EVALUATION OF PRODUCTIVE PERFORMANCE OF DESI DUCKS REARED IN CONFINEMENT

By

C. V. ANDREWS

THESIS

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DECLARATION

I hereby declare that this thesis entitled "Evaluation of Productive Performance of Desi Ducks Reared in Confinement" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Place : Mannuthy

Date : 20-12-1978

Signature :

Name : C.V. ANDREWS

CERTIFICATE

Certified that this thesis, entitled "EVALUATION OF PRODUCTIVE PERFORMANCE OF DESI DUCKS REARED IN CONFINEMENT" is a record of research work done independently by Sri. C.V. Andrews under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

Name of the guide: Dr.C.K.Venugopalan

(Chairman, Advisory Board)

Place : Mannuthy

Date : 20-12-1978

Designation : SENIOR SCIENTIST

SENIOR SCIENTIST,
A.I.C.R.P. ON POULTRY (EGG)
Kerala Agricultural University
MANNUTHY-680 651 KERALA

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INTRODUCTION

Ducks (<u>Anas platyrhynchus domesticus</u>) numbered over nine million in the country according to 1972 census of which about four per cent were in Kerala. Within the State over half of the 3.6 lakhs duck population is concentrated in the district of Alleppey. Other districts with more than twenty per cent of duck population are Quilon and Palghat (Anon, 1975).

Ducks form only about three per cent of the total poultry population in the State. It has been estimated that they contribute 2.5 per cent of the total 960 million eggs produced per annum (Anon, 1976a). The major egg marketing centres in the State are concentrated in the Alleppey district and adjoining areas of Quilon and Ernakulam districts.

Ducks are by nature water loving birds and are seen in large numbers in back water areas of the State with flocks numbering 500 and above. Ducks are profitable from commercial point of view as they lay economically in the second year and even in the third year of production thereby reducing the cost of replacement (Mohapatra, 1978). The National Commission on Agriculture (Anon, 1976b) has recommended duck farming in the State as the coastal belt provides ideal environment for duck rearing. The Commission has commended the bigger size and stronger shell characteristics of duck eggs as favourable points in the transportation and marketing of eggs. Nutritionally,duck eggs and meat are comparable with those of hens but owing to certain disagreeable flavours, duck products are not universally acceptable to consumers, though they are believed to have certain medicinal properties.

Studies on ducks conducted in countries like Malaysia, Australia, England and elsewhere in India have been on body weight gains and quantity and quality of edible meat yields. Systematic studies on egg production potential of ducks have not been carried out to any large extent. From the literature available it is clear that ducks have been viewed more as meat producers as meat is relatively more in demand than eggs. Thus duck rearing in most places has been moulded to cater to the market requirements for meat; with egg production forming only a by-product of the duck industry. The situation in Kerala, however, is just the reverse in that ducks here are reared mostly for egg production; only surplus males and spent ducks are used for meat purposes. Available evidence and observations clearly point to the role of ducks as egg producers in competition with hens particularly in pockets of the State providing conducive environment for ducks. Though duck farmers place emphasis in egg production no scientific study has been conducted to estimate the egg production potentials and the cost structure relating to egg production. The nature of duck rearing in the State which is largely on traditional lines also needs the research fillip to put duck farming on scientific lines.

Duck rearing has largely been migratory in nature with two or three labourers moving with flocks approaching 5000 ducks. Low managemental levels coupled with periodic outbreaks of contageous diseases have made duck rearing highly risky. In the light of shrinking land resources, increasing attempts are being made to reclaim water logged areas for crop cultivation thereby increasing the problems of rearing ducks on traditional lines. This situation necessitates in depth investigations on various aspects of duck farming to develop suitable practices to exploit the vast potential offered in duck rearing. With increasing limitations on migration, it becomes all the more necessary to investigate potentialities of duck management under confinement so as to make duck rearing commercially viable.

This study, therefore, envisages the possibilities of rearing Desi ducks in confinement on lines similar to scientific poultry rearing so as to take advantage of the benefits of confinement rearing. The study would also reveal the egg production, feed consumption, body weight maintenance, livability, egg characteristics and hatchability of Desi ducks reared in confinement.

REVIEW OF LITERATURE

Perusal of literature reveals paucity of information on the production traits of Desi ducks in general. Studies in the past seem to be limited to egg quality, egg weight and growth rate of ducks. Information on the egg production potential, feed efficiency, maintenance of body weight and livability is of utmost importance in commercial rearing of ducks.

Abakumov (1971) analysed the records from 1959 to 1966 and observed that the birds with access to ponds had in 1960 and 1966 a feed conversion efficiency of 5.18 and 4 and a production of 137 and 213 eggs per duck per year respectively. Corresponding values for birds without access to water in 1959 were 5.46 and 90 eggs.

Rikhter et al.(1975) after comparing two systems of housing ducks viz unlimited access to pond or to confinement in a fenced area with access to 3 x 100 m pools (ie 0.6 sq.m. of water area per bird) reported that the feed consumption per kg gain in body weight was 6.1 to 8.5 and 5.7 to 6.6 respectively.

Mohapatra (1978) reported that in Khaki Campbell the individual egg production of almost an egg a day for over twelve months have not been uncommon and flock averages in excess of 100 eggs per annum have been obtained. He also reported that the average egg production for Indian Runner breed ranges from 250-300 eggs per bird per year.

Sivadas (1978) reported that the egg production for Desi ducks after 8 months of age and four months in production had reached a little under 15 per cent production. The poor production in the ducks was attributable to the effects of exposure to aflatoxin contaminated feed very early in their life.

Bundy and Diggins (1960) have opined that the use of range may result in a saving of 10-20% of feed compared to complete confinement system. Similarly Ramakrishnan (1975) observed that the birds under confinement consumed more quantity of feed to the birds on range.

Marais et al. (1968) reported that White Pekin ducks had higher body weight at 8, 10 and 12 weeks of age than White Plymouth Rock but the feed conversion ratio was 5.3 in ducks as compared to 2.97 in chicken at 12 weeks of age.

