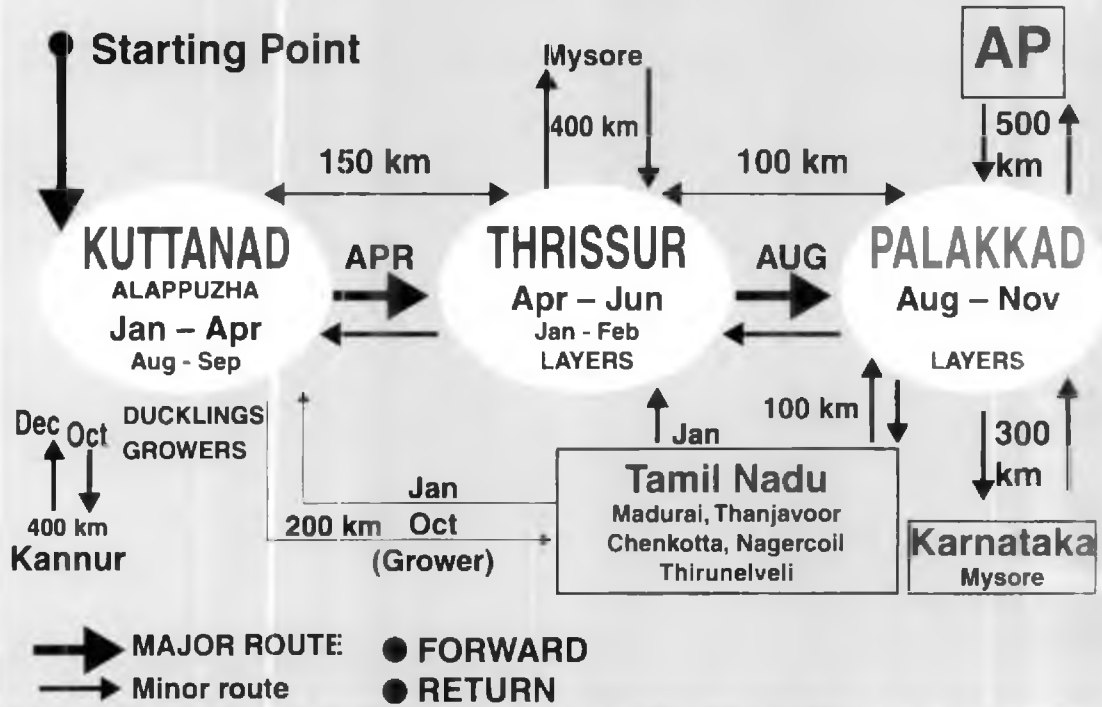


CORYPHA PALM TREE



Corypha Trunk Pieces

DUCK FLOCK MOVEMENT IN KERALA



Specially designed Trucks

8

DUCK FLOCK MOVEMENT

There is a constant movement of ducks from Kuttanad to different regions of the state as well as to the neighboring states. Availability of suitable and speedy transporting facilities and financial assistance from egg merchants help this 'speedy movement' of flocks from one place to another. The major objective of flock movement is to find harvested paddy fields for feeding

The major foraging centres in Kerala are Kuttanad of Alappuzha District, Kole fields of Thrissur and Paddy fields of Palakkad District. There are also minor feeding places like Kumarakam in Kottayam, Neyyattinkara in Thiruvananthapuram, Angamaly in Ernakulam, Thirur in Malappuram and different places in Kannur District. The major route of flock movement in Kerala is Allappuzha- Thrissur - Palakkad. At the same time, certain flocks are moved to random feeding places available in different parts of Kerala.

MAJOR ROUTE

Kuttanad

Duckling production starts at Kuttanad with different hatch seasons. The major hatching season begins during November-December. After hatching almost all flocks of ducklings are maintained in Kuttanad till April every year. The ducklings will be 3 to 4 months of age at this time.

Thrissur

During April most of the grower birds and layer birds from Kuttanad and other flocks are dispersed to different parts of the state or nearby states. A large contingent moves towards Thrissur (150 km distance). These flocks are kept here upto June by feeding in the post harvested paddy fields and Kole land area . When the season is over, a section of the flocks is maintained by hand feeding with the help and financial assistance

of egg traders. A section of farmers moves towards Tamil Nadu (Madurai, Tanjavur, Dharmapuri etc. - approximately 350 km) or Mysore (400 km) in search of harvested paddy fields either from Thrissur or from Palakkad.

Palakkad

In August (Chingam) paddy harvest starts at Palakkad and almost all ducks from Thrissur (70 km) and other regions of Kerala, Tamilnadu (250 km) Mysore (400 km) and Andhra Pradesh (500 km) move towards Palakkad. Palakkad is considered as the central meeting place of ducks from four southern states. After exhausting the feed resources from harvested paddy fields by November, these flocks move towards other parts of Kerala or neighboring states. It was observed that after this season at Palakkad, ducks brought from Andhra Pradesh are transported back to their state while ducks from Karnataka and Tamil Nadu move into different parts of Kerala or to Tamil Nadu or Karnataka for foraging.

In addition to the major route, a minor route covering different places in Kerala as well as neighboring states of Tamil Nadu and Karnataka does also exist. A pictorial diagram highlighting the major and minor routes of duck flock movement is given for reference.



9

PECULIARITIES OF DUCKS

The information on the anatomical and other peculiarities of ducks will help to understand their feeding habits and daily routines in the foraging system of rearing.

Head

Ducks have a comparatively round head and flat beaks extending forward from head. As these beaks have a special shape, they are called as 'bills'. The bills have lamellae on their sides which filter out the solid food particles from water.

Ducks and geese come under the category of water fowls. They can get along together and are soft in nature. Ducks do not have head appendages like comb, wattles and earlobes as seen in chicken. But in Muscovy ducks, wrinkled fleshy skin could be seen on face, head and eyes. Drakes have shiny, attractive and beautiful small feathers on their head and neck. These feathers exhibit different colours when light falls on them and this is called as iridescence.

Neck

Neck portion of ducks is shorter in comparison to geese. Ducks are generally held by their necks as the cartilagenous rings of trachea are complete which give strength to the neck of ducks.

Body

The length and size of the body of ducks are less in comparison to those of the geese. The dorsal side of the body forms the back and lower sides forms the chest and behind the chest is abdomen.

Tail

Drakes have peculiar feathers called 'drake feathers'. These are two feathers at the tip of the tail which are curved upward and inward.



Wings

Feathers that help in flying are called primary feathers and the other feathers in the wings are called secondary feathers. In case of Kuttanad ducks, there are two dark areas on both sides of the body and is covered with black feathers called as 'wing speculum'.

Legs

The toes of the feet are interlinked with a spread of delicate skin called as web which helps in swimming. The pad under the foot acts as a cushion for the ducks to walk on land surfaces. The femur is short when compared to tibio tarsal bones. Generally, these have double the length of the femur.

Toes

Ducks have four toes, the first is curved inside and other three are turned anteriorly. First toe has two bones while the second one has three bones. Similarly third and fourth toes have four and five bones respectively. The last bone in each toe is sharp and claws are formed from these bones. The other bones of the toes have depressed facets anteriorly, whereas posteriorly they have round head of bones. The bones on toes taper as they go anteriorly. The length of the webbed toes is noticeably longer and this helps in swimming for a longer time.

Feathers

Feathers help in regulating the temperature of body. Feathers covering the body during the embryonic stage is called as 'down'. The feathers which develop during different stages of growth are of four types viz; Contour feathers, Coverts, Ramellous and Retrices. The structure and function of these are also different.

Skin

Skin is covered with contour feathers and therefore demarcation of each body part is not very easy. The arrangement of contour feathers in a peculiar pattern is called as pterylosis. This is a special feature of ducks.

Feather tract

Feathers are arranged in feather tracts called as 'Pterylae'. These tracts are found in specific parts of the body covering different regions. Feathers in different regions have different sizes due to the structural differences of barbules, barbicels and their branches. Feathers in the wings are divided into primaries and secondaries. It is difficult

to demarcate the pterylosis due to intermingling of down feathers and contour feathers.

Moulting

Moulting is a phenomenon of shedding of feathers in birds and it takes place once in an year under the action of hormones produced by thyroid and pituitary glands. The rate of moulting differs among birds. Wild fowls moult once in a year and it may take four months to complete the process. In domesticated birds moulting is different. The chicken moult at the end of the laying period. Moreover, there is a definite order to drop feathers. But the ducks do not follow any such specific order. All the feathers are shed at a time. Whatever be the phenomenon, ducks never lay eggs during moulting.

Interlocking of feathers

When ducks attain 3 months old, new feathers grow and the tips of the wings cross over each other. This is called 'interlocking of feathers'. Often, interlocking is used to identify the age of ducks at younger ages. When new feathers are grown the old ones are shed and the birds also remove feathers with their bills. Later on feathers on the wings sheds together and the new ones grow together. This process gets completed in 6 weeks period. When sufficient paddy fields are not available farmers may resort to artificial moulting of their duck flocks. But it should be planned properly. Newly grown feathers are oily in nature. It may help ducks to swim freely in water. This will also help them to remove dirt sticking on the feathers quickly. Feathers will not get dirty easily.

