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**A BEHAVIORAL VISION IN ANALYSIS OF OSTRICH  
PERFORMANCE UNDER VARIOUS SYSTEMS  
OF BREEDING**

(With 5 Tables and 1 Figure)

By

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**رؤية سلوكية لتحليل إنتاجية النعام تحت أنظم التربية المختلفة**

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أجريت هذه الدراسة لاستبيان دور سلوكيات النعام لتوضيح مدى التباين في إنتاجية البيض ومعدل الخصوبة تحت أنظم تربية وإيواء مختلفة. هذا وقد خلصت الدراسة إلى التالي زاد متوسط إنتاج البيض معنويا (لكل ثلاثة أسابيع) في الأرضية الرملية عنه في الأسمنتية و المختلطة وذلك تحت نظم تربية وإيواء واحدة (المكثف) مما أوضح أهمية العش لإنتاج البيض وتعارض الأرضية الصلبة مع ذلك. زاد متوسط إنتاجية البيض ومعدل الإخصاب معنويا تحت النظام شبه المكثف عنه في النظام المكثف والممتد. كان لوجود الأسوار السلوكية أشد الأثر في جذب انتباه الذكر عن إنتاجه وذلك لرغبته في جماع أخرى تعلن عن رغبتها في حظيرة مجاورة مما أدى إلى عدم توافق بين كلا من الذكر والأنثى في نفس الحظيرة (تواصل بصري غير مرغوب). لوحظ وجود ضغوط اجتماعية في النظام الممتد نظرا لوجود عدد كبير من الذكور مما أدى إلى عدم إتمام التزاوج (الخوف الذكور المتتحية) وقلّة معدل الإخصاب. زاد معدل الإخصاب معنويا في النظام شبه المكثف (المثالي) عنه في الأنظمة الأخرى وكذا مع مرور الوقت وذلك لوجود الأسوار المانعة للتواصل البصري الغير مرغوب.

**SUMMARY**

This study was mainly carried out to give a behavioral vision during explanation of the fluctuation in both egg laying and fertility under different breeding systems. This vision was also exploited to clarify the difference of the latter productivity aspects with the managerial practices

under the intensive system of breeding. Means of egg laying per 3 weeks under the intensive system increased significantly ( $P \leq 0.01$ ) on sand. However, the mean of egg laying decreased in both concrete and mixed litters (concrete and sand) than that in sand. Total means of both egg laying and number of fertile eggs increased significantly ( $P \leq 0.01$ ) under the semi-intensive system. At the same time, the number of both egg laying and fertile eggs decreased under both intensive and extensive system. The presence of courting hen in the neighbor pen under the intensive system may attract a cock away from his female (incompatibility between the breeding pen-mates). Cocks in the extensive system were always under social stress, which may result finally in presence of incomplete mating and in turn, lowering the fertility rate. Means of egg laying per hen under semi-intensive system reached the standard record a year (63.9 egg/year). During the breeding season, the number of fertile eggs comprised 77.6 % of the lay under the semi-intensive system. On the other hand, the lowest percentage of fertile eggs was recorded under the extensive system. Fertility rates were almost increased under the semi-intensive system (ideal) with passing time of the breeding season. The arguments among cocks were probable to occur all over the breeding season because of the coming stimuli through the wire fences in the intensive system. Cocks and hens showed their desire towards inaccessible sexual partners under the intensive system only.

*Key words: Ostrich, egg laying, fertility and housing.*

## INTRODUCTION

Ostrich are the tallest and the heaviest living bird. They are well adapted to live in the dry conditions. Moreover, ostrich is the only living bird with two toes. Ostrich is known as the fastest creature on two legs (Tully and Shane, 1996).

As a matter of fact, ostrich are raised for several purposes. Accordingly, they are raised for meat, egg, feather and hide production. That makes ostrich the bird of choice from the productive point of view. Tully and Shane (1996) confirmed that the only way to maintain a healthy and profitable ostrich industry in the long term is by implementation of comprehensive, practical and effective methods of management and preventive medicine.

Ostrich breeding pair produces 15-120 eggs a year (Hicks, 1993). It is worse to mention that the presence of aggressive pen mates affects adversely the egg laying (Deeming, 1998).

However, during the breeding season, a hen should lay between 15 to 70 eggs for approximately 40 years of her breeding life. An ideal average is about 60 to 70 eggs a year with a break of 60 to 90 days between season. Hefty arguments and fights were observed between cocks in neighboring pastures. The birds which were only separated by a wire mesh fence could see each other. Then, with spreading their wings and opening the peaks, they kick with one of their legs. Accordingly, it could happen that a bird gets its toe stuck in the fence and falls (Huchzemeyer, 1998).

Although chain link fencing appears to fulfill most requirements for emus pens. Shade cloth over provides protection from wing rubbing and also prevents fighting between birds in adjoining pens. It also provides protection from wind, blowing precipitation and sun. The visual stimulus of other birds often distracts the breeding pairs early in laying season (Irons, 1995). He also added that the most obvious cause of infertility was failure to copulate, due to behavioural problems. Although ostriches are gregarious in nature, with one male breeding several hens, they display individual preferences. The latter fact may result in presence of incompatibility which existed when birds are not allowed to select their mates. The general rule for breeding males and females is to allow mating in pairs but a vigorous cock is often put in with two hens.

Behavioural disorders often lead to a failure to copulate. The most common problems are excessive aggression obsessive territorial behaviour, incompatibility between males and females, and human imprinting in males (Hicks, 1993; Irons, 1995 and Huchzemeyer, 1998).

Social interactions within and between breeding groups exert an important influence on reproductive behaviour, and ultimately on egg fertility rates (Deeming, 1998).

The current study is a trial to establish the relationship between the behavioural disorders, management and the most important elements of production in ostrich.

#### **MATERIAL and METHODS**

This study was carried out at Egyptian-Saudi Co. for ostrich breeding at Ismailia Governorat, Wady El-Molak.

**Management and feeding programs:**

**Feeding:**

Ostriches were fed ad libitum. The diet was offered every day morning. The amount per one ostrich composed of:

Poultry breeder dry ration	100gm.
Meat as thin strip	100gm.
Corn	200gm.
Lettuce	100gm.
Carrot	100gm.
Bean	500gm.
Egg	2 eggs
Bread	100gm.

The poultry breeder dry ration was that produced by Cairo Company for table egg production. It was made of yellow corn, Soya bean cake, bran, lime stone, vitamins and mineral mixture. This ration contains:

- Crude protein not less than 18%.
- Crude fat not less than 2.9%.
- Crude fiber not less than 2.7%.

**Watering:** A tap water was offered to birds in a drinking basin ad libitum. The basin was subjected to daily cleaning and replacement with fresh water. The above mentioned program was according to Fatma (1994).

**Camping off:** 8 to 12 weeks before the beginning of breeding season, the sexes are separated. That routine is essential for ensuring a good average number of eggs in the following seasons with a high percentage of fertility. This break will give the bird a well-deserved rest (Tuckwell and Rice, 1997).

**Breeding systems:**

The breeding systems in the farm were classified into three systems: -  
Intensive system.

This system was classified into 8 breeding units. Each unit included one cock and two hens, which were enclosed in an area of 5x30 m<sup>2</sup>. Moreover, the breeding unit was surrounded by a wire-mesh fence.



**Semi-intensive system:**

This system was classified into 3 breeding unit. Each unit included one cock and three hens, which were enclosed in an area of 10x40 m<sup>2</sup>. Each unit was surrounded by a block fence.

**Extensive system:**

This system included 3 breeding units. Each unit included six cocks and twelve hens. An acre was assigned for each unit. The previous systems were designed according to Hulton(1989). The age of both cocks and hens were about 4 years old. The litter in the previous systems was sand, except in the intensive system, which included various types of litters (sand, concrete and both).

The main trend of the study was to evaluate the existing situations in the previous farm in relation to the systems of breeding and in terms of productions. The essential items of production were egg laying and fertility.

Firstly, we evaluated the ostrich performance for each breeding unit under various breeding systems. Accordingly, the records were used to determine the mean of both egg laying and fertility for each breeding unit/ three weeks from the onset of breeding season (March) till the 15<sup>th</sup> week of breeding. Actually, the breeding season is synchronized photoperiodically and coincides with increasing day light length (Mellett, 1993).

Secondly, the ostrich performance was recorded for both intensive system/hen as before.

Different types of litters under the intensive system of breeding gave a reason for studying the previous productivity items. Recording was carried out in the same previous manner.

**Behavioural observation:**

The occurrence of the following behavioural activities was recorded in the previous breeding systems:

- Social interactions between cocks in the extensive system and through the fence in the intensive and semi-intensive systems as well.
- Probable attraction of a cock to a courting female in the adjoining pen.
- Addressing the desire of either cock or hen to the inaccessible sexual partners.
- The presence or absence of fractures, wounds and injuries.
- Statistical analysis.

F test, L.S.D and t in pairs were used to test the significance between means throughout the study according to Sendecore and Cochran (1980).

### RESULTS

**Table 1:** Means ( $\pm$ ) of egg laying and fertility under different types of litters within the intensive system of breeding.

Types of litter	Egg laying per 3 weeks	Fertility per 3 weeks
Concrete	3.8 $\pm$ 1.07	1.0 $\pm$ 0.447
Sand	11.2 $\pm$ 2.67*	2.8 $\pm$ 1.24
Both concrete and sand	3.8 $\pm$ 0.97	1.2 $\pm$ 0.489

\* Significant difference at  $P \leq 0.05$

L.S.D.  $_{0.05} = 5.401$

**Table 2:** Means ( $\pm$ ) of egg laying per 3 weeks in ostrich under different systems of housing.

The unit (week)	Systems		
	Intensive	Semi-intensive	Extensive
0 ~ 3	2.6 $\pm$ 0.78	12.33 $\pm$ 8.95	0.00 $\pm$ 0.00
4 ~ 6	4.4 $\pm$ 1.08	14.0 $\pm$ 7.63	0.66 $\pm$ 0.66
7 ~ 9	5.2 $\pm$ 3.72	19.66 $\pm$ 3.92	4 $\pm$ 0.58
10 ~ 12	6.8 $\pm$ 0.86	18 $\pm$ 7.09	6.67 $\pm$ 4.25
13 ~ 15	7.6 $\pm$ 1.93	17.6 $\pm$ 5.89	2.67 $\pm$ 1.45
Total mean	5.32 $\pm$ 0.88	16.32 $\pm$ 1.36	2.82 $\pm$ 1.2

\*\* Highly significance at  $P \leq 0.01$

L.S.D.  $_{0.05} = 3.59$

**Table 3:** Means ( $\pm$ ) of egg laying / hen per 3 weeks in both intensive and semi-intensive systems.

Breeding systems	Means $\pm$ SE	A year
Intensive	2.66 $\pm$ 0.44	38.13
Semi-intensive	4.47 $\pm$ 0.38**	63.9

\*\* Highly significance at  $P \leq 0.05$ .

**Table 4:** Mean ( $\pm$ ) number of fertile eggs per 3 weeks in ostrich under different breeding systems.

The unit (week)	Types of system					
	Intensive	%	Semi-intensive	%	Extensive	%
0 ~ 3	0.5 $\pm$ 0.37	19.2	8.33 $\pm$ 5.45	67.6	0.00 $\pm$ 0.00	0.00
4 ~ 6	0.75 $\pm$ 0.41	17.05	10.33 $\pm$ 5.84	73.7	0.66 $\pm$ 0.66	0.00
7 ~ 9	0.37 $\pm$ 0.18	7.12	14.33 $\pm$ 5.23	72.9	0.66 $\pm$ 0.33	0.00
10 ~ 12	3.62 $\pm$ 1.02	53.24	15.33 $\pm$ 5.69	85.2	2.66 $\pm$ 2.18	39.9
13 ~ 15	3.50 $\pm$ 1.16	64.05	15.66 $\pm$ 5.33	88.7	0.00 $\pm$ 0.00	0.00
Total mean	1.748 $\pm$ 0.74	28.53	12.79 $\pm$ 1.47**	77.6	0.79 $\pm$ 0.49	7.9

\*\* Highly significant at  $P \leq 0.01$ .

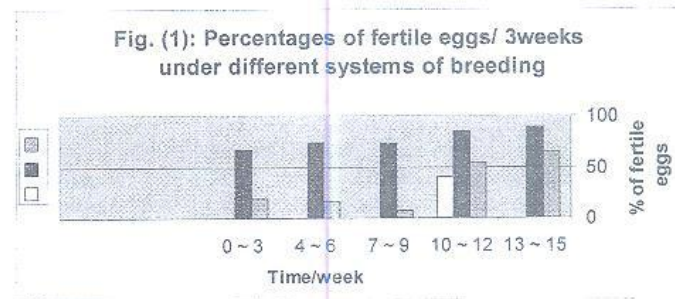
L.S.D.  $_{0.05} = 3.05$

**Table 5:** Occurrence of detrimental behavioral activities and affections under different breeding systems.

Sex	Breeding system		
	Intensive	Semi-intensive	Extensive
<b>Cocks:</b>			
▪ Fighting each other*	+	-	+*
▪ Showing the desire towards inaccessible hens	+	-	-
▪ Incomplete mating	+	-	+
▪ Affections	+	-	+
<b>Hens:</b>			
▪ Addressing the desire towards inaccessible cock	+	-	-
▪ Affections	+	-	-

\*Fighting of cocks in the extensive system occurred just after relocation. This fighting was for attaining the higher rank. After a period of time a solid social structure was formed and in turn fighting disappeared.

+ Presence of events  
- Absence of events



### DISCUSSION

Means of egg laying per 3 weeks under the intensive system increased significantly ( $p \leq 0.01$ ) on sand (Table 1). However, the mean of egg laying decreased in both concrete and mixed litters (concrete and sand). Moreover, there was no significant difference between concrete and mixed litters. The increase in egg laying on sand may be attributed to the nature of sand which did not interfere with digging and nest building. As a matter of fact, the presence of a nest is essential for egg laying (Welty, 1975). On the other hand, the presence of concrete floor will



prohibit the nature of cock during digging and preparation of the nest. This may affect the egg laying due to absence of the site for broodiness and keeping of eggs (nest). The previous explanation agrees with Grzimck (1995) who mentioned that a cock scratches out the nest depression in a sandy spot which is essential for egg laying. Regarding the fertility rates (Table 1) under various types of litters, there was no significant difference.

From Table (2), it is clear that the total means of both egg laying and fertile eggs increased significantly ( $p \leq 0.01$ ) under the semi-intensive system. At the same time, the number of both egg laying and fertile eggs decreased under both intensive and extensive system. The significant increase in the number of egg laying and fertility under the semi-intensive system may be attributed to the design of housing which eliminate the effect of visual stimuli coming from the adjoining pen through the block fences. On the other hand, the presence of courting hen in the neighbor pen under the intensive system may attract a cock away from his female (incompatibility between the breeding pen-mates). Accordingly, the social interactions were observed under the intensive system through a wire mesh fence. In fact, the aggressive pen-mate may give a reason for decreased egg laying under the intensive system, which affects the egg laying. On the other hand, males in the extensive system were always under social stress, which may result finally in presence of incomplete mating and in turn, lowering the fertility rate (Table 5). Therefore, it could be concluded that, aggression and the presence of social stress exerted an important influence on reproductive behavior and ultimately on egg fertility rate. The pervious results were an outcome of breeding units under different systems of housing. It is urgent to study the egg laying per hen every 3 weeks under both intensive and semi-intensive system. From table (3), means of egg laying per hen every 3 weeks increased significantly ( $P \leq 0.01$ ) under the semi-intensive system. Moreover, means of egg laying per hen under semi-intensive system reached the standard record a year (63.9 egg/year). The previous results and reasons coincide with what mentioned by Tuckwell and Rice (1997). In addition, from our study, fractures and injuries were more frequent under the intensive system than that in the semi-intensive. The absence of affections under the semi-intensive system may be due to the block fence, which limits the interactions between males (Table 5). The previous finding and explanation are nearly consistent to (Hicks, 1993; Irons, 1955 and Huchzemeyer, 1998). From the above, it is highly recommended to



avoid a razor wire fence and its detrimental consequences (male distraction, head and neck injuries and foot entrapment). The application of block fence is encouraging for successful breeding management in ostrich.

During the breeding season, the number of fertile eggs comprised 77.6 % of the lay under the semi-intensive system (Table, 4). The previous result agrees with (Tuckwell and Rice, 1997). On the other hand, the lowest percentages of fertile egg were recorded under the extensive system for the detailed reasons mentioned above. Fertility rates were almost increased under the semi-intensive system (ideal) with passing days of the breeding season (Fig. 1). The increase in fertility rates may reflect the psychological settlement of the breeding pen-mate with time. The block fence of the semi-intensive system will prevent the visual stimuli coming from the adjoining pen. This will realize complete attraction and satisfaction by a cock towards his females (Tully and Shane, 1996).

The occurrence of detrimental behavioral activities and affections were also studied under different breeding systems. The reflection of harmful activities was concentrated on both sexual partners. Accordingly, the observations were oriented towards both cocks and hens. Prolonged fighting were only observed in the intensive system of breeding. The arguments were probable to occur allover the breeding season because of the coming stimuli in adjoining pens through the wire fences. Under the extensive systems, fighting occurred just after relocation of birds (after the end of camping off). Accordingly, fighting under the extensive system did not continue after establishment of a solid social structure. The above-mentioned finding agree with (Tuckwell and Rice, 1997). Cocks and hens showed their desire towards inaccessible sexual partners under the intensive system only. Actually, a receptive female will drop to the ground near the fence which may attract a cock through a wire- mesh in the adjacent breeding pen. The incomplete mating (mounting trial) was only observed under the extensive system. This may be explained through the dismounting (incomplete mating) which displayed by submissive cocks on approach of a dominant one. Affections for both hens and cocks were frequent under the intensive system, which may reflect the harmful effects resulted from a razor wire fence. Affections under the extensive system were probable after relocation of birds (after the end of camping off) because of fighting for a higher rank. The above mentioned are nearly similar to (Hicks, 1993; Irans, 1995 and Deeming, 1998).

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