Podoba (1970) observed that feed conversion efficiency was better by 5.5 to 15.82 per cent in cross bred ducks eventhough the body weight of the same was intermediate.

Majna _et al._ (1973) observed an average body weight of 2512 g and feed conversion ratio of 2.96 at 53rd day of life in White Pekin ducks.

Moudgal (1974) reared the ducks under intensive system on deep litter after four weeks of initial battery brooding and reported a body weight of 1932 g and feed conversion ratio of 2.64 at seven weeks of age.

Surendranathan and Nair (1971) reported that eighty six apparently healthy adult non-specific Desi breed of domestic ducks aged twelve months, indigenous to Kerala when confined to dry surroundings for a prolonged period of 3 months provided with water only for drinking showed a reduction in body weight from 1463 to 1179 g.

Mc clung and Jones (1973) reported that for egg type chickens the body weight is usually measured at maturity, but there are indications that birds continue to gain weight after maturity.

The early growth and quick attainment of greater portion of the mature weight as characteristics of ducks and geese were reported by Milby and Henderson (1937).

Shmelev and Gutsulyak (1974) reared two groups each of fifty Pekin ducks, one with unlimited access to a pond and the other in a fenced area without access to the pond. The feed utilization per kg gain was 5.35 and 4.73 respectively. He also reported that the body weight at 60 days of age in birds with access to pond exceeded that of the other by 11.5 per cent.

In studies on weight gains and changes in body confirmations from hatching until 28 weeks of age in Pekin as well as Mullards, Gibes (1975) observed that weight gains were faster at 4 weeks of age and increase in body length at 8th week in both groups. But after 5 weeks of age there was a decline in growth rate in both.

Singh et al.(1976) studied the effect of different systems of housing on growth, feed efficiency and mortality in Pekin ducks and observed that there was no significant effect of systems of housing on body weight of ducks at six weeks of age. They also pointed out that the feed utilization was best in the semi intensive system at all ages and also the mortality upto ten weeks was lowest in the intensive system.

Blount (1965) in his feeding trials on ducklings over a six weeks period on diets including 2.5, 5, 7.5 per cent a strongly toxic meal giving dietary concentrations of approximately 0.3, 0.6, and 0.9 ppm aflatoxin B_1 respectively, again demonstrated a greater susceptibility of ducklings to aflatoxin. On the lowest level of inclusion there was no deaths among the poults whereas 30% of the ducklings died and the survivors showed a much greater depression in final weight gain than poults.

Romanoff and Romanoff (1949) reported that the proportional parts of duck's egg weighing 80 g has the percentages as 52.6, 35.4 and 12.0 for albumen, yolk and shell respectively.

The mean weight of duck eggs as reported in Indian literature varies from 62 to 72 g (Bose and Mahadevan 1956).

Johnson and Zindel (1964) observed that average body weight of caged birds was significantly more than that of floor birds and that eggs of caged birds had significantly thicker shells than those from floor birds.

Romanoff (1967) has reported that the mean weight of eggs of different breeds of ducks as Pekin 85 g, Mullard 80 g, Muscovy 70 g and Runner 60 g.

Ahamed et al. (1971) collected 12 eggs every four days from 100 Khaki Campbell ducks and from 100 W.L. hens for 3 months in the middle of their first year of lay. Mean egg weight was 53.4 and 49.5 g, mean albumen thickness 4.62 and 4.32 mm, albumen weight 28.53 and 26.20 g, weight of yolk 15.55 and 13.96 g, shell thickness 0.33 and 0.29 mm, shell weight 4.5 and 3.8 g and shell membrane 0.55 and 0.35 g respectively. All differences were significant.

Sergeeva (1975) studied the morphological physical and chemical properties of duck eggs at different stages during the laying season. Egg quality changed with the age of female. During the first month of lay eggs were light in weight, had an oblong shape, high shell quality, low vitamin content. By eleventh month of age, they had lower specific gravity and their shape became rounded. The content of thick albumen and vitamin was positively related to hatchability.

Kotia _et al_. (1975) compared the quality characters of eggs laid by 50 caged W.L. pullets with those from 50 pullets kept on litter. They found that caged birds produced significantly heavier eggs with thicker shells than birds on deep litter.

Hagger _et al_. (1975) analysing the results for the five laying seasons observed that battery hens were significantly superior to hens on floor in egg production egg weight, feed conversion, shell thickness and albumen quality.

The period of incubation for duck eggs is 28 days whereas for the Muscovy or Brazilian is from 33 to 35 days (Ives, 1951).

Chatterjee (1956) observed that the optimum results in hatchability with duck eggs were obtained with 70-75 per cent relative humidity. He further stated that when the relative humidity was above 75 per cent or below 65 per cent the hatchability results were poor.

Mc Ardle (1966) suggested that duck eggs should be incubated in forced draught incubators at 37.5°c for best results. He also recommended that the relative humidity should be about 70 per cent. He also stated that spraying of warm water over the duck eggs during the last four days of incubation as a means to provide higher humidity.

George (1977) observed that the mean fertility per cent of eggs collected from ducks reared on free range was 88.63.

MATERIALS AND METHODS

MATERIALS AND METHODS

A trial of 46 weeks duration was carried out to evaluate the production performance of Desi ducks reared in confinement. One hundred Desi ducks of the same strain and hatch selected at random constituted the experimental subjects. These birds were 135 days of age at the commencement of the trial. Ducks were wing badged, weighed individually and then randomly allotted to two groups of fifty each. One group was reared under intensive system while the other group was maintained under semi-intensive system. Both the groups were provided with the same type of shelter having 4.4 m length and 4.4 m breadth ie 19.36 m^2 floor area to give 0.39m^2 (3900 cm^2) per bird. The group under semi-intensive system was provided with an additional run having 23.7 m length and 17.7 m breadth giving 400.1 m^2 area ie 8.39 m^2 (83900 cm^2) per bird. They were allowed free access to the run during day time and were kept in the house during night time. Wood shavings were provided as litter in both the houses. Wallowing facilities were not provided for both the treatments.

The layer ration was computed following the composition of duck layer diets given in other Universities in the country (Singh and Pal 1973). The composition and chemical analysis of the ration are set out below:

Composition of diet

Ingredients	Quantity used/100 kgs.
1. Yellow maize	30
2. Rice polish	10
3. Dried tapioca chips	10
4. Gingelly oil cake	25
5. Coconut cake	10
6. Fish meal	10
7. Shell grit	2.5
8. Mineral mixture	2.5
For every 100 kg of mixed feed added:	
1. Sod. chloride	250 g
2. Rovimix A B_2 D_3*	25 g
3. Galinex**	25 g
Analysed composition	Percent
1. Dry matter	93.2
2. Crude protein	17.3
3. Ether extract	3.0
4. Crude fibre	9.4
5. N.F.E.	57.5
6. Total ash	12.8
7. A.I. Ash	4.0
8. Calcium	3.31
9. Phosphorus	1.17

* Rovimix A + B_2 + D_3 (Roche Products India Limited) contained Vitamins A, B_2 and D_3 at levels of 40,000 I.U., 20 mg and 5000 I.U. per g respectively.

** Galinex (blue cross farma) each contained Vitamin B1, Vitamin B_2, Vitamin B_6, Vitamin B_{12}, Vitamin E, Cal. Panto, Niacin and Folic Acid at levels of 4 mg, 5 mg, 8 mg, 60 mcg, 40 mg, 40 mg, 60 mg and 4 mg respectively.

Feed and water were provided *ad libitum* throughout the experimental period. Care was taken to keep the feed wastage minimum by keeping the feed through always half full.

The first phase of experimental period was divided into six periods of 28 days each. The egg production, feed consumption, feed efficiency, livability, body weight maintenance and egg quality studies involving egg weight, shell weight, thin and thick albumen weight and yolk weight were recorded in all the six periods. Making use of the data pertaining to egg production and feed consumption during each period, feed efficiency was calculated. The body weight of individual ducks in both the treatment groups was recorded on the last day of each period. Based on the data obtained, the pattern of body weight maintenance in each experimental group was worked out. The number of ducks died during each period was recorded and the percentage livability was calculated.

Five eggs were selected at random from each treatment group daily on the last three days of each period for egg quality studies. However, during the fourth period, since there was a decline in egg production only three eggs from each treatment group could be selected daily.

The eggs from each treatment group were broken out carefully onto a glass plate for visual examination. The thin and thick albumen and yolk were separated and were weighed individually. Also the weight of shell was recorded. The percentages of different components in relation to total egg weight were calculated. In all, quality studies were carried out in 174 eggs.

In the second phase a total of 161 eggs from the intensive group and 145 eggs from semi-intensive group were saved for fertility and hatchability studies. A male:female ratio of 1:12 was maintained in both the treatment groups. The number of eggs set for each hatch and the percentage of fertility and hatchability are set out in table 15.

The eggs were held in a well ventilated room for a maximum period of seven days before they were set. The eggs were subjected to pre-incubation fumigation and were arranged in setting trays at random in a chicken-egg incubator which was previously cleaned, disinfected and tested.

The temparature and humidity maintained in the incubator are detailed below:

Setter	Tempt. °c (dry bulb)	Humidity °c (wet bulb)
1-24 days	37.2 - 37.3	32.2 - 33.3
Hatcher 25th-28th days	37.2	33.3 - 34.4

Warm water was sprayed over the eggs during the period of incubation with a view to give higher humidity (Mc Ardle, 1966). Eggs were turned six times daily from 4th to 24th day. Eggs were candled on 8th, 18th and 24th days of incubation. Infertile eggs were removed on the above days and the hatch was taken out on the 29th day.

The data pertaining to the study were subjected to statistical studies according to Snedecor and Cochran (1967).

RESULTS

RESULTS

Egg production

Data relating to per cent hen-day egg production of ducks reared under intensive and semi-intensive systems and their chi-square values were as shown in Table 1. The data revealed that the percentage mean hen-day production for the intensive and semi-intensive systems were 14.49 and 12.60 respectively. The aggregate average egg production under the intensive system was significantly higher ($P < 0.01$) than that under the semi-intensive system. This difference was largely due to the significant differences observed during the early periods of the experiment.

Feed consumption

In Table 2, the average quantities of feed consumed per duck per day are shown. Significant differences in feed consumption (Table 4) between treatments as well as periods were evident with higher mean values for intensive system (191 g) compared to semi-intensive system (185 g). Between periods consumption was more in the early than later periods. Incidently this higher rate of feed intake also coincided with higher egg production.

Feed efficiency

Feed efficiency expressed as the quantity of feed (kg) required to produce a dozen eggs are set out in Table 3. The mean feed efficiencies were not significantly different (Table 4) between treatments, though ducks under intensive system used 19.49 kg of feed per dozen eggs compared to 22.70 kg for ducks under semi-intensive system. Feed efficiency was better during early periods of the study than the later periods as a result of better egg production.

Body weight maintenance

Average body weight of ducks under intensive and semi-intensive systems for the six periods were as shown in Table 5. It is apparent from the Table that the overall body weight was found to be better in confinement system when compared to the semi-intensive system though the statistical analysis showed no significant difference. In both the systems, the average body weight was found to gradually decrease over the periods except for the last.

But analysis of data on body weight of the individual ducks (Table 6) in both the groups did not reveal any significant linear regression on the periods. Instead, the deviation from linearity was found to be significant ($P < 0.05$). However, the pattern of body weight maintenance between periods was nearly the same in both the systems.

Livability

The data relating to livability are shown in Table 16. Mortality was generally negligible and survival rates were over 96 per cent in both the treatments.

Egg quality traits

Egg quality studies were carried out on random samples of eggs collected from the two groups during the last three consecutive days of each period. The traits studied were egg weight, per cent thin albumen, thick albumen, yolk and shell. The mean egg weights and percentage of egg components as influenced by the housing systems are summarised in Table 14. The average weight of eggs in the intensive system of rearing was 60.42 g, the per cent albumen, per cent yolk and per cent shell being 56.13, 30.26 and 13.62 respectively. Of the total albumen in the eggs laid by birds in the intensive system the thin and thick albumen proportions were 42.44 and 57.56 per cent respectively. In the semi-intensive system the mean egg weight was 60.66 g while the per cent albumen, per cent yolk and per cent shell were 56.01, 30.79 and 13.24 respectively, the thin and thick albumen being 42.25 and 57.75 per cent.

Egg weight.

The average egg weight for the two groups during the six periods are shown in Table 7. Under intensive and semi-intensive systems, mean egg weights were 60.42 g and 60.66 g respectively. The apparent difference was not statistically significant. But significant differences were observed in the mean egg weights between earlier and later periods indicating higher mean weights during the later periods of the experiment (Table 12).

Thin albumen.

Table 8 shows the quantities and percentages of thin albumen to the total weight of the egg. Analysis of the data revealed the percentage contribution of thin albumen as 23.82 and 23.67 for intensive and semi-intensive rearing respectively. Though there was no difference between treatments (Table 12) significant differences were obtained between periods.

Thick albumen.

Similar to thin albumen the per cent thick

Fertility and Hatchability

The results of fertility and hatchability in the two systems of housing are shown in Table 15. The per cent hatched in the semi-intensive system (26.85) was found to be significantly higher than the per cent hatched (9.23) in the intensive system. The per cent of infertility (25.52) in the semi-intensive system was significantly lower than the per cent infertility (59.63) in the intensive system.

The overall performance of experimental birds in both the systems of rearing are presented in Table 16.

Table 1. Per cent hen-day egg production

Treatments	Periods						Mean for treatments
	1	2	3	4	5	6	
Intensive	12.79	25.36	19.75	6.55	13.47	8.78	14.49
Semi-intensive	19.36	19.36	13.56	4.37	11.37	8.31	12.60
Chi-square value	18.81**	13.69**	15.80**	5.30*	1.85	0.06	8.92**

** Significant at $P < 0.01$

* Significant at $P < 0.05$

Table 2. Mean daily feed consumption (g) per bird in different periods as influenced by the rearing system.

Treatments	Periods 1	2	3	4	5	6	Mean for treatments
Intensive	196	196	185	197	195	177	191[a]
Semi-intensive	194	194	181	188	189	166	185[b]
Mean	195	195	183	192.5	192	171.5	188.5

C.D. for comparing period means = 10.62 ($P \angle 0.01$)

Means carrying same superscript did not differ significantly ($P \angle 0.05$)

Table 3. Feed efficiency (kg feed/doz eggs) as influenced by the housing system.

Treatments	Periods 1	2	3	4	5	6	Mean for treatments
Intensive	18.46	9.45	11.23	36.22	17.42	24.14	19.49[a]
Semi-intensive	12.05	12.67	16.01	51.62	20.01	24.07	22.70[a]
Mean	15.26	11.06	13.62	43.92	18.72	24.11	21.09

C.D. for comparing period means = 12.98 (5% level)

Means carrying same superscript did not differ significantly.

Table 4. Analysis of variance for the different production characteristics studied.

Source	df	SS	MSS	F
1. <u>Feed consumption</u>				
Treatments	1	96.33	96.33	13.89*
Periods	5	862.67	172.53	24.89**
Error	5	34.67	6.93	-
2. <u>Feed efficiency</u>				
Treatments	1	31.72	31.72	1.24ns
Periods	5	1452.77	290.55	11.41*
Error	5	127.37	25.47	

** Significant ($P < 0.01$)

* Significant ($P < 0.05$)

ns Non significant.

Table 5. Average body weight maintenance of ducks (g) influenced by the housing system.

Treatment	Initial weight	Periods 1	2	3	4	5	6	Mean for treatments
Intensive	1437.5	1437.8	1369.5	1352.3	1303.0	1284.0	1311.0	1356.44^{ns}
Semi-intensive	1442.5	1410.2	1348.5	1309.2	1323.0	1252.0	1281.0	1338.06

No significant difference between treatments (t = 0.28)

Table 6. Analysis of variance of individual body weight gain (g) for different periods.

System	Source	df	SS	MSS	F
Intensive	Linear regression	1	23575.37	23575.37	2.11 ns
	Deviation from regression	4	137048.86	34262.22	3.06 **
	Error	287	3208353.45	11178.93	
	Total	292	3368977.68		
Semi-intensive	Linear regression	1	41169.85	41169.85	2.53 ns
	Deviation from regression	4	167252.6	41813.15	2.57 *
	Error	287	4667070.38	16261.57	
	Total	292	4875492.83		

ns non significant

* significant ($P < 0.05$)

** significant ($P < 0.01$)

Table 7. Average egg weight (g) as influenced by the two systems of housing.

Treatments	Periods 1	2	3	4	5	6	Mean for treatments
Intensive	56.05 (15)	56.28 (15)	58.25 (15)	69.75 (12)	63.01 (15)	61.04 (15)	60.42^{a} (87)
Semi-intensive	56.61 (15)	56.82 (15)	57.66 (15)	71.21 (12)	61.18 (15)	63.98 (15)	60.66^{a} (87)
Mean	56.33^{a}	56.55^{a}	57.96^{a}	70.41^{c}	62.10^{b}	62.51^{b}	60.54

Figures in parenthesis shown number of eggs studied.

Means carrying the same superscript did not differ significantly.

Table 8. Mean of thin albumen (g) and percentage of thin albumen as influenced by the housing system.

Treatments	Periods												Mean for treatment	
	1		2		3		4		5		6			
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Intensive	11.32	20.20	11.89	21.13	15.18	26.06	17.45	25.02	16.25	25.79	14.89	24.39	14.39[a]	23.82
Semi intensive	12.13	21.43	12.46	21.93	15.25	26.45	17.49	24.56	15.45	25.25	14.22	22.23	14.36[a]	23.67
Mean	11.72	20.81	12.18	21.54	15.22	26.26	17.47	24.81	15.85	25.52	14.56	23.29	14.38	23.75

Means carrying same superscript did not differ significantly

Table 9. Mean weight of thick albumen (g) and percentage of thick albumen influenced by the housing system.

Treatments	Periods 1		2		3		4		5		6		Mean for treatment	
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Intensive	20.77	37.06	19.27	34.24	18.99	32.60	20.94	30.02	17.78	28.22	19.64	32.18	19.52[a]	32.31
Semi intensive	20.37	35.98	19.42	34.18	18.66	32.36	21.70	30.47	16.67	27.25	21.63	33.81	19.62[a]	32.34
Mean	20.57	36.52	19.34	34.20	18.83	32.49	21.28	30.22	17.23	27.72	20.63	33.00	19.57	32.32

Means carrying same superscript did not differ significantly

Table 10. Mean weight of yolk (g) and percentage of yolk as influenced by the housing system.

Treatments	Periods												Mean for treatment	
	1		2		3		4		5		6			
	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%	wt.	%
Intensive	15.59	27.81	16.69	29.66	15.85	27.21	22.89	32.82	21.19	33.63	18.40	30.14	18.28[a]	30.26
Semi intensive	15.82	27.95	16.54	29.11	16.07	27.87	24.97	33.80	21.30	34.82	20.10	31.42	18.68[a]	30.79
Mean	15.70	27.87	16.61	29.37	15.96	27.54	23.43	33.28	21.24	34.20	19.25	30.80	18.48	30.52

Means carrying same superscripts did not differ significantly

Table 12. Analysis of variance for the egg characteristics studied.

Source	df	SS	MSS	F
<u>Egg weight</u>				
Treatments (adj)	1	9.43	9.43	0.798^{ns}
Periods (adj)	5	3549.03	709.81	60.056^{**}
Interaction	5	99.01	19.80	1.712^{ns}
Error	160	1851.19	11.57	
<u>Thin albumen</u>				
Treatments (adj)	1	0.005	0.005	0^{ns}
Periods (adj)	5	663.093	132.619	77.015^{**}
Interaction	5	15.532	3.106	1.85^{ns}
Error	161	270.301	1.679	
<u>Thick albumen</u>				
Treatments (adj)	1	1.149	1.149	0.285^{ns}
Periods (adj)	5	311.99	62.398	15.503^{**}
Interaction	5	43.165	8.683	2.24^{ns}
Error	160	620.940	3.881	
<u>Yolk</u>				
Treatments (adj)	1	11.553	11.553	2.474^{ns}
Periods (adj)	5	1315.681	263.136	56.358^{**}
Interaction	5	18.925	3.785	0.806
Error	160	751.503	4.697	
<u>Shell weight</u>				
Treatments (adj)	1	1.459	1.459	5.248^{*}
Periods (adj)	5	9.113	1.823	6.558^{*}
Interaction	5	1.829	0.366	1.331
Error	161	44.347	0.275	

** significant ($P \angle 0.01$)
 * significant ($P \angle 0.05$)
ns non significant

Table 13. Summary of egg qualities of both systems pooled together

Contents	Periods 1 wt.	1 %	2 wt.	2 %	3 wt.	3 %	4 wt.	4 %	5 wt.	5 %	6 wt.	6 %	Mean wt.	Mean %
Thin albumen	11.72	20.82	12.18	21.54	15.22	26.25	17.47	24.80	15.85	25.52	14.44	23.28	14.38	23.74
Thick albumen	20.57	36.53	19.34	34.19	18.83	32.49	21.28	30.21	17.23	27.75	20.63	33.01	19.57	32.32
Yolk	15.70	27.88	16.61	29.37	15.96	27.54	23.43	33.26	21.24	34.20	19.25	30.80	18.48	30.52
Shell	8.33	14.77	8.43	14.90	7.95	13.72	8.26	11.73	7.78	12.53	8.07	12.91	8.13	13.42
Total	56.32	100.00	56.56	100.00	57.96	100.00	70.44	100.00	62.10	100.00	62.50	100.00	60.56	100.00

Table 14. Mean egg weight and per cent egg components as influenced by the housing system.

System of housing	Mean egg weight	per cent albumen	per cent yolk	per cent shell	Albumen fraction per cent thin	Albumen fraction per cent thick
Intensive	60.42	56.13	30.26	13.62	42.44	57.56
Semi-intensive	60.66	56.01	30.79	13.24	42.25	57.75
Overall mean	60.54	56.07	30.52	13.43	42.35	56.65

Table 15. Data showing the percentage infertility and hatchability in two systems of rearing.

Hatch No.	Intensive					Semi-intensive					Over-all per cent
	Total No. of eggs incubated	Infertility		Hatchability		Total No. of eggs incubated	Infertility		Hatchability		
		No.	%	No.	%		No.	%	No.	%	
1	33	27	81.82	0	-	41	10	24.39	7	22.58	
2	37	23	62.16	2	14.29	34	6	17.65	6	21.43	
3	46	28	60.87	2	11.11	36	7	19.44	12	41.38	
4	45	18	40.00	2	7.41	34	14	41.18	4	20.00	
Total	161	96	59.63	6	9.23	145	37	25.52	29	26.85	20.23

Table 16. Overall performance of experimental birds as influenced by different systems of rearing.

	Intensive	Semi intensive	Mean
1. Egg production (per cent hen-day)	14.49	12.60	13.54
2. Feed consumption (per bird per day) (g)	192	185	188.5
3. Feed efficiency (kg feed per doz. eggs)	19.49	22.70	21.09
4. Livability No. started/No. survived	50/49	50/48	100/97
5. Egg weight (g)	60.42	60.66	60.54
6. Per cent albumen	56.13	56.03	56.08
7. Per cent yolk	30.26	30.80	30.53
8. Per cent shell	13.62	13.25	13.43
9. Per cent fertility	40.37	74.48	57.42
10. Per cent hatchability (over fertiles)	9.23	26.85	20.23

DISCUSSION

DISCUSSION

Egg production

It may be seen from the results that the ducks under the intensive system gave a hen-day egg production of 14.49 per cent and the corresponding value for the ducks in the semi-intensive system was 12.6 per cent. Analysis of the data revealed that the average egg production in the intensive system was significantly higher ($P < 0.01$) than that obtained in the semi-intensive system. The trend in egg production was maintained during the first three periods in both systems of rearing. However, there was a sudden decline in egg production during the fourth period which slightly improved in the subsequent periods. The pattern of egg production exhibited by the experimental birds in this study did not follow the usual pattern observed in domestic chicken where the decline is rather gradual after peak production. Normal laying pattern of desi ducks during the pullet year of production has not been reported hitherto. Probably, they follow the seasonal pattern in laying. As the present work was limited to only 168 days of production, no definite pattern could be reported from these results. Laying performance of Desi ducks for full year production has to be assessed on similar lines for more reliable estimates. Also it is probable that the laying pattern could be brought in line with chicken by continued rearing in confinement over years. It is a good sign that the birds under intensive system of rearing laid consistently better over their sisters in the semi-intensive system. This points to the fact that larger areas of runs could be dispensed with as the same is found not essential from the results of the study.

The egg production figures obtained in this study were very low in comparison to the figures reported for Khaki Campbell and Indian Runner ducks (Mohapatra, 1978). Desi ducks on range are reported to lay over 100 eggs per annum, though there are no scientific data to substantiate this.

It is to be pointed out that the ducks during the trial received a ration containing 17.30 per cent crude protein. In the absence of any standards for feeding laying ducks, it is not apparent whether the productivity obtained in this study is the true reflection of the genetic potential of the stock. Therefore, it is suggested that further studies are the Desi ducks.

Abakumov (1971) reported that there was a sharp decline in egg production in ducks when reared without access to water. As the ducks used in this study were raised from eggs collected from flocks maintained on range for generations together and tuned to entirely different managemental pattern, the lack of free access to water and the shift of technique of management could have contributed to the poor rate of production.

Moreover, Sivadas (1978) observed that poor egg production in ducks maintained in the University duck farm during the period under study was attributable to the effects of exposure to aflatoxin contaminated feed very early in their life. It is likely that the experimental birds were exposed to aflatoxins. The poor egg production obtained in the study may be attributable to the exposure of birds to aflatoxins specially in their early life. It may be stated here that the feed was not screened to the presence of aflatoxins. Therefore it is also suggested that the egg production potential of Desi ducks may be assessed making use of Desi ducklings and maintaining them on feed screened for aflatoxins through-out the experimental period. As an alternative, the Desi ducks on point of lay raised under the traditional system may be procured and then they may be maintained under confinement on feed screened for aflatoxins.

Feed consumption and feed efficiency

It was revealed from the study that the ducks in the intensive system consumed on an average 191 g per day of feed compared to 185 g consumed by the ducks in the semi-intensive system. Also there was apparent variation in the quantum of feed consumed during the different periods of the study. Analysis of data pertaining to feed consumption indicated that the consumption differed significantly between treatments and periods. Under similar situations of rearing, domestic chickens also exhibit such variations in the rate of feed intake (Bundy and Diggins, 1960).

The comparatively lower feed intake by the birds on semi-intensive system may be due to the fact that they had access to green pasture also, whereas the birds in the intensive system were denied this facility. Laying type chicken generally consume on an average 120 g of feed daily. From the results of the present study it is observed that the laying ducks require a little over one and a half times of feed consumed by the chicken. The apparent variations in consumption at the different periods of the trial may be regarded as normal. Feed intake of laying birds is mainly influenced by the rate of production and seasonal changes.

The egg production obtained in the present study was very low when compared to that reported in Khaki Campbell and Indian Runner ducks or in domestic chicken. Therefore, the feed efficiency in terms of kg of feed required to produce a dozen eggs appeared far below the desired values. In fact, feed efficiencies in the semi-intensive and intensive systems of rearing obtained in the present investigation were 22.7 and 19.49 respectively. These values seem to be very poor and uneconomic when compared to the same for chicken under similar system of rearing. Feed cost being the major item of expenditure in confinement rearing, unless the egg production is improved to a satisfactory level, it is not worthwhile to raise ducks of such production otential as is seen from the study. May be, selective breeding and better feeding methods could improve the feed conversion efficiency to a higher level. Therefore, future plans should be aimed at developing stocks of higher egg laying potential. Also feeding standards should be established and quality feed ingredients screened for aflatoxins should be used in all formulations. Only if these two objectives are achieved duck rearing in confinement could be successful.

Body weight maintenance

The results pertaining to the body weight maintenance revealed that the ducks in the intensive system had better body weight when compared to those in the semi-intensive system. The statistical analysis of the data indicated that the differences were not significant. The results also showed that the average body weight gradually decreased over the periods except for the last in both the treatments. The initial body weights were 1438 g and 1443 g for the intensive and semi-intensive groups and the final body weights were 1311 g and 1281 g respectively for the treatments.

The mean body weights for the intensive and semi-intensive systems were 1356 g and 1338 g respectively. The gradual decrease in the mean body weight in both the treatments over the five periods deserves serious attention. This trend is in contrast to the normal trend expected in body weight maintenance by the laying stock of chickens (Mc clung and Jones, 1973). Surendranathan and Nair (1971) reported a reduction in body weight from 1463 g to 1179 g when Desi ducks were confined for a period of 3 months without wallowing facility. However, the ducks used in the above study were 12 months old at the time of confinement in contrast to 135 days of age of the ducks used in the present study. Moreover, Surendranathan and Nair (1971) in their study apparently also did not screen the feed for aflatoxins.

The reduction in body weight observed in the present study might have resulted from the possible toxic effects most probably from aflatoxin. This must also explain the low productivity obtained in the present study. Therefore, it is suggested that further studies may be taken up making use of Desi ducks and feeding them on diets screened for the usual toxins in order to get a clear picture of the normal pattern of body weight maintenance by this stock.

Livability

A total of three ducks died during the period of experimentation. One bird from the intensive group and two from semi-intensive group were died and post-mortem examination revealed that all the deaths were due to aflatoxicosis. This finding also supports the earlier contention that the possibility of toxic effects cannot be ruled out for low productivity and gradual decrease in body weight observed during the period of experimentation. However the percentage of livability was 98 per cent and 96 per cent for the intensive and semi-intensive treatment groups which can be considered as satisfactory. It is to be presumed that the level of toxins was not large enough to produce higher deaths among the birds but seems adequate enough to adversely affect the production characteristics of laying ducks.

Egg quality

Egg weight.

A perusal of Table 14 would indicate the average egg weight obtained in the two treatments in the study. The mean weight was 60.42 g in the intensive system and corresponding figure for the semi-intensive system was 60.66 g. This figure seems to be lower, since George (1977) reported a mean weight of 68.86 g out of 572 Desi duck eggs collected from a flock on range. Lowered egg weights as a result of aflatoxicosis has been reported by Sivadas (1978).

The mean weight of duck eggs reported in Indian literature varies from 62 to 72 g (Bose and Mahadevan, 1956). The mean egg weight in this study is comparable to the mean egg weight of 60 g reported for Mallard ducks (Romanoff, 1967). The mean egg weight which was 56.33 g during the first period gradually increased and attained a weight of 62.1 g by the fifth period which was not further enhanced during sixth period. However the mean egg weight during the fourth period may be seen very high (70.41 g) which does not follow the usual pattern of egg weight maintenance. It may be mentioned here that the egg production during this period was very low and all the eggs produced had to be weighed and hence this apparent variation.

Egg contents

The mean percentages of albumen, yolk and shell of the eggs in the intensive system were 56.13, 30.26 and 13.62 respectively. Corresponding values for the eggs saved for quality studies from the semi-intensive system were 56.03, 30.80 and 13.25 respectively. It may be seen from the figures that the differences in the per cent components of eggs laid by birds in the two systems are negligible indicating that the systems of rearing did not appear to exert any influence on their proportions. Romanoff and Romanoff (1949) reported that the proportional parts of duck eggs as 52.6, 35.4 and 12.0 per cent for albumen yolk and shell. The apparent difference in the percentages reported in the present study may be due to breed differences. Also the average egg weight observed in the present study was around 60 g while the above proportions reported by Romanoff (1967) was for eggs weighing around 80 g.

Albumen.

The average weight of albumen observed in this study was 33.95 g of which 14.38 g was thin albumen and 19.57 g thick albumen. The respective percentages of thin and thick albumen to the total albumen worked out to be 42.35 and 56.65. Romanoff and Romanoff (1949) reported 57.3 per cent dense albumen 2.7 per cent chalaziferous layer and 40 per cent thin albumen in an average hens egg. Romanoff and Romanoff (1949) had reported that the actual and relative weights of the egg's structural elements especially of the shell deviate rather widely and that there is a prevailing lack of uniformity in the proportional composition of eggs, even of the eggs of a single individual.

Yolk.

The mean weight of yolk obtained in this study was 18.48 g. Ahamed et al. (1971) reported 15.55 g as the yolk weight of Khaki Campbell eggs. The slight difference observed in this study is attributable to the higher weight of eggs employed (60.54 g) compared to 53.4 g in their studies.

The mean percentage of yolk to the mean egg weight obtained in this study was 30.52 per cent. However, Romanoff and Romanoff (1949) had reported 35.4 per cent of yolk for duck eggs weighing 80 g and 31.9 per cent for the average hen's egg.

As in the case of albumen, the analysis indicated only significant period differences, the differences between treatments being negligible. The percentage of yolk obtained during the later periods were higher than those observed during the earlier periods, which is a normal trend and is in agreement with the observations of Balachandran (1978) in White Leghorns.

<u>Shell.</u>

In contrast to the observations on other quality traits in this study, shell weight differed significantly between periods as well as treatments. The eggs laid by ducks in the intensive system had higher percentage of shell (13.62) compared to that of the eggs from semi-intensive system (13.25), the difference being statistically significant ($P < 0.05$). Difference in shell weight as a result of differences in housing systems have been reported by several workers.

Eggs from earlier periods had higher shell weights when compared to later periods in both the systems. The mean weight of shell irrespective of treatments observed in this study was 8.13 g and its percentage to the total egg weight was 13.43. Sergeeva (1975) also reported better shell quality in earlier periods of lay compared to later periods in duck eggs.

Thicker shells in chicken eggs obtained from birds housed in cages when compared to that of eggs obtained from the hens on litter have been reported by various workers (Johnson and Zindel, 1964 ; Kotia et al, 1975 and Hagger et al, 1975).

The treatment differences reported by these workers in chickens for this trait are in line with the observations made in this study.

Fertility and hatchability

In all 161 eggs were saved for hatching from the intensive system and 145 eggs from semi intensive system and they were spread over four hatches. The percentage infertility observed was 59.63 for the intensive system and a corresponding figure for semi intensive system was 25.52. The percentage hatchability obtained was 9.23 per cent in the intensive and 26.85 per cent in the semi-intensive groups.

The data clearly indicate that the birds in the semi-intensive system performed better as far as both traits were concerned. The fertility obtained in the semi-intensive system was 74.48 per cent and this value was more or less comparable to the fertility reported in Desi ducks by George (1977). However, higher fertility levels can possibly be obtained by narrowing the male female ratio. Paul Ives (1951) recommended a male female ratio as 1:6 for ducks. Similarly Mohapatra (1978) opined that the usual practice for obtaining fertile eggs is to allow one drake for every 5 or 6 ducks. Moreover, he has also reported that the heritability for fertility is 0.05 which implies that the emphasis should be on managemental practices in order to obtain good results in fertility. Also, there are no standards for feeding breeding ducks. The requirements of ducks for different nutrients especially the critical vitamins are not precisely known. In order to very successfully raise ducks in confinement and to obtain encouraging results in the hatching, it is imperative that the exact requirements are accurately assessed.

