A STUDY OF THE OPERATIONS OF A COMMERCIAL HATCHERY IN GHANA

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ABSTRACT

The operations of a commercial hatchery in Ghana were studied and records covering a period of thirteen months were compiled and analysed.

The hatchery studied is a unit of a fully integrated farm. Its eggs were stored in an air conditioned room and were set twice a week. The layer chicks were harvested on Mondays and broiler chicks on Thursdays. The records indicated that 775,403 broiler eggs were set and 595,709 saleable broiler chicks were hatched: this represented 76.8% of eggs set and 85.1% of fertile eggs. Out of the 835.539 layer eggs set a total of 623,841 saleable chicks (50%. 1% pullet chicks and 49.9% cockerel chicks) were hatched; the saleable chicks value was 74.7% of eggs set and 89.9% of fertile eggs. In both broilers and layers fertility declined with advancing age of the breeders.

The problems observed and their possible solutions have been discussed

Keywords: Hatchery, operations, egg-hatchability, egg-fertility, chicks, Ghana.

INTRODUCTION

There is the need for the records and operations of hatcheries, and for that matter agricultural enterprises, to be studied by researchers. Such studies would give researchers a better insight into the problems of the enterprises and even unveil problems, hitherto unknown, for further and more comprehensive investigations.

Olympio and Badu [1] and Osei and Banson [2] have reported on hatchery practices that could improve hatchability under Ghanaian conditions. These two studies focused on specific problems and used relatively small numbers of eggs over short periods. An analysis of the records of a hatchery is a more general approach and involves a large number of eggs over a much longer period.

The present work analyses the records of a commercial hatchery in order to (1) provide information on the level of performance of a reputable hatchery in Ghana (2) provide data which other hatcheries can use to assess their own performance and (3) offer possible solutions to problems revealed during the study.

MATERIALS AND METHODS

The records were obtained from the hatchery of Afariwaa Farms and Livestock Products Limited which is located in the Coastal Savannah Zone in the Greater Accra Region of Ghana. The farm is fully integrated with a breeding farm, a hatchery, a feedmill and commercial broiler and egg farms.

The hatchery is equipped with Petersime incubators with a total setting capacity of 125,000 eggs. Both commercial layer day-old chicks and commercial broiler day-old chicks are produced by the hatchery. The Afabro broiler chicks are hatched on Thursdays and the Afabrid layer chicks on Mondays. The hatching eggs are supplied to the hatchery by the breeding farm, all the settable eggs are fumigated (Potassium permanganate and formalin) and then stored in an air conditioned room at 19-21°C and 40% R.H. from one to seven days.

On the day the eggs are set they are removed from the storage room, allowed to warm to room temperature and transferred to the setting trays. They are then fumigated and placed inside the setters. The setter temperature (37.6°C) and humidity (60-65% R.H.) as well as the turning mechanism were automatically controlled. The eggs were candled on the 18th day and all the fertile eggs (eggs showing well developed embryos) transferred to the hatchers and fumigated. The hatcher temperature (36.9-37.2°C) and humidity (75-85%) were automatically regulated.

The hatch is pulled on the 21st day of incubation. Saleable chicks were colour sexed in the case of the chicks from the Afabrid layer parents and then boxed. The broiler chicks were not sexed. Records were also taken of weak and deformed chicks and dead-in-shell embryos.

Data Collected

The data were collected over a thirteen month period from August 1994 to August 1995 and were analysed separately for broilers and layers. The data on broilers were compiled from August 1994 to July 1995 and those on layers from September 1994 to August 1995. Each monthly period was made up of four or five hatches depending upon whether there were four or five Mondays or Thursdays in the month.

The following parameters were studied: Fertility, hatchability of fertile eggs, hatchability of eggs set and per cent dead-in-shell. The data were subjected to regression analyses, with age (month) as the independent variable (X), and fertility, or hatchability or dead-in-shell, as the case may be, as the dependent variable (Y). Age covered a period of twelve months, the first month was assigned a value of one and the last month a value of twelve.

A total of 1, 610,942 eggs were set during the period considered. Out of this number of eggs 775,403 were eggs obtained from the Afabro broiler parents and 835,539 eggs were from the Afabrid layer parents.