Oil gland

Oil gland produces an oily substance and it is located in between the feathers at the base of the tail. It is similar to the sebaceous glands in mammals. This gland is situated just above the junction of the last sacral and first coccygeal vertebrae. The gland is found in two equal parts on the both sides of the vertebrae. The size is about that of seeds of date palm. The oil produced from this glands, makes the feathers shiny.

In layer ducks, the body-weight decreases as production advances and the egg weight increases as age advances.

Internal Organs

Liver

It is a major visceral organ performing the role of immunity building and detoxification in the body. Toxic substances that are absorbed through the intestine and the toxic

compounds that are produced in the body as a result of metabolic processes are converted in to compounds that are nontoxic by the functions performed by the liver. The liver in ducks are comparatively larger in size and it accounts for about 3-4 % of the total body weight. In chicken it is only 1.7 to 2.3 %. In developed countries the liver of ducks has a special preference and is sold as such. Therefore, ducks are commercially reared for producing liver and marketed in many countries especially in China and Japan.

Heart

Like in other animals and birds, heart is concerned with circulation of blood in the whole body. It is a very important organ and is made up of tough cardiac muscles. As in animals, left part of the heart deals with purified blood and right part is concerned with purification of blood. Heart is primarily concerned with transportation of oxygen and nutrients to body cells and removal of toxic substances from body cells. As heart is completely made with muscles, it is fit for human consumption. When duck heart is related to its body weight, they are comparatively larger. Their heart accounts for 0.8 per cent of the total body weight whereas it is only 0.5 % in chicken.

Gizzard

Gizzard is otherwise termed as muscular stomach. Its main function is grinding of ingested feed into smaller particles. It undergoes regular and rhythmic contractions, which are rotatory in nature. As teeth are absent in birds including ducks, mastication is not taking place in the mouth. Instead, gizzard of birds takes up this mixing job. Since ducks reared under intensive system are fed with ground feed mixture, gizzard does not have much significance. On the other hand, ducks reared under extensive natural system picks up mostly whole grains from the field and hence gizzard has much significance. The serous layer of gizzard is very tightly attached to the musculature and it is difficult to peel it off. The whole gizzard except the serous layer is suitable for human consumption.



10

BEHAVIOUR OF DUCKS

Feed and water intake

The wild ducks had differences in their food habits according to the geographical areas to which they belonged. But due to similarity in the source of food, these differences are comparatively less in domesticated ducks. Their food items comprise of seeds of water plants, fruits, water insects, oysters, arthropods and other aquatic organisms. This could be considered as the reasons for the characteristic differences in the nutrient quality of their eggs. Since the feed consists of aquatic plants and organisms, the long chain fatty acid concentration is more in their eggs than short chain fatty acids.

Feeding pattern

Ducks follow different characteristic styles and methods while feeding. At first they focus on finding out the smaller food particles. The most common method is to get enthusiastically involved in various physical activities, shaking their head with bills on water surface or in mud. By this method, they filter the invertebrate organisms living in mud and small floating plants. By quickly opening and closing the lower jaw, water is allowed to enter their mouth and this water is expelled out through lamellae, the cartilage like structures, which guard the sides of the bill.

There are three types of feeding patterns followed in water. If the water is few inches deep only, they dip their head and neck in the water and search with their bills. If it is deeper, they dip their front portion of the body in the water and only tail portion stays outside. This method is more common and familiar. This is called 'tipping up' or 'up ending'. Diving deep into the water is the third method. This is most commonly done by ducklings. This is the method for searching the food even from the lower portion of the water sources. Adult ducks also adopt this method. Seeds to be drawn from the deeper portion of the water are procured by employing this method.

They capture the flying arthropods by fast movement of their bills. Some times chasing and hunting will also be there. This is usually noticed in ducklings. Ducks also search for the crawling insects on land and eat them.

During the swimming time, they find and eat food of plant origin. For getting seeds from plant they adopt a peculiar method. While swimming, they catch hold of a weed by their bills. Then they allow the stem to slide between the bills which make the seeds to fall down. These floating seeds are then taken in by the ducks. Cereals and other dried food particles in and around water are favourites of ducks. This is the reason why harvested paddy fields having a few inches of water are considered rich feeding habitat for ducks.

While feeding in shallow waters, they try forceful diving movements. When they come up, usually they have food between their bills. For flutter and shaking their wings, they raise their body above the surface of the water. For this, they rest their foot forcibly in water. This is frequent and commonly seen in ducks. During this process, they raise their front part of the body a little upwards. At the same time, they move their back portion to sides. Along with this, foot movements are also there, resembling a dance. Each stage of diving lasts only for a few seconds. Then immediately, the head and neck are immersed into the water to search for food. By the quick movements of feet they disturb the mud in the deep portion of water sources. With these movements they disturb the invertebrates trapped, and makes them to appear on water surface. Then these are grabbed and taken in.

