A Retrospective Study of Egg Production, Fertility and Hatchability of Farmed Ostriches in Botswana

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Abstract: A retrospective observational epidemiological study was conducted to study on-farm reproductive performance (egg production, fertility and hatchability) on 4 ostrich farms in Botswana. An average of 600 birds per farm and a total of 38,447 eggs were involved. The period of operation of the farms ranged from 2-11 years. Fertility ranged from 63.5-89% (µ = 76.3%), while, hatchability ranged from 39.4-83.6% (µ = 53.8%). Hatchability averaged 54.2 and 52.4% and on farms employing the male: female breeding ratio of 1: 2 and 1 : 3, respectively, while, it averaged 62.9 and 65.9% on farms employing natural and artificial incubation, respectively. Egg production, fertility and hatchability were all competitive when compared to other country figures although there is still vast room for improvement. Record keeping needs to be encouraged on farms.

Key words: Egg production, fertility and hatchability, Botswana

INTRODUCTION

Ostrich (Struthio camelus) farming in Botswana is not well developed despite Botswana being home to the largest wild ostrich population (Mushi et al., 2008, OPCSDD, 2005). It lags behind South Africa, Zimbabwe and Namibia in Africa and contributes a paltry 0.2% of the world domesticated flock (OPCSDD, 2005). The large wild population underpins the potential that the Botswana ostrich industry has, since it presents every suggestion that environmental conditions are conducive for ostrich survival. The dearth of information pertaining to reproductive performance of ostriches (Mushi et al., 1999; Mushi et al., 2008) could be one of the factors hampering growth of the industry. For all farmed species, information derived from on-farm data helps in establishing real targets for performance on a farm or regional basis, highlights losses that occur on individual farms, provides an impartial assessment of stock intended for purchase or culling and enables an objective comparison to be made between individual animals and between farms (Dohoo and Ruegg, 1993; Tranter and Morris, 1990). Realistic targets would in turn provide industries with objective standards. Several measures of productivity for farmed ostriches have been proposed and include the number of eggs laid per hen per year, the percentage of incubated eggs that are fertile (fertility), the percentage of fertile eggs that hatch (hatchability) and the percentage of hatched chicks that survive to a specified age (survival percentage) (More, 1996). Fertility and hatchability rates have been published and range from 10-60 and 27-67%, respectively in countries like Australia, South Africa, Namibia and Zimbabwe (Dzama et al., 1995; Deeming, 1996; More, 1996; Cloete et al., 1998; Van Schalkwyk et al., 2000; Mushi et al., 2008). However, such data exists for only one farm in Botswana, involving one breeding season. As a result, farmers are left with no option but to import production targets despite the obvious influences that may be associated with different environmental factors among others. The aim of this study was therefore to conduct an observational epidemiological study involving multiple farms and seasons, on reproductive performance of farmed ostriches in Botswana.

MATERIALS AND METHODS

Egg production records from farms around Botswana were perused for data related to egg production, fertility and hatchability. The farms were basically radiated around Gaborone (24°38' 47S and 25°54' 43E) and Lobatse (25°13'E and 25°55'S), which are 1 014 and 1192 m above sea level, respectively, have a semi-arid climate and receive an annual rainfall of 500 mm. All the farms generally followed similar husbandry systems as described by Mushi et al. (2008) including the feed and feeding regime.

Average eggs per hen were computed as:

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\text{Average eggs per hen} = \frac{\text{Total number of eggs laid in a season}}{\text{Number of hens involved}}
\]

Fertility was computed as:

\[
\text{Fertility} = \frac{\text{Total number of fertile eggs}}{\text{Total number of eggs laid}} \times 100
\]
Hatchability was computed as:
\[
\frac{\text{Total number of eggs that hatched successfully}}{\text{Total number of fertile eggs set}} \times 100
\]

Fertility and hatchability were further analyzed relative to the type of incubation and breeding ratios used, that is, finding averages on the basis of type of incubation and breeding ratios used. Farms visits and interviews with farm managers were also used to augment data collection and for the elaboration of farm procedures.

RESULTS

A total of 4 farms were involved and these were basically those that kept proper records. The period of operation of the farms that participated ranged from 2-11 years. All the farms generally followed the same husbandry patterns and differed mainly in the following ways: some were using artificial incubation while others were using natural incubation and others were using male: female breeding ratios of 1:2 and 1:3 respectively. For purposes of this study, the four participating farms were randomly coded as farms 1-4. Farms 2 and 3 were using natural incubation while farms 1 and 4 were using artificial incubation. The decision to use natural incubation was based on financial considerations. Farm 1 was the longest operating farm and provided records that dated back to 1995, while, other farms provided records that only covered the 2004-2006 period. The number of birds per farm ranged from 67-1953, with an average of 600 birds per farm. Of these, 7% were breeders while the remainder were growers. The breeders’ ages ranged from 4-9 years, with an average age of 6 years. The breeders were all fed the same feeds; maintenance ration during off season and breeder ration during breeding seasons.

A total of 38,447 eggs were laid during the period under study, 1.6% of which were from the smaller farms utilizing natural incubation. The average number of eggs laid per hen was 43.2. The fertility of eggs from farms 1 and 4 ranged from 63.5-89% (\(u = 76.3\%\)) (Fig. 1).

The other causes of egg losses apart from infertility were eggs with holes, cracked eggs, chalky eggs, very small eggs and spoilt eggs.

Overall hatchability ranged from 39.4-83.6% (\(u = 53.8\%\)) while, mean hatchability rates were 65.9 and 62.9%, at farms using artificial and natural incubation, respectively (Fig. 2).

Average hatchability was slightly higher among farms using the 1:2 breeding ratio (54.2%) than at the farm that was using the 1:3 breeding ratio (52.4%) (Fig. 3). The main causes of reduced hatchability included early embryonic death, egg rots, broken yolk, dead-in-shell and weak hatch.
Artificial Insemination (AI) in the ostrich (Rozenboim et al., 2003; Rybnik et al., 2007; Malecki and Rybnik, 2008) may offer more opportunities for the industry as this may allow Breeding Soundness Examinations (BSE) and AI as in other livestock species. In this study, only factors like nutrition and age of breeders could be investigated and were generally similar and therefore unlikely to be the sources of variation. The observation that farms 1 and 4 that were using the same male: female breeding ratio of 1:2 produced different fertility rates of 63.5 and 89% respectively seems to suggest a lack or low association between fertility and breeding ratios. This could be in agreement with Malecki and Martin (2003), who noted that fertility was not affected by sex ratio. Further more, the existence of sperm-storage tubules at the utero-vaginal junction of the oviduct of the female ostrich (Bezuidenhout et al., 1995; Madekurozwa, 2002) and the fact that ostrich hens can have a fertile period of 5-28 days post-coitus (Birkhead, 1988; Swan and Sicouri, 1999; Malecki et al., 2004) may reduce the need for frequent matings. Also, Malecki et al. (2004) noted that fertilisation rate in ostrich eggs is high because most eggs contain excessive numbers of sperm yet very low numbers of sperm appear sufficient to achieve fertilisation.

Hatchability ranged from 39.4-83.6% (u = 53.8%), thus, competing well with the 27-67.5% range noted elsewhere (Deeming, 1996; More, 1996; Bradley, 1997; Mushi et al., 2008). Just like fertility, hatchability was also farm related, with Farm 1 recording high fertility and low hatchability, while Farm 4 had the opposite trend. The causes of poor hatchability in this study were similar to those noted by Mushi et al. (2008) and included early embryonic death, egg rots, broken yolk, dead-in-shell chicks and weak hatches. Problems associated with poor hatchability include prolonged pre-incubation storage of 2 weeks, season, poor breeder nutrition, breeder age, improper egg handling that may affect the developing embryo, contamination, incubator or hatcher malfunctions and humidity or temperature problems (Deeming, 1995; Van Schalkwyk et al., 2000; Nahm, 2001; Cabassi et al., 2004; Hassan et al., 2004; Ipek and Sahan, 2004; Malecki et al., 2005). Among these factors only breeder nutrition and age were verifiable and were unlikely to be the sources of variation.

In this study, hatchability rates between farms using artificial and natural incubation did not differ much at 65.9 and 62.9%, respectively. In theory, natural incubation would be expected to yield better results as it has evolved over many years. However, allowing natural incubation diminishes egg production since, the hen would start brooding after laying a clutch, even before the end of the breeding season (Kimwele and Graves, 2003). As a result, workers have been trying to simulate conditions in the natural nest in order to improve on artificial incubation.
Average hatchability also differed slightly among farms using the male:female breeding ratios of 1:2 and 1:3 at 54.2 and 52.4%, respectively, probably suggesting a low association between breeding ratio and hatchability. As already noted, hatchability is mainly influenced by incubation circumstances and conditions.

**Conclusion:** Reproductive performance of ostriches on some Botswana farms compares well with performances noted elsewhere. More effort is however still needed in order to attain optimal results. Breeding ratios did not appear to have an influence on fertility, neither did the mode of incubation on hatchability. Further research is needed on the influence of both factors on ostrich reproduction. Record keeping needs to be encouraged on the farms.

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**REFERENCES**