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RESULTS

Broilers

Table 1 shows a summary of data on the Afabro broiler parents' eggs set during the period considered.

Table 1: Fertility, hatchability and dead-in-shell values of Afabro broiler breeder eggs

MONTH	FERTILITY OF EGGS SET %	HATCHA-BILITY OF FERTILE EGGS SET %	HATCHA-BILITY OF EGGS SET %	DEAD-IN-SHELL %
August 1994	94.1	91.3	85.9	8.7
September "	93.7	89.9	84.3	10.1
October "	92.4	90.9	84.0	9.1
November"	89.5	88.5	79.2	11.5
December "	86.0	90.6	77.9	9.4
January 1995	87.0	90.6	79.1	9.4
February "	87.1	89.9	78.3	10.1
March "	82.4	88.1	72.6	11.9
April "	83.8	90.0	75.4	10.0
May "	84.0	91.7	77.1	8.3
June "	84.0	92.4	77.6	7.6
July "	84.8	88.5	75.0	11.5

Fertility

The average fertility of the broiler eggs set between August 1994 and July 1995 was 87.3% $\pm$ 3.9. From a high percentage of 94.1 in August 1994, fertility declined to 82.4% in March 1995 and rose in the ensuing months to 84.8% in July 1995. There was a significant ($P<0.01$) negative linear relationship between age and fertility of the Afabro broiler parents. The regression line was defined by $\hat{y} = 93.9 - 1.00x$.

Hatchability of Fertile Eggs

The average hatchability of fertile eggs was 90.2%$\pm$1.3. The values fell within a narrow range of 88.1% and 92.4% and showed no definite trend.

Hatchability of Eggs Set

The values for hatchability of all eggs set ranged between a minimum of 72.6% in March 1995 and a maximum of 85.9% in August 1994 with a mean of 78.9% $\pm$ 3.85. Regression analysis showed a significant ($P<0.01$) negative linear relationship between age and the hatchability of eggs set. The regression equation was $\hat{y} = 84.9-0.92X$, where is the estimated hatchability and X the age in months.

Dead-in-shell

The mean dead-in-shell value was 9.8%$\pm$1.2, and the values ranged between 7.6% recorded in June 1995 and 11.9% in March 1995. The values did not show a definite trend and the coefficient of regression, b = 0.012, was not significant ($P>0.05$).

A total of 595,709 saleable broiler chicks were produced in the year and this represented 76.8% of the eggs set and 85.1% of fertile eggs.

Layers

Table 2 shows a summary of the data on the eggs set from the Afabrid layer parents for each of the 12-monthly periods.

Table 2: Fertility, hatchability and dead-in-shell values of Afabrid layer breeder eggs

MONTH	FERTILITY OF EGGS SET %	HATCHA-BILITY OF FERTILE EGGS SET %	HATCHA-BILITY OF EGGS SET %	DEAD -IN-SHELL %
September 1994	84.0	88.9	74.6	11.1
October "	87.3	93.3	81.5	6.7
November "	88.2	91.5	80.7	8.5
December "	85.8	94.0	80.7	6.0
January 1995	83.8	93.0	77.9	7.0
February "	83.0	92.5	76.8	7.5
March "	80.4	92.0	74.0	8.0
April "	79.9	91.1	72.7	8.9
May "	78.4	93.1	73.0	6.9
June "	76.2	90.5	69.0	9.5
July "	81.8	90.4	74.0	9.6
August "	84.2	91.1	76.7	8.9

Fertility

The fertility of the Afabrid birds varied from 76.2% (June 1995) to 88.2% (Nov. 1994) with a mean of 82.7% $\pm$ 3.4. The fertility values increased from the first month to the third then decreased gradually to the lowest value in June 1995. There was a significant ($P<0.05$) negative linear regression between age and fertility of the Afabrid layers. The regression line was given by the equation $\hat{y}=86.9-0.64X$, where is the estimated fertility and X the age in months.

Hatchability of Fertile Eggs

Hatchability of fertile eggs was higher than 90% during all the 12-monthly periods considered except in September 1994 when it was 88.9%. The mean value was 91.9% $\pm$1.4 and the highest monthly value was 94.0% obtained in December 1994.

The regression analysis yielded a non-significant negative regression coefficient (b =- 0.069).

