

## Effect of Timing of Artificial Insemination on Fertility and Hatchability of Shikabrown Breeder Hens

J.A. Obidi<sup>1</sup>, B.I. Onyeanus<sup>2</sup>, J.O. Ayo<sup>2</sup>, P.I. Rekwot<sup>2</sup> and S.J. Abdullahi<sup>2</sup>

<sup>1</sup>Department of Veterinary Physiology and Pharmacology, <sup>2</sup>Department of Veterinary Anatomy, Ahmadu Bello University, Zaria, Nigeria

**Abstract:** The influence of timing of artificial insemination on fertility and hatchability of breeder hens was carried out by inseminating breeder hens at 10:00 hr and 15:00 hr with pooled semen from Shikabrown White breeder cocks for four weeks. Fertile eggs were collected two days after the first insemination and stored at a temperature of 16°C for seven days before incubation. Fertility was higher ( $P < 0.05$ ) in hens inseminated at 10:00 hr when sperm quality was optimal. The fertility values of  $82.1 \pm 1.0\%$  and  $85.0 \pm 2.3\%$  obtained in Shikabrown White and Shikabrown Red hens, respectively, for 10:00 hr insemination were significantly ( $P < 0.01$ ) different from the corresponding values of  $76.0 \pm 3.2\%$  and  $78.3 \pm 2.5\%$  recorded at 15:00 hr insemination in the Shikabrown White and Shikabrown Red hens, respectively. The hatchability values of  $72.5 \pm 2.8\%$  and  $67.0 \pm 3.3\%$  were obtained for Shikabrown White and Shikabrown Red hens, respectively, for the morning hour insemination. These values were significantly ( $P < 0.01$ ) different from the corresponding values of  $65.0 \pm 1.0\%$  and  $63.0 \pm 1.1\%$  obtained in the Shikabrown White and Shikabrown Red hens, respectively, for 15:00 hr insemination. The results showed that timing of artificial insemination influence fertility in Shikabrown breeder hens and this is probably mediated by meteorological factors. In conclusion for better fertility of Shikabrown hens, insemination should be carried out at 10:00 hr.

**Key words:** Artificial insemination, influence of timing, hatchability, breeder hens

### INTRODUCTION

It has been well established that artificial insemination in avian species has relative advantages as compared with natural mating (Fuquay and Reden, 1976; Surai and Wishart, 1996; Penfold *et al.*, 2000; Brillard, 2003). These advantages of artificial insemination include increased number of settable eggs, better overall fertility and hatchability, thus reducing the cost of production per unit of day-old chicks (Brillard, 2003).

Several factors must be synchronized for optimum success of artificial insemination and they include breeder stock management, sperm quality and quantity, sperm dosage, depth of insemination, frequency and timing of artificial insemination (Lake, 1978; Van Krey and Siegel, 1980; King *et al.*, 2002). Timing of artificial insemination in commercial poultry breeding enterprise is of great importance for optimum success of artificial insemination. Brillard and Bakst (1990) have demonstrated that spermatozoa deposited 1-3 hr prior to, or just after oviposition, are eliminated by normal vaginal contraction involved in oviposition. Brillard (2003) also recommended that the period of artificial insemination in a given poultry breeder house should not be done around the time of lay for maximum insemination results.

Shikabrown breeder stock is a heavy breed brown egg layer developed at the National Animal Production Research Institute, Ahmadu Bello University Shika, Zaria, Nigeria. It is hardy and highly adapted to the harsh

tropical environment with a high genetic (reproductive) potential for commercial production (NAPRI, 2000). This prospect may be assisted by artificial insemination.

The aim of this study was to determine the optimum timing of artificial insemination in Shikabrown breeder hens for maximum fertility.

### MATERIALS AND METHODS

A total of forty breeder hens, consisting of twenty hens each of Shikabrown White and Shikabrown Red served as subjects. The breeder hens were about 48 weeks old with body weights of  $1.70 \pm 0.8\text{kg}$  and  $1.84 \pm 0.7\text{kg}$  for the White and Red strains, respectively.

