Journal of Entomology and Zoology Studies
Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(4): 354-360

Received: 06-05-2017
Accepted: 08-06-2017

**Muhammad Abrar**
Department of Zoology, GC University Faisalabad, Pakistan

**Qazi Adnan Ahmad**
Biology Lab, University Community College, GC University Faisalabad, Pakistan

**Zahid Ali**
Department of Wildlife and Parks, Government of Punjab, Pakistan

**Muhammad Anwar Iqbal**
Department of Zoology, Women University of Azad Jammu and Kashmir, AJK, Pakistan

**Shamsa Altaf**
Department of Zoology, GC University Faisalabad, Pakistan

**Aneela Sagheer**
Department of Zoology, GC University Faisalabad, Pakistan

**Sarfraz Hussain**
Department of Zoology, GC University Faisalabad, Pakistan

**Hamidullah**
Department of Zoology, University of Peshawar, Peshawar, Pakistan

**Zeeshan Shafiq**
Department of Zoology, Minhaj University, Lahore, Pakistan

**Luqman Khan**
Division of Neurogenetics, Graduate School of Life Sciences, Tohoku University, Japan

**Zahid Farooq**
Department of Wildlife and Parks, Government of Punjab, Pakistan

**Correspondence**
**Qazi Adnan Ahmad**
Biology Lab, University Community College, GC University Faisalabad, Pakistan

# Effect of cage spacing on production, fertility and hatchability of eggs in Indian peafowl at wildlife breeding center (Gatwala), Faisalabad-Pakistan

**Muhammad Abrar, Qazi Adnan Ahmad, Zahid Ali, Muhammad Anwar Iqbal, Shamsa Altaf, Aneela Sagheer, Sarfraz Hussain, Hamidullah, Zeeshan Shafiq, Zahid Farooq and Luqman Khan**

**Abstract**
The present study was undertaken to evaluate the effect of cage spacing on production, fertility and hatchability of eggs in Indian peafowl at Wildlife Breeding Center in 2010 for a period of 24 weeks. Result of feed consumption in all the three treatment groups of peafowl were statistically significantly different ($p< 0.01$) (Table 1a). In group C (cage spacing 4.13 x 2.90 m) statistically minimum mean feed (68.95 ± 1.87**)** was consumed. Statistically maximum mean feed was consumed by group B (cage spacing 4.57 x 4.57 m) which was 97.25 ± 1.00 while the feed consumption in group A (cage spacing 7.25 x 4.15 m) was 81.69 ± 1.40. From this study it is being concluded that peafowl breeding at cage spacing 4.57 x 4.57 m (21 $m^2$ area, per bird space 7 $m^2$) has shown better results for all production parameters.

**Keywords:** Hatching of Eggs, Peafowl, Fertility, controlled

## 1. Introduction
Pheasants occupy the most promising place among the most popular of birds. Pheasants due to having diversity of colours in them, large and beautiful in shape, have the greatest ornamental value [3]. Among pheasants the Indian peafowl (*Pavo cristatus*) is the most handsome pheasant with beautiful feathers. Indian or Common peafowl, Blue peafowl, Paon blue (French), Blauer pfau (German), Mohr (India) and Monara (Ceylon) are the vernacular names of Indian peafowl in various regions of the world [1, 3, 22].
According to zoological classification this species belongs to the Genus *Pavo*, subfamily Povoninae, Family Pheasianidae, Order Galliforms and Class Aves [17]. The subfamily Pavoninae has two genera, *Pavo* and *Afropavo*. Genus *Afropavo* has only one species called Cango peafowl (*Afropavo congensis*) and no sub species is found. This species occurs only in the evergreen forests in Cango river basin, Africa [17]. However, reports showed [11] the *Afropavo* is not a true peafowl. It is only a close relative of the peafowl.
The green peafowl has three sub-species which are recognized by feather colour and area distribution [17]. There are three mutant forms of Indian peafowl viz., white peafowl (*P. C. mut. albino*), Black winged peafowl (*P. C. mut. nigripennis*), and Pied peafowl [16, 17]
As per knowledge less published material on the connection between birds welfare issues specially housing and true fertility on commercial pheasants [2]. Birds may have social influence of incubation pattern, and their spacing model during reproduction is linked with less hatchability and thus entails a direct reproductive disadvantage [21]. The birds living at low densities be supposed to have lower densities because of difficulty in synchronizing reproduction between the genders [3].
The poultry egg production industry increasingly used high stocking densities both during rearing and laying phases as mean to decrease housing and equipment's costs per bird [5,9]. Nevertheless, the excessive reduction in the available cage area per bird, as well as feeder and drinker space per bird, may have negative effect on growth and later performance, since feed intake might decrease and, consequently live weight.[5] Body weight and feed intake are crucial factors in birds development; egg production, egg size and feed conversion. The possibility exists that this happens in pens/cages of breeding birds in captivity [5]. If this were so, this resulted in decreased gain per bird housed and too small profit margins due to less eggs