Hatchability of Eggs Set

Hatchability as a percentage of total eggs set varied between 69.0% in June 1995 to 81.5% in October 1994. The average hatchability of eggs set was 76.0%$\pm$3.6. The values declined from the highest recorded in October 1994 to the lowest recorded in June 1995. Regression analysis indicated that the regression coefficient (b =- 0.640) was significant ($P<0.01$).

The regression line was defined by the equation $\hat{y}=80.1-0.64X$ where $\hat{y}$ is the hatchability of eggs set and X the age in months.

Dead-in-Shell

The average dead-in-shell value for the layers was 8.0%$\pm$1.4; it ranged from 6.0% in December 1994 to the highest value of 11.1% recorded in September 1994. Five out of the 12 months had dead-in-shell values of 7.5% or lower. The data showed a non-significant positive regression.

A total of 623,841 saleable chicks were obtained from the total eggs set. This gave saleable chicks expressed as a percentage of eggs set as 74.7% and of fertile eggs as 89.9%. The number of pullet chicks was 312,654 and cockerel chicks 311,187 giving a female to male ratio of 1.000:0.995 (or 50.1% to 49.9%).

DISCUSSION

Broilers

The decline in fertility from September to March was due, perhaps, mainly to age and weight. The broiler parents were produced in six hatches at weekly intervals and the first batch came into lay in June 1994. The high fertility observed in September 1994 coincided with the period of peak egg production. As the broilers grew older and heavier their eggs became less fertile (i.e. higher percentages of "clears" were removed from the eggs being candled). The decline in fertility with advancing age, in natural matings, is a common problem [3,4]. Wilson *et al.* [5] explained that the phenomenon was due to lack of mating desire or successful copulation. Similarly, Duncan *et al.* [6] explained the decline in fertility in the broiler parents they studied on the basis of both age and weight. They observed that sexual behaviour declined in older birds and that the large mass of the broilers and probably their conformation interfered with the deposition of semen.

A possible solution to the decline in fertility with age on a flock basis will be to have the broiler parents come into lay in batches at intervals of three or four months. In this case as one batch gets older and heavier a new and younger batch would come into production to improve the average fertility. This method would be economically sound in places where there is a constant demand for broiler meat throughout the year. Unfortunately, this is not the case in Ghana where the demand for chicken meat peaks sharply at Christmas and a constant supply of day-old chicks creates a supply problem during the peak period and a marketing problem during the off-season.

Layers

The fertility values obtained for the layer parents were low. The low values appear to be due to the practice in the hatchery of setting the eggs from the layer parent stock in the older incubators which develop faults quite often. The faults were frequently traced to the cooling mechanism and the heating system. This would mean that the optimum temperature for embryonic development was not always maintained. The temperature fluctuations would adversely affect embryonic development. Since candling was done on the eighteenth day of incubation at the hatchery and all "clear" eggs were classified as infertile, without breaking the eggs for further examination, it is likely that eggs that were indeed fertile but which failed to develop as a result of unfavourable temperatures, were wrongly classified as infertile. It has been established that early embryonic deaths could be wrongly classified as infertility [7, 8].

Age was also a factor in the low fertility values recorded for the layers. The decline in fertility observed from December 1994 to June 1995 was reversed only because eggs from a new batch of layer parents were added to the eggs from the older ones and within two months fertility rose by eight percentage units. A study of the breeder populations over the period under consideration indicated that there was a high proportion of birds over 72 weeks of age. The layer breeders are normally culled at 72 weeks of age.

The egg storage room was cooled by an air conditioner and because the room was dry a moist cloth was provided to maintain a favourable humidity. Unfortunately, the method was not reliable and the prevailing low humidity of 40% R.H. could have increased the incidence of early embryonic deaths especially in eggs stored for more than three days. Funk and Forward [9] concluded that hatchability was higher at R.H. of 80 to 88% than at 58 to 62% or 34 to 38%. The temperatures that prevailed in the air conditioned storage room (19-21°C) were higher than the recommended temperature [10] of 10°C for eggs stored up to one week.

CONCLUSIONS

It is imperative for hatcheries to institute measures that would improve fertility and hatchability and reduce early embryonic deaths. Commercial hatcheries handle large volumes of eggs and even one percentage increase in the yield of day-old chicks could yield monetary returns.

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