The two strains of breeder hens were equally subdivided into groups I and II, with each group having ten Shikabrown White and ten Shikabrown Red breeder hens. The hens were individually caged and properly identified by their cage numbers.

Groups I and II breeder hens were inseminated at 10:00 hr and 15:00 hr, respectively for four weeks each, with 0.05ml of pooled semen from Shikabrown White breeder cocks, using graduated tuberculin syringe. Three persons were involved in the insemination process. The first person carefully caught and restrained one hen at a time with his hands. The second person carried out abdominal massage of the breeder hens according to the method of Lake and Stewart (1978) and as soon as there was partial eversion of the cloaca, he exerted a controlled pressure on the lower abdomen for eversion of the vagina.

Thereafter, the tuberculin syringe with pooled semen was inserted into the hen's vagina by the third person, who released the semen intravaginally as soon as the vagina started to relax.

A total of 623 fertile eggs comprising 298 eggs of Shikabrown White and 325 eggs of Shikabrown Red were collected from hens and properly identified two days after the first insemination for seven consecutive days. Each day's fertile egg collections were transported to the incubation and hatching facilities of National Animal Production Research Institute, Shika, Ahmadu Bello University Zaria, Nigeria and stored at 16°C for a maximum of seven days and then incubated in a Buckeye incubator (Lopen Group, Mill Lane Lopen, South Pertherson Somerset, TA 13 5JS, England) at 37.6°C according to the method of Tona *et al.* (2003).

Percent fertility and hatchability were determined following candling at day 18 of incubation and at hatching on day 21, respectively.

## RESULTS

The effect of timing of insemination on fertility and hatchability of eggs obtained from artificially inseminated breeder hens are shown in Table 1 and Figs. 1 and 2. Fertile eggs obtained from Shikabrown White hens inseminated at 10:00 hr had a higher ( $P < 0.01$ ) percent fertility than those obtained from hens inseminated in the afternoon at 15:00 hr, with the values of  $82.1 \pm 1.0\%$  and  $76.0 \pm 3.2\%$ , respectively.

The percent fertility of eggs obtained from Shikabrown Red hens was also higher ( $P < 0.01$ ) in hens inseminated at 10:00 hr than those inseminated at 15:00 hr with the values of  $85.0 \pm 2.3\%$  and  $78.3 \pm 2.5\%$ , respectively.

These results of the present study showed that Shikabrown Red hens inseminated at 10:00 hr had a higher ( $P < 0.01$ ) fertility than the White strain ( $85.0 \pm 2.3\%$  and  $82.1 \pm 1.0\%$ ), respectively.

The percent hatchability of eggs obtained from Shikabrown White hens inseminated at 10:00 hr was  $75.0 \pm 2.5\%$ , while those inseminated at 15:00 hr had a hatchability of  $65.0 \pm 1.0\%$  for the same strain. The percent hatchability of Shikabrown Red breeder hens inseminated at 10:00 hr was  $67.0 \pm 3.3\%$ , while those obtained from 15:00 hr insemination was  $61.0 \pm 4.0\%$  ( $P < 0.01$ ). The results showed that following insemination at 10:00 hr, Shikabrown White hens had a higher hatchability than Shikabrown Red hens ( $75.0 \pm 2.5\%$  and  $67.0 \pm 3.3\%$ , respectively).

The overall hatchability obtained in the two Shikabrown strains of breeder hens inseminated were  $72.5 \pm 2.8\%$  and  $63.0 \pm 1.1\%$  at 10:00 hr and 15:00 hr, respectively.