Search for food

Kuttanad ducks usually get enough food during paddy harvesting season. The other seasons are lean seasons for them. During lean seasons egg production drops down drastically and farmers face an economic crisis. During lean seasons birds are hand fed. More over, they may also be taken to neighbouring states in trucks. After a few months, they are brought back, when paddy harvest begins in the State.

Drinking pattern

Like other birds, fixed body movements and specific patterns are associated with the drinking process in ducks too. After dipping their bills in water, they raise it above the water level. This action is particularly common in flocks if they are kept away from the water for sometime.

Body care activities

Ducks are careful in cleanliness and beauty of their body. They spent lot of their

time for cleaning and keeping the feathers shiny. They dash and dive in water several times and shake the feathers for removing water drop. Along with this, they clean the accumulated dirt. They have natural movement and patterns for cleaning their feathers and body. Bills are mostly used for this. Long neck, capable of bending to a great extent helps a lot in this. With these cleaning movements, they remove many external particles, which cause irritation to skin.

Patterns of body movements

In order to wet the entire body ducks have several special movement patterns, during stages of bathing and diving. The movements which help to provide comfort and minimize disturbances as described by F.Mc Kinney in 'Behaviour of Ducks' are as follows.

1. Shaking movements
2. Stretching movements
3. Cleaning movements
4. Oiling
5. Nibbling
6. Bathing

Shaking movements

Once they come out to land from water a general body shake occurs. But this is not common during swimming. During other times two independent movements are seen. One is lateral head shakes and the other is rotary head flicks. Apart from these, other movements are also seen. The tail portion is completely shaken laterally. Movement/shaking of feet is usually seen just before sleep. Just prior to sleep, one foot is tucked close to the belly under the feathers. Preceding this, a series of forward and backward foot movements could also be seen.

The most noticeable and familiar body movement of ducks is their wing flap. This is done several times forcefully keeping their body erect. This is also commonly seen immediately after bathing and subsequent oiling of feathers. Along with combing of feathers wings are shaken resembling shuffling and fanning of tail feathers. All these movements are seen in well defined situations. The principal objective of all these movements is to remove water and other foreign particles from the body surface and feathers.

Stretching movements

To keep the body surface in optimum condition three types of stretching movements are used.

1. Stretching the legs and wings
2. Stretching both the wings
3. Stretching lower jaw

The first two movements are characteristic of resting birds. They may also occur just before and after sleep. The third type resembles 'yawning' of human beings. All these movements help in the natural process for protection of body surface.

Cleaning movements

Ducks scratch their head with the inner edge of the middle toe which is modified in to a semi-sharp edge as they cannot use their bills for oiling and cleaning the feathers of head. Foreign particles on the feet are removed by pecking by use of bills. Cleaning of bills is an interesting process. This is accomplished by dipping their bills in water and blowing out through the nostrils. One more common method is just dipping their bills several times in water. The dirt and feather portions sticking to the bills are removed by this method. When there is irritation around the eyes, they rub their head on shoulder. This is also adopted for spreading the oil during and after bathing.

Oiling

Application of oil is an essential process for keeping the body and head clean. Oiling is an important routine process. This is a process of spreading the oil throughout the feathers, which is produced by oil glands situated just above the tail. This is usually followed by bathing. Oiling can occur at other times also. Ducks after getting out from water, move on to the land and remove the water drops by shaking the body and feathers. Water on chest is wiped out using bills. After shaking their head vigorously several times, they turn their head back to one side. Tail is also turned or tilted in the same direction. Due to this movement of the tail, the feathers overlying the oil glands are erected. The birds rub their bills around the oil glands. Its chin and head are also rubbed. Oil is distributed over the feathers by these rubbing movements. This process extends upto five minutes during which period, the oil is taken 4-5 times from oil glands. Half an hour or more is spent for oiling. This is made possible by delicate movement of bills. Slowly this movement subsides and stretching movements of their body begin. Subsequently, this also stops and the duck slowly falls into sleep.

BATHING AND ASSOCIATED MOVEMENTS



Glimpses of Cleaning Activities

KOLE LANDS OF THRISSUR



Eco-friendly Duck Production

Nibbling

Several minutes are spent during a every day for nibbling their feathers. Usually these movements are coupled with bill dipping in water. With this process, the particles causing irritation are removed and at the same time the feathers are cleaned.

Bathing in water

Activities of ducks in water are quite interesting and attractive. Dashing and diving in water, swimming, wallowing in mud and water by dragging their legs, roaming in shallow waters etc., are all part of their activities in water. With these activities, they take bath several times a day. A complete bath may not be there always. The commonest bathing movement is head dipping . They do this while swimming in shallow paddy fields or in deep back waters. When they straighten up, the water is spilled on their body. In proper bath, forceful wing shaking and somersaulting are included followed by jumping and diving. In diving, sudden diving, small flying and wing shaking on water surface are the principle features. These are considered as major activities in water. All these movements are related to bathing and help in cleaning the feathers.

Movement/Travel

Indigenous ducks of Kerala are famous for walking long distances, in search of food. This genetic capability is exploited to their advantage by the farmers. Ability for walking long distances in shallow water bodies and harvested paddy fields is a speciality of Kuttanad ducks. Sometimes they chase other birds for short distances also.

Swimming

Swimming is done with the help of periodic movements of legs. When the legs are moved forward the skin between the toes is folded and when it is moved backward, skin is expanded. This helps a lot in moving forward through water.

Sleep

Ducks in water close their eyes for not more than a short period. But when they are in sleep or at rest, they close their eyes for one hour or more. Ducks which spent majority of time in water, enter the land mainly for taking rest. This is done by hiding the head in feathers of shoulder or leaning their head to the shoulder bones and keeping their bills pressing to the feathers. This may extent for longer time. But they will open their eyes in between. The sleeping ducks when disturbed wake up immediately and become active and warn other ducks.

Season and habit

During different seasons of the year, many changes in the routine activities of ducks are seen. The distance covered in each day depends upon the area of feeding, habitats and the security of resting place. If enough feed is present, they roam around more time in the field. This makes the farmers happy since more eggs are laid by such a flock.

Head movements are noticed in all the months. But other behavioral pattern especially some peculiar voices made by ducks may change according to weather and social relations. In pre-domesticated flocks, making sharp whistling voices were considered as calls or signals of readiness for mating with its pair. But in domesticated flock, much significance is not given for seasonal behavior. Similarly, several activities are also controlled by weather. In cold seasons and windy weathers reproductive activities were found to be comparatively less in wild ducks.

Mating behaviour

After summer months, the wild ducks were enthusiastic in making friendship, flocking together and finding mates. But no studies have been conducted to ascertain their behavior in domesticated ducks. The egg laying period and mating period of wild ducks vary in different geographical areas. The beginning of artificial hatching of eggs hampered the natural reproductive cycle. It has been reported that male and female wild ducks flocked together during cold months and got involved in several activities. They found mates and then got separated. But the influence of weather in the mating process of domesticated ducks is not evident.

In the natural habitats of forest, the males accompanied the females when they went for making nests. When the females were in the nest for laying eggs, the males waited and remained outside the nest. This caring and friendly nature of mate was considered essential for natural hatching process. There may also be changes according to the atmospheric conditions. But now, all these habits and behavioural patterns have changed consequent to domestication.



11

DUCK EGGS AND MEAT

Duck eggs and meat contain nutrients in a well balanced ratio. It also contains unsaturated fatty acids which help in the control of cholesterol. Therefore, it is advisable to include duck eggs and meat in our diet. Experienced farmers claim that duck eggs are better than chicken eggs in certain aspects.

Duck eggs

Duck eggs fetch premium price than chicken eggs in Kerala. They cost almost double that of chicken eggs. This is mainly due to the preference of people for duck eggs over chicken eggs. In addition to its nutritional quality, people believe that it has certain inherent medicinal properties.

Duck eggs are widely used by people of Kerala from ancient days for getting relief from piles. It is scientifically proved that the metabolizable energy production is less from duck eggs due to the advantageous ratio between protein and fat levels and the peculiarity of fatty acid profile in duck eggs. It may help in preventing varicosity of blood vessels/ haemorrhoidal veins in the rectum in persons having piles.

Structure and contents

The outstanding character of Kerala ducks is their egg size that varies from 65 to 75g. This is the single major factor which makes the farmers prefer indigenous ducks of Kerala rather than ducks of other states or even the Khaki Campbell, which is identified as the best egg type all over the world. The Khaki Campbell egg weigh around 60 g only.

The duck eggs on average will provide 60-68 g of edible portion after the removal of shell. Albumin constitutes 60 %, yolk 30 % and shell contribute 10 % of the total weight. The protein in the egg is called albumen. An egg weighing 70 g contains 49.6 g water and 130 k cal of metabolizable energy. It contains 1 g carbohydrate, 8.97 g protein, 9.63 g fat and 0.8 g ash.

Albumen

The albumen of duck eggs contain conalbumin, ovalbumin and lysozyme. For increasing the quality of scrambling the albumen, lemon extract may be helpful. The citric acid content of lemon will adhere the ovomucin factor which will effectively reduce the duration of scrambling. This acidified duck eggs are preferred over chicken eggs for preparation of 'angel cakes'.

Yolk

Egg yolk contains fatty acids, fat soluble vitamins and cholesterol. Yolk of duck eggs mixes with water due to the presence of phospholipids, proteins and calcium ions that affect surface tension. These factors form a layer over the fat globules preventing it from adhering. This will help in uniform mixing of the fat globules. In this arrangement, the polar side will face towards water and the non-polar side directed towards fat. In such an arrangement, the fat globules are adhered to both sides and may reduce the surface tension.

Lecithin

Lecithin is a phospholipid that is formed when the phosphotidyl choline combines with the fatty acids and glycerol.

Water

As in chicken eggs, water is the major component of duck eggs too. Chicken egg on an average contains only 70.83 % water, whereas water content in duck egg is 74.57 %.

Protein

The amount of protein is comparable in duck and chicken eggs. Hundred grams of chicken egg contain 12.14 g of protein compared to 12.81 g in duck eggs. Thus duck eggs contain a little higher quantity of protein.

Amino acids are the basic structural factors in proteins. There are 21 essential amino acids, of which some are important and the others are less important. Duck eggs are good source of amino acids wherein 18 out of 21 essential amino acids are available. Except cysteine and isoleucine other amino acids are more in duck eggs when compared to chicken eggs.

Availability of amino acids in 100 g of duck eggs is shown below.

Amino acid composition of duck and chicken eggs (g)

Amino acids	Duck eggs	Chicken eggs
Lysine	0.951	0.820
Methionine	0.576	0.392
Cysteine	0.285	0.289
Threonine	0.736	0.596
Isoleucine	0.598	0.759
Phenyl alanine	0.840	0.686

Fats and Fatty acids

A close perusal of fat content indicates that duck eggs contain more fat than chicken eggs. Duck eggs contain 13.77 % fat compared to 11.15 % in chicken eggs. The structure of lipids in duck eggs is also peculiar. In an egg weighing 70 g, saturated fatty acids account for 2.58 g and unsaturated fatty acids about 5.43 g. Of the unsaturated fatty acids, 4.57 g are monounsaturated, while the remaining 0.86 g belongs to polyunsaturated groups. Eventhough the polyunsaturated fatty acids are less than 1 g, it is considered as advantageous from the health point of view. An essential fatty acid present in duck eggs in considerable concentration is arachidonic acid.

Availability of fat in 100g duck and chicken eggs is given below

Availability of fat in 100g duck and chicken eggs

Factors	Duck egg	Chicken egg
Total saturated fatty acids (g)	3.68	3.35
Total monounsaturated fatty acids (g)	6.52	4.46
Total poly unsaturated fatty acid (g)	1.22	1.45
Total unsaturated fatty acid (g)	7.74	5.91
Cholesterol (mg)	884	548

Unsaturated fatty acids are found abundantly in duck eggs. Natural food materials of ducks like snail, crab and oyster belonging to the family arachinidae are considered as the major source of arachidonic acid. Eicosa tetra enoic acid (ETA) contains 20 carbon atoms and four double bonds (Arachidonic acid), Eicosa penta enoic acid (EPA)

contains 20 carbon atoms and five double bonds (Timnodonic acid) and Docosa hexa enoic acid (DHA) contains 22 carbon atoms and six double bonds (Cervonic acid) are present in duck eggs. The exact levels of these fatty acids in Kuttanad duck eggs are not documented so far.

It is believed that the balanced ratio between the different fatty acids present in the duck eggs reduce the chance of cardiac ailments. Ducks reared under the foraging system mainly feed on aquatic foods and those foods contain omega-3 fatty acids mentioned above. Ultimately these are present in sufficiently large amounts in duck eggs. It is reported that omega -3- fatty acids reduce the cholesterol level in humans and thereby reduce the incidence of heart diseases.

The presence of omega-3 fatty acids also improves the efficiency of heart and prevents the deposition of fats. An egg weighing about 70 g contain 618 mg cholesterol on an average. As a food component, this level is not harmful because rich quantities of choline found in the phospholipid fraction of the egg stabilize the fat content in the liver. As a result, the absorption rate of cholesterol is reduced and the absorbed cholesterol is broken down to smaller fragments. The accumulation of cholesterol in blood vessels is thus controlled and hence duck eggs are comparatively harmless though it may contain cholesterol level at the rate of 884 mg/100 g.

Salts and minerals

With respect to the availability of inorganic elements duck eggs are in the higher status than chicken eggs. The minerals viz., calcium, iron, magnesium, phosphorus, potassium, sodium, zinc, copper, manganese and selenium are present in duck eggs. Except zinc, all other elements are more in duck eggs than chicken eggs. Availability of minerals in 100 g of egg is given below.

Mineral composition of duck and chicken eggs (mg)

Minerals	Duck egg	Chicken egg
Calcium	64	56
Iron	3.25	2.09
Magnesium	16	12
Phosphorus	220	180
Potassium	222	180
Sodium	146	138
Zinc	1.41	1.44

Since the duck eggs weigh 10-20 g more than chicken eggs, the availability of minerals is comparatively more in duck eggs on per egg basis

Vitamins

Duck eggs are comparatively high in vitamin content. It contains 1328 IU of vitamin A when compared to 520 IU in chicken eggs. The levels of B vitamins, viz., thiamine, riboflavin, niacin, pyridoxin and B₁₂ are also not different. When we consider the whole of vitamins, duck eggs contain plenty of vitamin A, major B vitamins and vitamin E. Similar to chicken eggs, duck eggs also lack in vitamin C.

Egg Shell

Duck eggs are white in colour and are larger in size. The shell thickness is more and is approximately 0.53 mm. The shell is very hard and is not broken easily while handling. This reduces the chances of breakage while transporting to distant places. The pore size of the duck eggs is more but they are covered by a protective mucus covering which prevents the entry of micro organisms. It also prevents the loss of water from inside the eggs and entry of atmospheric air from outside. All these factors improve the quality of eggs. Hence these eggs can be stored for longer periods.

Since the eggs are collected from the field, there is possibility of duck droppings and dirt adhering to the shell. It has to be removed by rubbing with dry clothes. Washing of eggs leads to loss of the protective covering. When the shells are very dirty washing of eggs is advocated.

Internal quality of eggs

Duck eggs differ from chicken eggs in their internal quality too. The albumen is comparatively thicker and egg yolk is golden yellow in colour and rounded. The vitelline membrane covering egg yolk is also very thick. This membrane can be easily removed from the boiled egg because of its thickness. Boiled duck eggs have a pleasant smell.

The informations on the nutrient content of duck eggs were collected from the reports of USDA (US Department of Agriculture) published in August 2002. Well defined studies to determine the nutrient profile of eggs obtained from the field stock of ducks in Kerala has not been taken up. There is only very little scope for wider variations in major nutrients since these are mostly determined genetically.

Duck meat

Duck meat is easily digestible and has high nutritive value. Ready-to-Cook (R - to C) yield of duck meat is in the range of 65-68 per cent. The heart, liver and gizzard

constitutes the giblet and it accounts for 6 % of the R-to-C yield. The proportion of different parts of the meat from Kuttanad duck is as follows.

Breast	26 %
Back	21 %
Legs and thigh	23 %
Wings	17 %
Neck & skin	13 %

Giblets

The heart without pericardium, the liver without gall-bladder and the gizzard without the content and its serous layer are collectively known as giblets. This is a highly relished meat triad of duck origin, especially in foreign countries.



12

DUCK DISEASES AND BIO-SECURITY MEASURES

Ducks, especially indigenous varieties, are generally hardier than chicken. However, disease outbreaks do appear from time to time. Statistics on the incidence, morbidity and mortality and etiology of duck diseases are not available. The reported outbreaks represent only a small portion since many farmers are reluctant to report the diseases and mishaps.

Infectious diseases like Duck Plague (Duck Viral Enteritis), Duck Pasteurellosis, Duck Viral Hepatitis, Duck Pox and some other unidentified diseases have been reported from field stock. In general, Duck Plague and Duck Pasteurellosis tend to be the major havoc among indigenous ducks. A study on the traditional duck farming system in Kerala indicated that Duck Plague is the major disease affecting ducks of all age groups. Its high degree of morbidity and mortality may result in the complete devastation of duck population. Though, most of the farmers vaccinate their birds against duck plague, the disease still does occur in a mild form. The following reasons are attributed.

1. Unscientific storage of vaccines.
2. Faulty vaccination techniques followed by the farmers.
3. Under dosing.
4. Vaccination during disease outbreaks.

A brief outline of the commonly occurring duck diseases is given below.

Duck Plague (Duck Viral Enteritis)

Ducks and other water fowls of all age groups are susceptible to duck plague. It is caused by a herpes virus. Transmission is horizontal and the virus spreads rapidly in the flock. Ducks recovered from the disease are immune but usually act as carriers. Wild migratory birds are also responsible for the spread of the disease. The disease is more likely to be spread if the birds have access to water.

At the onset of outbreak, some birds may die without showing any symptom. There is sudden, high and persistent mortality. Birds are listless with droopy wings, ruffled and dull feathers. Affected ducks seem to be reluctant to move. Eyes are swollen with sticky eyelids. Affected birds are unable to swim in water. There will be sudden drop in egg production. Profuse greenish diarrhoea, some times mixed with blood, could be seen among the affected birds. Diagnosis could be made by post-mortem examination. Microscopical examination and virological tests may be attempted for confirmatory diagnosis.

There is no specific treatment. However, antibiotic supplementation is useful in preventing secondary infection. Attenuated live virus vaccines are effective in the prophylaxis of the diseases. Ducks are vaccinated thrice, first at 4 weeks, second at 8-10 weeks and third at 16-18 weeks of age. Diluted vaccine is administered subcutaneously at the wing web/thigh region. It is advisable to vaccinate the ducks once in every 6 months after 3rd vaccination.

Duck Pasteurellosis

It is caused by the bacterium *Pasteurella multocida* and affects ducks above 4 weeks old. The disease is prevalent in Kerala and other South Indian States. The onset is sudden in a flock and the affected ducks which were active till then flutter 2-3 times and die. Because of the sudden death, farmers call this disease as “Attack” comparing heart attack in humans. The mortality rate is high. In acute form the birds show loss of appetite, increased thirst, high body temperature, ruffled feathers, mucus mixed discharge from mouth, high body temperature and diarrhoea. Birds of the grower stage and adults are affected. Ducks which are in peak lay and good health condition are affected first in the flock. Chronic form of Duck Pasteurellosis is also noticed. Diagnosis is done by blood smear and bacteriological examinations.

Both sulphonamides and antibiotics are effective in the treatment of this disease. Though, the medicine can be given either in feed or water, under extensive system of duck rearing, provision through feed is impossible. Usually, drugs are administered by

AILMENTS



Ocular Infection



Leg Weakness



Total Paralysis

FARMING SCENARIO



Water Bodies



Herding



Flocking Places

the farmers orally to the affected flock. The treatment should be continued for a minimum of 5 days.

Improper selection of medicines, sub optimal dosage and strain variations stand in the way of controlling this disease.

In endemic areas, ducks should be vaccinated against the disease. Unfortunately, the use of vaccine is limited since it is not available in the country. The Centre for Advanced Studies in Poultry Science in collaboration with the Microbiology Department of College of Veterinary and Animal Sciences of Kerala Agricultural University has now come out with an oil adjuvant vaccine against duck pasteurellosis which was found very effective in preventing this disease. The NATP on Productivity Enhancement of Ducks has recently started a vaccine research unit.

Duck Viral Hepatitis

It is a highly infectious disease of ducklings caused by an RNA virus (*Picornia*). The transmission is horizontal and only ducklings under 5 weeks of age are affected. Two forms of the disease known to occur are type 1 and type 2. Though it is a common duck disease in other countries, it is not seen in Kerala. Immunisation by the use of serum from infected ducks as well as vaccine are reported to be effective in the prevention of this disease.

Aspergillosis

It is caused by *Aspergillus fumigatus*. Ducklings under 3 weeks old are more susceptible. Transmission is mainly through air. Aspergillosis is a respiratory disease and laboured breathing is the typical symptom. There is no effective treatment. The disease can be prevented to a great extent by proper cleaning and disinfection of hatching eggs. Since litter materials are not used for brooding of ducklings as indicated in the earlier chapters, contamination through litter does not occur. Similarly, chances for feed to act as a source of contamination is also limited as ducklings nursery owners take keen interest in providing fresh feed materials during brooding period.

Mycotoxicoses

This is caused by the ingestion of aflatoxin or other mycotoxins from infected feed ingredients. Hot and humid conditions prevailing in Kerala favour toxin production. Although ducklings of all age groups are susceptible, the symptoms are more pronounced in ducklings below 1 month of age. Severity of disease depends upon the quantity of toxin in the feed. For prevention, the feed used during the nursery period and feed material meant for lean seasons should be free of mycotoxins. As concentrate feed is

offered only upto a maximum of 4-6 weeks of age and foraging is encouraged to the maximum extent, mycotoxicoses are not a major threat under extensive duck keeping in Kerala.

Duck Pox

It is caused by pox-virus different from poultry pox, turkey pox and pigeon pox. Ducks of all age groups are susceptible for duck pox. Major spread is by direct contact. 'Cutaneous type' of duck pox is characterized by wart-like growth on bill, head and sometimes on feet. 'Eye type' is characterised by severe conjunctivitis and sometimes it may lead to blindness. Mortality is very low. Under extensive system of duck rearing, occurrence of duck pox is negligible.

Even though, ducks are susceptible to a number of disease conditions viz., Ranikhet disease, Ornithosis, Duck influenza and Parasitic infestations, their actual occurrence is very low in the duck rearing system followed in Kerala.



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