However, the results of the study pertaining to fertility clearly indicate that whenever a male female ratio of 1:12 is maintained, almost double (74.48%) fertility percentage could be obtained in the semi-intensive system when compared to the intensive system (40.37%). It is also suggested that further studies narrowing the male female ratio are warranted in both the systems of management in order to critically pin point the optimum ratio so as to obtain a fertility status comparable to that of chickens in confinement.

Mohapatra (1978) has reported that duck eggs in general has a lower hatchability as compared to chicken eggs. He has also opined that duck eggs are required to be turned at an angle of 180° as against 90° for chicken eggs. In the present study the selection of hatching eggs was not based on the size of eggs in both the treatments. Added to that, the eggs were turned only at 90° since a chicken egg incubator was employed. These factors might have also contributed to the poor hatchability figures obtained in this study. More over the nutritional factors might have been responsible for the poor results in the hatchery. However, it is apparent from the results that the hatchability figures were definitely superior in the semi-intensive treatment group (26.85%) as compared to the intensive treatment group (9.23%). This can possibly be explained by the fact that the birds in the semi-intensive group had access to the runs from where they could have possibly obtained some nutritional factors congenial for better hatchability.

Besides, it was observed during the course of the study that the matings in the intensive system were less frequent than in the semi-intensive system. Also the birds in the intensive system had consumed more feed than those in the semi-intensive system thereby probably ingesting proportionately higher levels of toxins that might have been present in the feed. This is another factor which might have contributed towards the low levels of fertility and hatchability in the intensive system.

The results indicate the desirability to go in for incubators specially designed for hatching duck eggs. However, when the two systems of management are compared as in the present study, almost a four-fold increase in the hatchability resulted in the semi-intensive group. The present study clearly indicate the essentiality for taking up further studies with different male female ratio, better plane of nutrition with special reference to critical vitamins and also appropriate incubator management in order to obtain high fertility and hatchability in duck eggs which are the two key factors in order to put duck farming successfully on scientific lines.

When the two systems of management in this study are compared it is apparent that the intensive system works out to be more economical compared to the semi-intensive system as far as egg production is concerned. The livability percentages obtained in both the treatments are quite good. All the three deaths that occurred during the period of experimentation were due to aflatoxicosis. This definitely indicates the essentiality of screening the feed for toxins. The possible presence of toxin in the feed might have affected not only the production but also the hatchability. The high level of infertility recorded in this study might have also been due to sterility in males which might have resulted from the toxic effects. Therefore, in order to get a real picture of the economics involved in rearing Desi ducks in confinement, controlled studies making use of this stock and maintaining them on feed screened for aflatoxin are absolutely essential.

For commercial egg production purposes, the present study indicates that the intensive system may prove better than the semi-intensive as in the case with chicken.

In order to exploit high livability level of Desi ducks it is desirable to make use of the stock in future breeding programmes. However, since their egg production potential is rather low, it is also suggested that a better germplasm may be introduced so that the cross breeds may have better egg production potential compared to Desi ducks and retaining the high livability exhibited by the Desi ducks.

Nevertheless, rearing breeding stock in the semi-intensive system might prove beneficial as evidenced from the results of this study based on the advantages in fertility and hatchability.

SUMMARY

SUMMARY

An experiment of 46 weeks duration was designed and conducted to assess the production potentialities of Desi ducks (Anas platyrhyncus) under two systems of rearing. One hundred ducks of 135 days old were randomly allotted to two groups and reared in intensive and semi-intensive systems under identical conditions of feeding and management. The ducks under semi-intensive system had free access to the run during day time. Data were collected on egg production, feed consumption, feed efficiency, livability, body weight and egg quality were recorded for 6 periods of 28 days each. A total of 161 eggs from the intensive group and 145 from semi-intensive group were utilised for fertility and hatchability studies. A male female ratio of 1:12 was maintained for breeding purpose.

The following conclusions were drawn from the study:

1. On a comparison of per cent hen day production, the birds under intensive system returned a better average than those under semi-intensive system and the birds under the intensive system showed significantly higher aggregate egg production than those under semi-intensive.

2. Birds under intensive system consumed more feed than those under semi-intensive system though the difference was not statistically significant. The mean feed efficiencies showed no difference between treatment.

3. The pattern of body weight maintenance of birds in both the systems was the same. However the initial average body weight of experimental birds in both the systems decreased gradually over the periods except for the last.

4. Livability was excellent in both the systems of rearing.

5. The two systems of rearing did not affect the egg size or egg quality in terms of albumen, yolk and shell percentages.

6. The fertility rate and hatchability of fertile eggs were much higher in the semi-intensive system comparing to the intensive system of rearing.

The overall results of the study indicated that intensive system of rearing Desi ducks can be adopted for table egg production. However, breeding ducks perform decidedly better in the semi-intensive system. The very low egg production observed in the study warrents further detailed investigations before advocating confinement rearing of Desi ducks.

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ABSTRACT

EVALUATION OF PRODUCTIVE PERFORMANCE OF DESI DUCKS REARED IN CONFINEMENT

BY

C.V. ANDREWS, B.V.Sc.

ABSTRACT OF A THESIS

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Kerala Agricultural University

Department of Poultry Science

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ABSTRACT

This thesis embodies the results of an evaluation of the productive performance of Desi ducks reared in confinement. One hundred ducks of 135 days old were reared in two groups of 50 each under intensive and semi intensive systems of management.

The results revealed that the ducks reared under intensive system returned better hen-day egg production and also consumed less feed than those under semi intensive system. The efficiency of feed conversion did not differ, between treatments.

The pattern of body weight maintenance was similar in both the systems and the survival rates were excellent in both the systems.

The two systems of rearing did not appear to exert any influence on the egg size or egg quality in terms of albumen, yolk and shell percentages.

Fertility and hatchability of eggs were better in the semi intensive system.

It was concluded from the above results that the intensive system of rearing Desi ducks may be adopted for table egg production while for breeding purposes, semi intensive system may be a better choice.