## DISCUSSION

The present study has demonstrated that fertility and hatchability varied with time of insemination. The higher fertility and hatchability were obtained from hens inseminated in the morning hours (10:00 hr), indicating that artificial insemination should be carried out in the

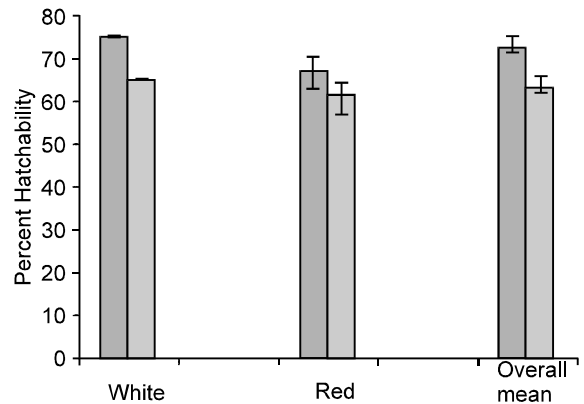


Fig. 1: The Effect of Timing of Insemination on Hatchability of Eggs

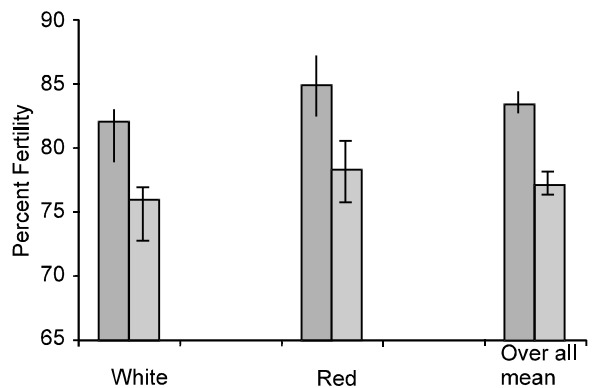


Fig. 2: The Effect of Timing of Insemination on Fertility of Eggs

morning hours in the Northern Guinea Savannah zone of Nigeria for optimum insemination results.

The important relationship between sperm concentration and fertility, artificial insemination time and fertility and time of insemination, have been reported in avian species (Lake, 1978; King *et al.*, 2002). This observation has also been reported in the endangered Northern Pintail duck (Penfold *et al.*, 2000). The lower densities (consistency) of semen observed in the afternoon collection may be responsible for the relatively lower fertility recorded for hens inseminated in the afternoon (15:00 hr) hour in the present study.

Therefore, the higher fertility recorded in the morning hour may be due to a higher sperm quality recorded in the morning insemination. The observed depression in fertility during the afternoon insemination may also be attributed to diurnal rhythm, which shows that fertility in breeder hens may be influenced by intrinsic biological activity. This observation supports earlier reports by Mahmoud *et al.* (1996); McDaniel *et al.* (1996) and Brillard (2003).

Fluctuations in meteorological parameters such as a rise in ambient temperature induces changes in metabolism (Piccione and Caola, 2002), which in turn affects the efficiency of the sperm storage tubules to trap inseminated spermatozoa for controlled release for fertilization (King *et al.*, 2002).

The present study further confirms that the negative influence of high ambient temperature is one of the most serious factors limiting livestock production and reproductive efficiency in the tropics (Mahmoud *et al.*, 1996; Ayo *et al.*, 2005). Based on the fact that the hen's oviduct is most receptive to semen just after an egg is laid, that is, when there is no hard-shell egg in the uterus (Lake, 1978. Brillard, 2003) corresponding mainly to 10:00 hr in the present study, it is concluded that the hens were more receptive to spermatozoa during the morning hours of the day.

## REFERENCES

- Ayo, J.O., O.O. Owoyele and T. Dzenda, 2005. Effect of ascorbic acid on diurnal variation in rectal temperature of Shaver Brown Pullets during the harmattan season. *Proceedings of 28<sup>th</sup> Annual Conference of the Nigerian Society for Animal Production*, 30: 57-67.
- Brillard, J.P., 2003. Practical aspects of fertility in poultry. *World's Poult. Sci. J.*, 59: 441-446.
- Brillard, J.P. and M.R. Bakst, 1990. Quantification of spermatozoa in the sperm-storage tubules of turkey hens and the relation to sperm numbers in the perivitelline layer of eggs. *Bio. Reprod.*, 43: 271-275.
- Fuquay, J.I. and J.A. Renden, 1976. