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Duck farming: A potential to reduce poverty in rural households in Indian communities – A review

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Abstract

Among different species of poultry, ducks are sturdy, prolific and disease resistance in nature. Indigenous ducks of our country constitute more than 90% of the total duck population and the second largest species after chicken which contributing towards egg and meat production in India. In India rearing of ducks is still in the hands of poor rural farmers, who depend mainly on ducks for their livelihood and employment, they rear duck on natural scavenging system in backyard. Duck farming and rising is a lucrative livestock industry in the globe because of its egg, meat and feather production. Poultry meat and eggs are one of the most widely consumed animal origin proteins food in various parts of the world, across a wide variety of cultures, traditions and religions. Ducks are reared like chicken for eggs and meat. As per livestock census 2019, the duck population of India is 27.43 million constituting 8.52 percent of the total poultry population. Duck population in India revealed that they are concentrated in Eastern, North eastern and Southern states of the country according to distribution and demographic dynamics. Ducks make a significant contribution in providing high-quality nutritional food needs however; the production of meat and duck eggs is still lower than chickens. Duck farming in India is characterized by extensive, seasonal, and it is held in the hands of small and marginal farmers and nomadic tribes. Three systems of duck rearing accepting in India i.e., free range system, Confined system and Indoor system. Duck plays important role in integrated farming with other farming like duck can rear with fish farming and/or paddy cultivation. Duck eggs contain all essential amino acids required by the human diet and are a good source of vitamins and minerals. Due to lower water content duck eggs have more nutrient than chicken eggs. Due to high nutritional value with complete essential amino acid composition and good fatty acid, people consume the duck meat. Large-scale duck production requires more efforts for higher efficiency and improving product quality by breeding, nutrition and management in accordance with animal welfare requirements and environmental protection. Duck feeds on natural scavenging system like insects, snails and waste from kitchen, paddy grains and weeds. Farmers rear duck on this food sources in addition to the feed received from foraging. Extra feed supplements are also necessary for better production, as per farmer economic condition.

Keywords: duck, integrated, meat, egg

1. Introduction

Duck farming plays a crucial part within the agricultural economy in Asian continent which alone accounts for 82.6% of the entire duck meat production of world (Jha and Chakrabarti, 2017) ^[1]. The duck meat and eggs are relished and consumed by people worldwide. Intensive awareness to empower rural households for duck farming to extend duck egg and meat on commercial aspects by rural household production is prerequisite (Adzitey and Adzitey, 2011) ^[2]. Duck rising may be a lucrative livestock industry within the globe due to its egg, meat and feather. Ducks are reared for eggs and meat production like chicken. Duck rising may be a lucrative livestock industry within the globe due to its egg, meat and feather. Ducks are reared for eggs and meat and feather production like chicken. Duck eggs are relatively larger, weighing about 4.5% of duck's weight, compared to chicken, whose egg weight is merely about 3.3% of the hen's weight (D. Narhari, 2009) ^[3]. The duck farming has the potential and may take the advantage to interact rural people in duck production and that they must tend adequate training for duck farming. It is an important tool for alleviating poverty among the rural communities and has great potentials in tribal area. These potentials can be tapped to reduce poverty among rural households or communities (Jha and Chakrabarti, 2017) ^[1]. As compare to chicken ducks are more prolific and more adaptable to free-range system of rearing. They also grow faster than chicken. That is why; they are more popular in many European and Asian countries. They need simple housing, compared to chicken (D. S. Rajput, *et al.*, 2014) ^[4]. In India poor village people can rear ducks easily.

Most of the farmers don't give any supplemental diets to their ducks. Generally they can get maximum return by giving minimum supplemental diets to their ducks. On the other hand improved feeding system of scavenging ducks was suggested by (Haque *et al.*, 1991) ^[5] to achieve optimum production.

2. Availability of exotic and local breeds

In India there are availability of exotic and native breeds of ducks for production like Khaki Campbell is one of the best egg and meat producing breed in ducks having fast growth rate and efficient feed converters (Adzitey and Adzitey, 2011) ^[2]. Duck breeds commonly used for meat production, egg production or for both purposes are easily available in India. As mentioned earlier on, exotic duck breeds like Pekin, Muscovy, Khaki Campbell, India Runner and mule are widely used for meat and/or egg production and are readily available in Asia. In recent times, numerous studies are administered to enhance upon the expansion, production performance and nutritional quality of those breeds. It has been reported that the fashionable domestic White Pekin duck perform better than the fashionable broiler chicken in terms of weight gain and feed efficiency to an equivalent live weight due to genetic improvement. These indigenous breeds are well adapted to the tough and hardy environmental conditions of Asia. They can prey on their own (foraging), survive local available feedstuffs, tolerate common environmental diseases and requires less skill to rear them. It is quite obvious that the majority people prefer things from their locality or society, but the performance traits of those breeds hamper their use for egg or meat production. Therefore there is the need for governments, scientists, concerned organizations and all stakeholders to work towards improving the performance characteristics of these indigenous breeds while maintaining and conserving their genetic diversity. Rural communities can cash in of the readily available duck breeds (both improved exotic breeds and indigenous breeds) to farm ducks and/or increase their production. There is already market for duck meat and eggs in Asia, therefore farming ducks can provide rural households jobs and income (Adzitey and Adzitey, 2011) ^[2]. The 'Desi' type duck found the major part of the duck population in Lakimpur and Dhemaj districts of Assam (Mahanta *et al.*, 2001) ^[6]. Primarily the farmers in Bangladesh reared 'Desi' and non-descript ducks (Jalil *et al.*, 1993) ^[7]. Nageswari were only found in limited pockets in the Cachar and Karimganj districts of Assam (R. Islam *et al.*, 2002) ^[8].

3. Duck Farming in Indian Scenario

The total poultry has increased by 16.81% and therefore the total poultry is 851.81 million during 2019. Backyard poultry increase over 45.78% and total backyard poultry is 317.07 Million in 2019. The commercial poultry has increased by 4.5% and the total commercial poultry is 534.74 million (20th Livestock Census, 2019) ^[9]. According to the data shown in census backyard poultry birds number has risen by a staggering 46 per cent between 2012 to 2019. And these poultry birds include fowls, ducks, emu, turkeys, quail and

other birds. In the commercial farms which are typically located near urban areas, number of poultry birds has risen by 4.5 per cent during the same period. As per FAO (FAO, 2010) ^[10] statistics, production of the duck meat increased from 0.026 million tonnes to 0.15 m tonnes, recording 577 percent increase in rate of growth, in 20 years. The current report on main duck meat producer countries indicates that, eight countries from Asia are among the top fifteen countries worldwide (FAO, 2010) ^[10]. The distribution and demographic dynamics of duck population revealed that they are concentrated in Eastern, North eastern and Southern states of the country. The leading states in duck population are West Bengal, Assam, Kerala, Andhra Pradesh, Tamil Nadu, UP, Bihar and Orissa (D. Narhari, 2009) ^[3]. Duck farming in India is characterized by nomadic, extensive, seasonal, and remains held within the hands of small and marginal farmers and nomadic tribes. Traditionally West Bengal and Kerala are the main consumer states for duck egg and meat and one among the explanations is that duck egg and meat highly suits and remains tastier for their fish based culinary preparations. Duck farming on small scale has been practiced for many years among rural communities for livelihoods and prevalent among weaker sections of rural population which provides them supplementary and steady income and employment and also provides nutritive duck eggs and meat for family consumption. (Jha and Chakrabarti, 2017) ^[11].

4. Socio-economic status of the Farmers

Duck farming was a subsidiary source of income for nearly all the farmers. People from all strata of the society, regardless of religion, education, occupation and economic background were involved. The majority (67.2%) were engaged in some sort of cultivation and their economic background was partially sound enough to take care of their families. All had gained their knowledge and experience of duck farming from their family predecessors (R. Islam *et al.*, 2002) ^[8]. In Kerala, mostly Christians were involved in duck farming, only 2% were illiterate and most were unable to support their families (Ravindran, 1983) ^[12]. Similarly most of the duck farmers belongs from in rural backward area were economically poor and were adopting the farming as a family profession. (Rithamber *et al.*, 1986) ^[13].

5. Systems of duck rearing

5.1. Free range system

The ducks are kept in enclosure only at night. At during the day time the ducks are free to roam outside for search of feed. And brought inside at night by putting some feed in extra amount in the shelter. The ducks only require night shelter and nests for laying eggs. Ducks will stay around the place, provided you treat them well. Advantage of this system is that the ducks go to the feed and harvest it themselves. This way, nutrients become available that the farmer cannot reach otherwise. Some farmers in herd their flocks to graze large areas after the rice harvest (R. Islam *et al.*, 2002) ^[8].

Table 1: Nutrient requirements of Ducks.

Nutrient	Starter (0- 8weeks)	Grower (9-20 weeks)	Layer	Breeder
ME Kcal/kg	2750	2750	2650	2650
CP %	22	16	18	15
Lysine	% 0.70	0.65	0.75	0.60
Methionine %	0.40	0.30	0.29	0.27
Ca %	0.65	0.60	2.5	2.75
Phosphorus %	0.40	0.30	0.45	0.30
Vitamin A, IU	2500	2500	6000	4000
Vitamin D3, IU	400	400	1000	900
Vitamin E Mg	10	10	20.00	10
Vitamin K Mg	0.50	0.50	2.00	0.50
Riboflavin ppm	4	4	5.00	4
Pantothenic acid ppm	11	11	15.00	11
Niacin ppm	55	55	55.00	55
Pyridoxine ppm	2.5	2.5	6.00	3.0

(K. P. Srivastav and B. Panda, 1982)¹⁴, (P. V. Sreenivasaiah, 2006)^[15]

5.2. Confined system

Ducks are kept enclosed permanently, either in a covered shelter (indoor system / intensive system) or with a run in the open. The ducks stay in the same place. It is easy to keep an eye on them and check them. An outside run of duck makes it easier to give the access to water, when pond can be put in the open run area (D. Narhari *et al.*, 1986)^[16].

5.3. Indoor system

The indoor system is for large-scale duck farms and where the production is mechanized to reduce labour costs (Nind and Tu, 1998)^[17]. The system requires more investment than the other two systems of housing. Farmer responsibility that, has to provide all feed and water properly and clean shelter regularly. If properly managed, growth can be fast and production cheap. In indoor system provide a large shallow container with water so that ducks can wash and bath. Like open drinkers they should be located over a drained area covered with wire or slatted floor (Adzitey and Adzitey, 2011)^[2].

5.4. Integrated Duck Rearing Systems

A well-known and established system, is the traditional 'duck-cum-rice system' or 'duck-cum-fish system' (Farrell, 1997)^[18]; (Setioko, 1997)^[19]; (Rajasekaran, 2001)^[20]; (Tai and Tai, 2001)^[21]. In this system duck production involves integrated with rice cultivation or fish farming. A symbiotic relationship exists between ducks and rice cultivation or ducks and fishes. The technique and knowledge of this system is easily available, known and practiced by rural communities engaged in duck production for centuries. It means that, little training and education is needed for such rural communities to improve upon this system to increase production to better their livelihoods (Adzitey and Adzitey, 2011)^[2]. Duck rearing combines well with other forms of farming like paddy and fish. In these systems the different forms of production complement each other and the farmer will have better production and more profit. Waste and by-products are used. It covers two well-known integrated systems.

5.4.1. Duck combined with paddy cultivation

In paddy fields ducks eat harmful snails and insects, this is a help for the paddy and at the same time the ducks get nutritious feed. The farmer spreads risks. Like if the rice yield is low there is still a yield of eggs and duck meat. Duck

farming from migrated duck birds is practiced by the poor agricultural laborers in South India. Farmer starts duck farming during the month of December by rearing ducklings. Ducklings were obtained from large farmers. By the month of February as the harvest of second crop of paddy is over the laborers starts migration with the ducks. The paddy cultivators of Tamil Nadu and Kerala generally welcome the ducks (G. Alok *et al.*, 2009)^[22].

5.4.2. Duck combined with fish ponds

Waste from the duck shed can be recycled and may be used for fish culture in integrated duck-fish farming (K. Bhagaban, 2006)^[23]. This process increases the production of natural food in the ponds, which in turn enhances the fish production. By integrating the duck and fish culture farming, more returns can be achieved by farmer. This gives the good benefits to the farmers. If the ducks are allowed to swim freely in the fishponds, the waste can be dispersed uniformly in the ponds and it can also be used as a good fertilizer. Because of these, expenses for fertilizer, feed, supplementary feed for fish is minimized. Ducks are inside the fishpond, it prevents the growth of the aquatic weeds and increases the biological productivity of the ponds. Due to the swimming action of the ducks, the amount of oxygen in the ponds gets increased. Ducks eat the weeds, insects, larvae, worms etc present in the pond, and hence there is no need to add more additional feed to them (D.S. Rajput *et al.*, 2014)^[4].

In duck - cum fish integrated farming, fishes with 10 cm length only to be stocked because fishes less than this length may be eaten by the ducks. Fish seeds can be stocked at the rate of 10000 numbers/ha which is depending upon the nature of the fishpond and the availability of fish seeds the stocking density may vary. Raising and rearing of ducks depends upon the type of the species and egg laying capacity (N. Ravisankar *et al.*, 2012)^[24]. To get more meat and egg from the duck-fish culture, proper management practices plays a vital role. The shed should be well ventilated and stagnant of waste water should be prevented. 200 ducks are sufficient for fertilizing 1 ha pond. Ducks get their natural food from the pond itself. The domestic waste, rice bran, broken rice and pulses are more than enough for them (N. Ravisankar *et al.*, 2012)^[24].

5.4.3. Duck, fish with paddy cultivation

Duck and fish can be reared together in the same field where paddy is being cultivated. This system adds other advantages to rural farmers. Manure from duck which can be used to improve soil fertility of agricultural lands. The duck manure can also be used as a source of organic matter in fish farming

to improve the growth of both phytoplankton and zooplankton which serves food source for fish. Droppings from duck can encourage the growth of aquatic snails, worms and other aquatic fauna and flora that act as feed for ducks. This system has also reported to increase productivity, ensure efficient use of water lowers spread economic risk of price fluctuation, has minimal environmental impact and a good system for sustainable agriculture (Tai and Tai, 2001) [21]. There is some evidence that fish-duck production system played a vital role in improving food security, nutrition and income level among households in rural Indian who were involved in fish-duck production compared to households which were not (Rajasekaran, 2001) [20].

6. Feedstuff availability for ducks

Feed is one of the most important factors to consider in any farming venture. Feed alone constituent about 70% of total production cost (Singh *et al.*, 2009) [25].

6.1. Duckling

Most of the farmers provided broken rice, crushed snails and cooked rice to the ducklings up to 15 days of age. After that they were fed kitchen waste, paddy grains, cooked arum (root), cooked vegetables and cooked rice, in addition to the feed received from foraging. The duck farmers in Tamil Nadu fed their ducklings different diets according to age, (Reddy, 1987) [26].

6.2. Adult duck

The primary sources of feeding for adult ducks were post-harvested paddy fields for grains, ponds and waterlogged areas for fish, snails and insects (Ravindran, 1983 and Reddy, 1987) [12, 26]. On the other hand, duck farmers in Kerala, Andhra Pradesh, Tamil Nadu and Indonesia feed adult ducks with the mixture of locally available feed ingredients. The survey also found that ducks in some areas were driven to distant locations in search of water for grazing and watering during periods of drought (R. Islam *et al.*, 2002) [8].

Under the traditional systems of duck production, ducks can scavenge on their own to obtain the necessary nutrients needed for their growth. By this feed supplementation (manufactured) can be avoided and subsequently reduction in feed cost. Non-conventional feedstuffs have been demonstrated to be valuable feed for poultry (Men *et al.*, 1995) [27]; (Adzitey *et al.*, 2010) [28]; (Dei *et al.*, 2010) [29]. Feed supplementation increased egg production of indigenous ducks (Haque *et al.*, 1991) [5]. Increasing ducks production under semi-scavenging system is closely related with the development of feeding system.

Table 2: Availability of Natural feed for scavenging

Session	Availability of scavenging feeds	Degree of Supplementation
Lean season (Summer)	Green grass, snails, small fishes, duck weeds etc	Supplementation is needed
Abundance season (Rainy)	Small fishes, snails, oyster, duck weeds, azolla, green grass, tadpoles, crabs, weed seeds, earth worm, insects etc	No Supplementation needed
Moderately abundance (Winter)	Whole paddy, grains, weed seeds, snails, crabs, small fishes, green vegetables etc	Supplementation is needed

6.3. Feed ingredients for supplement 10 kg feeds (Adult bird)

Ingredients	Quantity
Maize	4 kg
Rice Polish	3 kg,
Mustard Cake	1 kg
Min mix	350 g
Salt	250 g
Vita. mix	250
Antibiotics	75 g
Cocciostate	75 g

7. Care and Management of Duck

7.1. Care of Duckling

Electric lamps were used as a heat source for the first 1-2 weeks for brooding of ducklings (Nind and Tu, 1998) [17]. Ducklings up to 15 days of age were confined in enclosures in open areas surrounded by bamboo baskets specially made for this purpose. From 7 days of age they were allowed to swim in nearby ponds, waterlogged areas or canals. At night, ducklings were housed in one corner of the farmer's dwelling house, enclosed by wooden or bamboo mats. A practically similar type of rearing system was practised in Kerala (Ravindran, 1983) [12]. Ducklings may be brooded on wire floor, litter or batteries (Van and Dikken, 2004) [30]. The brooding period of layer ducklings is 3-4 weeks. For meat type ducklings, brooding for 2-3 weeks is sufficient. The temperature of 32 °C is maintained during the first week. It is reduced by about 3 °C per week till it reaches 24 °C during the fourth week. In wire floor, space of 0.5 sq. ft. per bird and in litter 1 sq. ft. per bird is sufficient up to three weeks of age. Water in the drinkers should be 5.0-7.5 cm deep, just sufficient to drink and not to dip themselves. In deep litter brooding, the thickness of the litter will be 3 cm and above to absorb the excess moisture in the ducks' droppings. In extensive system, no artificial warmth is provided, but the heat of brooding shed is conserved by making "Closed tents". After 15 days they were released and allowed to forage freely with their mother. The ducks are allowed to swim in water after the brooding period is over.

7.2. Care of adult Ducks

The farmers usually kept adult ducks under a scavenging or free-range rearing system in which the ducks were let loose in the morning and returned to the farmer's home yard in the evening. During the night they were put in a holding pen constructed on an elevated area surrounded by paddy fields. Only a few (8%) of farmers adopted an integrated duck/fish farming system (Rithamber *et al.*, 1986) [13] and (Mahanta *et al.*, 2001) [6] in Andhra Pradesh and Assam respectively. The duck farmers of Kerala followed a nomadic life that required continuous movement with their flocks, (Ramachandran and Ramakrishnan, 1982 and Ravindran, 1983) [31, 12]. Under intensive system a floor space of 4 to 5 sq. ft. is essential, where as in semi intensive system a floor space of 3 sq. ft. in shelter and 12-17 sq. ft. in outfield is sufficient. A feeding space of 6-7 cm. is sufficient. In rural duck farming, straight run ducklings (male and female) will be reared up to 10 to 15 weeks of age (Van and Dikken, 2004) [30]. For laying bird 30x30x45 cm. size box is sufficient for three birds. For layer light of 16 hours is sufficient. In layer mating ratio of 1:6 to 7 and for meat breeds a ratio of 1: 4 to 5 is sufficient (R. Singh, 2019) [32]. Under intensive system, a floor space of 4 sq. ft. per bird is essential. In semi intensive system a floor space of

3 sq. ft. per bird for night shelter and 10-12 sq. ft. per bird of outside run space is required (A. J. Smith, 1990) [33].

7.3. Breeding Management

The desirable sex ratio for good fertility and hatchability for ducks is 1:6 for intensive rearing and 1:15-20 for extensive rearing system. In extensive system of rearing of rural ducks, farmers keep a wide sex ratio of 1:20-25, however they get a reasonable good fertility of 70-80 percent (MacDonald and Low, 1985). Drakes usually mate during swimming.

7.4. Health Management

The most prevalent diseases were duck plague, duck cholera, hepatitis and botulism. Diseases in ducks, is most likely the result of unsanitary surrounding and faulty management or inherent weakness due to breeding. Ducks are more vigorous and less subject to diseases than chicken and turkeys. The highest mortality in local ducks due to duck cholera (Mahanta *et al.*, 2001 and Karim, 1987) [6, 35]. Mortality due to diseases was 10-15% in ducklings and below 10% in adults (Reddy 1987)26. The health protection offered by the farmers included occasional vaccination against duck plague, treatment with common antibiotics, potash solution, local vodka and black pepper. Flocks were routinely vaccinated against duck plague, (Ramachandran and Ramakrishnan, 1982 and Ravindran, 1983) [31, 12]. However, none of the farmers vaccinated their duck flocks against any of these diseases (Rithamber *et al.* 1986) [13].

Parasitic control -Ducks are resistance to internal parasites. The internal parasites include flukes, tape worm, and round worm. The infestation is prevalent only among those ducks which have access to stagnant water, overcrowded ponds. The external parasites include lice, mite ticks and ticks.

8. Prevention and control

1. Different types of anathematic drugs should used for controlling parasitic control.
2. Vaccinations - Some diseases are so infectious or so common in ducks by vaccinating the ducks, can protect them. Good hygiene and vaccinating ducks are the two most important aspects of preventing ducks becoming ill (National Agricultural Extension and Research Liaison Services, 2000) [36].
3. Purchasing disease free stock, sanitation, mineral & vitamin supplementation, periodic used of coccidiostate, deworming and following schedule vaccination are the important steps for prevention of diseases.
4. Common Medication for Duck: _____
 - A. Electral: _____10g/lit water at the time of arrival of duckling.
 - B. Antistress like Stresroak: _____20g/lit water at the time of arrival and one in every week.
 - C. Multivitamins like Vimeral: _____5ml/lit water 5 day continuously every month.
 - D. Amprolium (Anticoccidiostate): _____1g/lit water in normal bird start at 3 weeks of age continued 5-7 days and repeat every 2 month. In case of disease 2-5g/lit water.
 - E. Dewormer:_____ 15g/100birds, start at 3 weeks of age, continued 5-7 days and repeat every 2 month.
 - F. Tetracycline: _____5g/lit water for 5-7 days in case of diarrhea.

9. Conclusion

Duck keeping was a subsidiary source of income in India.

Ducks are more prolific birds and produce about more eggs (about 20-25) than backyard chicken. Duck farming in India is in an emerging sector. It needs lot of awareness in people for its betterment in future. There are readily available exotic and local breeds of ducks for production. Ducks have long productive and profitable life i.e., they lay eggs profitably during second and third year also. Ducks supplement their feed by foraging; hence it will reduce the feed cost. It lays their eggs during early in the morning and saves time and enables easy egg collection. Duck farming is having symbiotic relationship with paddy cultivation, so ducks and paddy cultivation can be integrated in the entire paddy farming areas. Ducks involved in integrated farming so farmer can able to get other resource income also, like symbiotic relationship with paddy cultivation. These are quite intelligent birds and they can be easily trained for their daily routine, and it reduces the labour for management. They are quite hardy birds, easily brooded and resistant to common avian diseases. The knowledge of traditional duck production is required to established in India because improper management practices leads to lowers the production.

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