production and fertility [9]. Similar is the case with captive breeding of peafowl in Pakistan i.e. not any optimum cage spacing has yet been explored for this bird by research to get maximum production.

Keeping in view this problem this study was undertaken to evaluate the effect of cage spacing on production, fertility and hatchability of eggs in Indian peafowl at Wildlife Breeding Center, Punjab Wildlife Research Institute, Gatwala, Faisalabad, to explore the most productive cage spacing in this species.

## 2. Materials and Methods

This research study was conducted at Breeding Center of Punjab Wildlife Research Institute (PWRI), Gatwala, Faisalabad, from March through August 2010 for a period of 24 weeks. Three different cage size groups were selected by following the scheme presented by Anonymous [6]. The cage size classes were 7.25 x 4.15 m (30 $m^2$ area, per bird space 10 $m^2$), 4.57 x 4.57 m (21 $m^2$ area, per bird space 7 $m^2$) and 4.13 x 2.90 m (12 $m^2$ area, per bird space 4 $m^2$). These were replicated thrice hence total nine cages were selected (three cages of each size class) for release of birds. Total 27 birds (9♂ & 18♀) were selected. The age of birds was 7 year and approximate weight of males was 4.7-5.1 kg and that of females was 3.6-3.9 kg.

The peafowls were distributed at a sex ratio of 1♂: 2♀ following Ali [2] in each cage. The cage spacing 7.25 x 4.15 m (30 $m^2$ area) was served as treatment T1 (Group A), cage with spacing 4.57 x 4.57 m (21 $m^2$ area) as treatment T2 (Group B) and with spacing 4.13 x 2.90 m (12 $m^2$ area) as treatment T3 (Group C). All the three groups were replicated three times. The birds were released into cages randomly. Every cage contained equal number of birds i.e. 1♂: 2♀. The design of the study was completely randomized (CRD). The replicates were assigned as A1, A2 and A3 for group ''A'' and for group ''B'' and ''C'' these were B1, B2, B3, and C1, C2, C3, respectively. Before collection of data birds were given adaptation period of four weeks.

The birds were fed on National breeder hen diet containing crude protein, Metabolizable Energy and calcium. [12] Feeding was done on daily basis at 08:30am, whereas, watering was done twice a day i.e. at 08:30am and at 04:00pm. The cages were cleaned daily to avoid any disease.

The medication and vaccination of birds was done at the start and middle of the trail on the prescription of local Veterinary Officer. They were fed with antibiotic and immunity booster to keep safe them from any disease outbreak. This process was repeated after every two weeks. The following data were collected:

### Feed Consumption (g)

A weighed quantity of breeder ration 200g/bird was offered to each group. Next day the rejected/unconsumed feed was weighed to record feed intake by each group [13]. The pots were again filled with fresh feed and this weighing process was repeated every day up to 16 weeks. Total and average feed intake per bird was calculated on weekly basis. This was done on the assumption investigated by Faitarone [9] that feed intake is significantly affected by stocking density.

### Egg production (No.)

Egg production of peafowl was recorded daily from the onset of egg laying up to 16 weeks laying period [18]. The targeted eggs were marked for each treatment group. [11, 18] Date of laying was also being noted on the eggs. Per bird weekly egg production in each group and its replicate was calculated. The rationale behind collection of this data was the findings of Nagarajan [18] who reported that egg production increases with decrease in stocking density (increase in cage space per bird).

### Egg Weight (g)

The egg weight on laying time was recorded daily [11, 13, 18, 22]. Eggs weight was also recorded on weekly basis by using all eggs collected during the week [10, 22]. This gives total mass of eggs produced by different groups in a week which was later used for calculation of feed conversion ratio.

### Storage of Eggs

The collected eggs were stored in a store room by placing them in trays. They were stored under 15-18 Cº with the relative humidity of 75-80% (RH) in storage room till setting in incubator [2, 12, 18].

### Feed Conversion Ratio (Fcr)

Feed conversion ratio (FCR) for every group and its replicates was recorded on weekly basis by using the formula:

**FCR =** Egg weight / Feed consumed [15].

### Disinfecting/Fumigation, Setting and Incubation of Eggs

The eggs were stored in store room for four days then these were placed in incubator for incubation. It was proper cleaning and fumigation was conducted before setting of eggs [12]. The eggs were antisepticised/ fumigated with formaldehyde solution and the setting interval was four days. Locally manufactured incubator by M/S Aroog Incubators, Serial No. 52, St. no. 2, A block, Al-Faisal town, Lahore, Pakistan was used for incubation of eggs. Incubator has separate setter and hatcher chambers. The eggs were turned automatically due to programmed device that was set 2 hourly. The subsequent temperature and relative humidity (RH) was tried to maintain during incubation period:

a) Setting temperature 99.7-100 °F up to 24 days of incubation.

b) Hatching temperature 1-2 °F reduced and 98.7°F – 97.7°F from 24 to 27 days of incubation.

c) Setting RH: 80-85% up to 24 day of incubation.

d) Hatching RH: 2-5% increased and 87-90% RH from 24 to 26 days of incubation and RH increased to 92% particularly at 27 day [12]

### Egg Fertility (%)

At the end of the incubation period after a waiting period of five days since the appearance of first hatched egg in each setting, the non-hatching eggs (the eggs having no chick release) were separated and cracked to see the late embryonic mortality (dead in shell chicks). Data for fertile eggs (dead in shell as well as hatched eggs) were collected and the fertility of incubated eggs was calculated as follows:

**(%) Fertility** = (number of fertilized eggs / total number of eggs placed into incubator) x 100 [18]

### Hatchability (%)

At the end of incubation period the hatchability of fertile eggs was calculated by the relation presented by researcher [18] as follows:

**(%) Hatchability** = (number of released chicks / total number of egg placed into incubator) x 100.

### Statistical Analysis of the Data
All the data obtained were analyzed using a Completely Randomized Design (CRD) [18] with the help of a computer package programme MINITAB (MINITAB, 2000). Duncan's Multiple Range (DMR) test was used to compare mean values of all parameters [8, 19].

## Results
### Feed Consumption (g)
Feed consumption in all the three treatment groups of peafowl were statistically significantly different ($p< 0.01$) (Table 1a). In group C (cage spacing 4.13 x 2.90 m) statistically minimum mean feed (68.95 ± 1.87**)** was consumed. Statistically maximum mean feed was consumed by group B (cage spacing 4.57 x 4.57 m) which was 97.25 ± 1.00. The feed consumption in group A (cage spacing 7.25 x 4.15 m) was 81.69 ± 1.40 (Table 1b).

Week-wise Feed consumption varied statistically in all three cage spacing at statistical level ($p< 0.01$) (Table 1a). In group A feed consumption varied from 62.38 ± 1.58 (during 2nd week) to 92.48 ± 0.30 (during 10th week). Feed consumption in group B varied from 81.57 ± 1.75 (during 1st week) to 104.9 ± 0.48 (during 8th week). While in group C it varied from 49.89 ± 1.47 (during 1st week) to 83.00 ± 0.19 (Table 1b).

The interaction between groups and weeks also showed significant statistical difference ($p<0.01$) (Table 1a). All three groups showed almost similar feed consumption trend i.e. in all groups less feed was consumed at the start of the trail. Statistically maximum feed was consumed by birds of all the groups at the middle of the trail. Reduction in feed consumption was again taken place in all the groups during last four weeks of the trail (Table 1b).

### Egg Production (Nos.)
Week-wise per peahen egg production was statistically significantly different ($p<0.01$) (Table 2a). Statistically mean minimum per peahen eggs (0.17 ± 0.17) were produced by group A during 16th week of the study and maximum (1.33 ± 0.17) during 4th, 5th, and 10th weeks of the trail (Table 2b). In group B statistically maximum per peahen eggs (3.33 ± 0.17) were recorded during 11th week of the trail and minimum (0.33 ± 0.33) during 16th week.

Maximum per peahen egg production (1.83±0.17) was recorded during 6th and 7th week of the study and minimum (0.00 ± 0.00) during 16th week in group C (Table 2b). Per peahen egg production was statistically significantly different in various cage spacing groups of peafowl ($p<0.01$) (Table 2a).

Maximum eggs per hen were produced by group B (2.09 ± 0.16) whereas group A and C had produced statistically similar eggs i.e. 0.20 ± 0.08 and 0.73 ± 0.10, respectively (Table 2b).Interaction between groups and weeks was also statistically significantly different ($p<0.05$) (Table 2a). During the trail egg production followed the same pattern. Egg production was minimum at the start and end of the study, whereas, maximum during the middle of the trail (Table 2b).

### Egg Weight (g)
In all three groups of peafowl mean egg weight was statistically significantly different ($p<0.01$) and also week-wise ($p<0.01$).Statistically minimum mean egg weight was recorded during 16th week (29.67 ± 29.67) and maximum during 8th week (95.98 ± 1.46) of the study in group A. in group B during 4th week of the trail maximum mean egg weight (118.8 ± 1.43) and minimum (33.11 ± 33.11) during 16th week was recorded (Table 3b).Statistically maximum mean egg weight (97.79 ± 4.98) was recorded in group B and minimum in group C (52.17 ± 5.91). Mean egg weight in group A was (71.44 ± 5.38**)** (Table 3b). Interaction of weeks and groups was statistically non-significantly in all three groups ($p > 0.05$) (Table 3a).

### Feed Conversion Ratio (Fcr)
Week-wise and group-wise data of feed conversion ratio were statistically significantly different in all groups ($p< 0.01$). Data for interaction between groups and weeks also showed statistically significant difference ($p< 0.01$) (Table 4a).

Statistically maximum feed conversion value recorded in group C (1.18 ± 0.06). Feed conversion value recorded in group A and B was statistically similar i.e. 1.04 ± 0.44 and 1.01 ± 0.05 respectively (Table 4b).During the trail maximum feed conversion value (1.97 ± 0.01) was recorded during 9th week and minimum during (0.06 ± 0.03) 12th week in group A. In group B minimum value recorded was (0.01 ± 0.01) whereas, it was maximum (1.23 ± 0.03) during 1st week. Feed conversion value was maximum (1.74 ± 0.00) during 1st and 15th week and minimum (0.00 ± 0.00) during 16th week of the trail.

There was statistically increasing trend in the value of feed conversion in all groups from start to middle of the trail. Then towards the end of the trail value of feed conversion was shown decreasing trend in all groups of peafowl (Table 4b).

**Table 1a:** Comparison of Feed Consumption (g) in various groups of peafowl tested through two factors Completely Randomized Design.

| Source of Variance | Degree of Freedom | Mean Square | F. Value | Probability |
|---|---|---|---|---|
| Weeks | 15 | 655.72 | 35.29 | S** |
| Groups | 2 | 9638.49 | 518.70 | S** |
| Week x Group | 30 | 98.51 | 5.30 | S** |
| Errors | 96 | 18.58 | | |
| Total | 143 | | | |

S** = Means statistically significant at α = 0.01

**Table 1b:** Comparison of Feed Consumption (g) means in different groups through Duncan's Multiple Range (DMR) test.

| Weeks | Groups | | |
|---|---|---|---|
| | A | B | C |
| 1 | 63.31 ± 1.30 F | 81.57 ± 1.75 F | 49.89 ± 1.47 E |
| 2 | 62.38 ± 1.58 F | 91.08 ± 0.85 CDE | 52.64 ± 1.97 DE |
| 3 | 72.65 ± 3.87 E | 89.30 ± 1.17 DE | 68.05 ± 6.68 C |
| 4 | 71.66 ± 1.34 E | 97.49 ± 1.10 ABC | 68.16 ± 5.29 C |
| 5 | 87.49 ± 2.90 ABC | 100.4 ± 0.61 AB | 59.98 ± 4.72 D |
| 6 | 88.03 ± 0.66 ABC | 103.7 ± 1.40 A | 78.92 ± 1.26 AB |
| 7 | 78.08 ± 1.05 DE | 100.8 ± 0.96 AB | 77.72 ± 1.59 AB |
| 8 | 84.19 ± 1.71 BCD | 104.9 ± 0.48 A | 80.60 ± 0.87 A |
| 9 | 90.42 ± 1.09 AB | 102.9 ± 1.28 AB | 83.00 ± 0.19 A |

| | | | |
|---|---|---|---|
| 10 | 92.48 ± 0.30 $^{A}$ | 102.4 ± 1.30 $^{AB}$ | 82.31 ± 0.34 $^{A}$ |
| 11 | 89.79 ± 0.88 $^{AB}$ | 100.4 ± 0.49 $^{AB}$ | 82.45 ± 0.56 $^{A}$ |
| 12 | 88.84 ± 1.10 $^{ABC}$ | 103.0 ± 0.65 $^{AB}$ | 79.37 ± 0.33 $^{AB}$ |
| 13 | 88.61 ± 1.56 $^{ABC}$ | 98.88 ± 1.17 $^{AB}$ | 72.46 ± 4.51 $^{BC}$ |
| 14 | 83.40 ± 1.21 $^{BCD}$ | 95.02 ± 0.70 $^{BCD}$ | 58.88 ± 3.93 $^{D}$ |
| 15 | 85.08 ± 1.49 $^{ABCD}$ | 87.42 ± 1.74 $^{EF}$ | 55.68 ± 6.63 $^{DE}$ |
| 16 | 80.72 ± 3.21 $^{CD}$ | 96.72 ± 4.63 $^{ABCD}$ | 53.15 ± 4.47 $^{DE}$ |
| Combined Ave. | 81.69 ± 1.40 $^{B}$ | 97.25 ± 1.00 $^{A}$ | 68.95 ± 1.87 $^{C}$ |

**Table 2a:** Comparison of per peahen Egg production (Nos.) in various groups of peafowl tested through two factors Completely Randomized Design.

| Source of Variance | Degree of Freedom | Mean Square | F. Value | Probability |
|---|---|---|---|---|
| Weeks | 15 | 2.98 | 8.61 | S** |
| Groups | 2 | 28.17 | 81.53 | S** |
| Week x Group | 30 | 0.64 | 1.84 | S* |
| Errors | 96 | 0.35 | | |
| Total | 143 | | | |

S* = Means statistically significant at $\alpha = 0.05$
S** = Means statistically significant at $\alpha = 0.01$

**Table 2b:** Comparison of per peahen egg production (Nos.) means in different groups through Duncan's Multiple Range (DMR) test.

| **Weeks** | **Groups** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| 1 | 0.67 ± 0.44 $^{AB}$ | 2.17 ± 0.73 $^{BCDE}$ | 0.17 ± 0.17 $^{BC}$ |
| 2 | 0.75 ± 0.43 $^{AB}$ | 2.00 ± 0.29 $^{CDEF}$ | 0.42 ± 0.22 $^{BC}$ |
| 3 | 0.67 ± 0.33 $^{AB}$ | 1.83 ± 1.01 $^{DEFG}$ | 0.83 ± 0.17 $^{ABC}$ |
| 4 | 1.33 ± 0.17 $^{A}$ | 2.83 ± 0.17 $^{ABCD}$ | 1.08 ± 0.22 $^{ABC}$ |
| 5 | 1.33 ± 0.17 $^{A}$ | 2.67 ± 0.17 $^{ABCD}$ | 1.00 ± 0.50 $^{ABC}$ |
| 6 | 0.92 ± 0.08 $^{AB}$ | 3.17 ± 0.17 $^{AB}$ | 1.83 ± 0.17 $^{A}$ |
| 7 | 0.75 ± 0.14 $^{AB}$ | 2.83 ± 0.17 $^{ABCD}$ | 1.83 ± 0.17 $^{A}$ |
| 8 | 0.83 ± 0.17 $^{AB}$ | 3.17 ± 0.33 $^{AB}$ | 1.25 ± 0.25 $^{AB}$ |
| 9 | 1.17 ± 0.60 $^{AB}$ | 3.00 ± 0.00 $^{ABC}$ | 1.00 ± 0.58 $^{ABC}$ |
| 10 | 1.33 ± 0.17 $^{A}$ | 2.17 ± 0.17 $^{BCDE}$ | 0.50 ± 0.50 $^{BC}$ |
| 11 | 0.83 ± 0.08 $^{AB}$ | 3.33 ± 0.17 $^{A}$ | 0.75 ± 0.43 $^{ABC}$ |
| 12 | 0.75 ± 0.14 $^{AB}$ | 1.50 ± 0.29 $^{EFGH}$ | 0.17 ± 0.17 $^{BC}$ |
| 13 | 0.25 ± 0.25 $^{AB}$ | 0.83 ± 0.17 $^{GHI}$ | 0.33 ± 0.33 $^{BC}$ |
| 14 | 0.67 ± 0.44 $^{AB}$ | 1.00 ± 0.58 $^{FGHI}$ | 0.42 ± 0.22 $^{BC}$ |
| 15 | 0.42 ± 0.22 $^{AB}$ | 0.67 ± 0.44 $^{HI}$ | 0.17 ± 0.17 $^{BC}$ |
| 16 | 0.17 ± 0.17 $^{B}$ | 0.33 ± 0.33 $^{I}$ | 0.00 ± 0.00 $^{C}$ |
| Combined Ave. | 0.20 ± 0.08 $^{B}$ | 2.09 ± 0.16 $^{A}$ | 0.73 ± 0.10 $^{B}$ |

**Table 3a:** Comparison of Egg Weight (g) in various groups of peafowl tested through two factor Completely Randomized Design.

| Source of Variance | Degree of Freedom | Mean Square | F. Value | Probability |
|---|---|---|---|---|
| Weeks | 15 | 3811.17 | 3.03 | S** |
| Groups | 2 | 25175.60 | 2.04 | S** |
| Week x Group | 30 | 733.6 | 0.58 | N.S |
| Errors | 96 | 1256.15 | | |
| Total | 143 | | | |

S** = Means statistically significant at $\alpha = 0.01$
N.S = Means statistically non-significant at $\alpha = 0.05$

**Table 3b:** Comparison of Egg Weight (g) means in different groups through Duncan's Multiple Range (DMR) test.

| **Weeks** | **Groups** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| 1 | 58.22 ± 29.11 $^{A}$ | 100.4 ± 0.49 $^{A}$ | 28.97 ± 28.97 $^{AB}$ |
| 2 | 59.57 ± 29.82 $^{A}$ | 10.9 ± 1.40 $^{A}$ | 53.12 ± 26.56 $^{AB}$ |
| 3 | 58.62 ± 29.32 $^{A}$ | 73.90 ± 37.02 $^{AB}$ | 80.90 ± 0.97 $^{A}$ |
| 4 | 88.73 ± 1.57 $^{A}$ | 118.8 ± 1.43 $^{A}$ | 82.13 ± 2.41 $^{A}$ |
| 5 | 89.93 ± 3.32 $^{A}$ | 115.3 ± 3.45 $^{A}$ | 55.33 ± 27.73 $^{AB}$ |
| 6 | 88.49 ± 5.25 $^{A}$ | 113.6 ± 4.75 $^{A}$ | 81.28 ± 1.05 $^{A}$ |
| 7 | 89.06 ± 1.37 $^{A}$ | 115.8 ± 3.32 $^{A}$ | 85.46 ± 0.40 $^{A}$ |
| 8 | 95.98 ± 1.46 $^{A}$ | 108.3 ± 6.08 $^{A}$ | 85.91 ± 0.49 $^{A}$ |
| 9 | 58.69 ± 29.35 $^{A}$ | 113.4 ± 2.39 $^{A}$ | 58.43 ± 29.22 $^{AB}$ |
| 10 | 92.28 ± 2.40 $^{A}$ | 115.8 ± 1.58 $^{A}$ | 29.57 ± 29.57 $^{AB}$ |
| 11 | 91.82 ± 1.06 $^{A}$ | 108.1 ± 4.11 $^{A}$ | 55.08 ± 27.61 $^{AB}$ |

| | | | |
|---|---|---|---|
| 12 | 93.82 ± 2.77 A | 106.4 ± 3.40 A | 28.70 ± 28.69 AB |
| 13 | 32.63 ± 32.63 A | 100.3 ± 0.76 A | 26.08 ± 26.08 AB |
| 14 | 57.86 ± 28.93 A | 72.53 ± 36.33 AB | 55.07 ± 27.60 AB |
| 15 | 57.67 ± 28.84 A | 67.91 ± 33.98 AB | 28.73 ± 28.73 AB |
| 16 | 29.67 ± 29.67 A | 33.11 ± 33.11 B | 0.00 ± 0.00 B |
| Combined Ave. | 71.44 ± 5.38 B | 97.79 ± 4.98 A | 52.17 ± 5.91 C |

**Table 4a:** Comparison of Feed Conversion Ratio (FCR) in various groups of peafowl tested through two factor Completely Randomized Design.

| Source of Variance | Degree of Freedom | Mean Square | F. Value | Probability |
|---|---|---|---|---|
| Weeks | 15 | 0.42 | 5.74 | S** |
| Groups | 2 | 0.42 | 5.70 | S** |
| Week x Group | 30 | 0.15 | 2.07 | S** |
| Errors | 96 | 0.07 | | |
| Total | 143 | | | |

S** = Means statistically significant at $\alpha = 0.01$

**Table 4b:** Comparison of Feed Conversion Ratio (FCR) means in different groups through Duncan's Multiple Range (DMR) test.

| Weeks | Groups | | |
|---|---|---|---|
| | A | B | C |
| 1 | 0.93 ± 0.47 AB | 1.23 ± 0.03 A | 1.74 ± 0.00 A |
| 2 | 1.42 ± 0.04 A | 1.11 ± 0.02 A | 1.58 ± 0.03 AB |
| 3 | 1.18 ± 0.08 AB | 0.82 ± 0.41 AB | 1.21 ± 0.11 BC |
| 4 | 1.24 ± 0.03 AB | 1.22 ± 0.01 A | 1.22 ± 0.08 BC |
| 5 | 1.03 ± 0.01 AB | 1.15 ± 0.03 A | 1.44 ± 0.06 ABC |
| 6 | 1.01 ± 0.05 AB | 1.09 ± 0.03 A | 1.03 ± 0.02 C |
| 7 | 1.14 ± 0.02 AB | 1.15 ± 0.02 A | 1.10 ± 0.02 BC |
| 8 | 1.14 ± 0.03 AB | 1.03 ± 0.05 A | 1.07 ± 0.01 BC |
| 9 | 1.97 ± 0.01 AB | 1.10 ± 0.1 A | 1.06 ± 0.00 C |
| 10 | 1.00 ± 0.03 AB | 1.13 ± 0.03 A | 1.07 ± 0.00 BC |
| 11 | 1.02 ± 0.01 AB | 1.07 ± 0.04 A | 0.98 ± 0.03 C |
| 12 | 0.06 ± 0.03 AB | 1.03 ± 0.03 A | 1.09 ± 0.00 BC |
| 13 | 1.71 ± 0.36 B | 0.01 ± 0.01 A | 1.12 ± 0.00 BC |
| 14 | 1.03 ± 0.01 AB | 0.76 ± 0.38 AB | 1.46 ± 0.13 ABC |
| 15 | 1.01 ± 0.02 AB | 0.78 ± 0.39 AB | 1.74 ± 0.00 A |
| 16 | 0.75 ± 0.38 B | 0.38 ± 0.38 B | 0.00 ± 0.00 D |
| Combined Ave. | 1.04 ± 0.44 B | 1.01 ± 0.05 B | 1.18 ± 0.06 A |

**Table 5:** Comparative study of various parameters regarding Influence of cage spacing on feed consumption, egg production, egg weight and feed conversion ratio of Indian Peafowl (*Pavo cristatus*)

| Parameters | Treatments | | |
|---|---|---|---|
| | A (10 m2) | A (10 m2) | A (10 m2) |
| Feed Consumption (g) | 81.69 ± 1.40 B | 97.25 ± 1.00 A | 68.95 ± 1.87 C |
| Egg Production (Nos.) | 0.20 ± 0.08 B | 2.09 ± 0.16 A | 0.73 ± 0.10 B |
| Egg Weight (g) | 71.44 ± 5.38 B | 97.79 ± 4.98 A | 52.17 ± 5.91 C |
| Feed Conversion Ratio (FCR) | 1.04 ± 0.44 B | 1.01 ± 0.05 B | 1.18 ± 0.06 A |

## 4. Discussion

In this study statistically mean maximum feed was consumed by group B having cage spacing 4.57 x 4.57 m (per bird space 7 m$^2$). Whereas, peafowls having cage spacing 4.13 x 2.90 m (per bird space 4 m$^2$) consumed minimum mean feed per bird. The peafowls of group B with cage spacing 7.25 x 4.15 m (per bird space 10 m$^2$), consumed feed intermediate between group A and group B. The results of the present study are in close agreement with the study of Ali [2, 7] who performed experiment with three sex ratios of peafowl at cage spacing 4.57 x 4.57 m (per bird space 7 m$^2$) and obtained similar results at sex ratio 1♂: 2♀. Another study [14] showed after experimentation on the effect of spacing on laying hens with two spacings i.e. 145 and 726 cm$^2$/bird that with decrease in spacing feed utilization adversely affected. Food restriction significantly increased body weight loss and decreased egg production, food consumption, final body weight and abdominal fat (Table 5).

The results of the present study are also supported by the findings of Zou and Wu [22]. They reported that less feed intake due to several reasons (as in the present study due to very large and small spacing) resulted in decreased egg weight and egg production in avian species as increase intake of feed increases the intake of protein and other ingredients of feed which resulted in increase in egg production. But Al-Rawi [4] found that sex ratio (hence density) have no effect on egg production in domestic fowl by housing them at similar cage spacing.

The results of the present study are also in close agreement with those of Anderson and Adams [5] who stated that the poultry egg production industry have increasingly used high stocking densities both during rearing and laying phases as means to decrease housing and equipment costs per bird. Nevertheless, the excessive reduction in the available cage area per bird, as well as feeder and drinker space per bird, may have negative effects on growth and later performance, since feed intake might decrease and, consequently, live weight. Similar results i.e. best feed intake at intermediate cage spacing were also shown by the study of another scientis [20] who reported that the feed intake of Japanese quails housed at densities of 175 $cm^2$ per bird was higher than at densities of 150 $cm^2$ and 200 $cm^2$ per bird. In one research [9] also found after experimentation with Italian quail that feed intake and egg production were lower at lower spacing. They further stated that the smaller density have resulted the best gain per quail housed per day. Nevertheless, the best gain per bird per day was also seen at higher densities. Body weight and feed intake are crucial factors in bird development, egg production, egg size and feed conversion. Stocking density has become a highly important economic factor due to intensification of industrial poultry production, which resulted in decreased gain per bird housed and too small profit margins.

The findings of the present study are also supported by the findings of Zou and Wu [22] who reported that less feed intake due to several reasons resulted in decreased egg weight and egg production in avian species as increase intake of feed increases the intake of protein and other ingredients of feed which resulted in increase in egg production. However, results obtained in some another study [1] showed that feed intake was not influenced by density when two housing systems (floor and cage) and two housing densities (100 and 125 $cm^2$ per bird) were evaluated.

In the present study statistically mean maximum per peahen eggs were produced by group B with cage spacing 4.57 x 4.57 m. Whereas, group A having cage spacing 7.25 x 4.15 m and group C with spacing 4.13 x 2.90 m had produced statistically similar eggs but lower then that of group B (Table 9). These results are in close agreement with the findings of Ali [2] who performed experiment with three sex ratios of peafowl at cage spacing 4.57 x 4.57 m and found maximum egg production with sex ratio 1♂: 2♀. The results of the present study are also in close agreement with the findings of those of some researchers [14]. Who reported that food restriction significantly increased body weight loss and decreased egg production, food consumption, final body weight and abdominal fat, but had no significant effect on egg weight, shell thickness and mortality. As obvious from cage spacing effect on food consumption in the present study.

## 5. Conclusion

From this study it is being concluded that peafowl breeding at cage spacing 4.57 x 4.57 m (21 $m^2$ area, per bird space 7 $m^2$) has shown better results for all production parameters. It is proposed that 4.57 x 4.57 m spacing at sex ratio 1♂: 2♀ be used for the breeding of this wild bird under captive conditions.

## 6. Acknowledgement

The authors would like to acknowledge the services of all staff of Punjab Wildlife Breeding Centre (Gatwala), Punjab, as they had supported very well to conduct this study. Thanks to anonymous reviewers for their valuable comments, who spent their precious time on reading this manuscript?

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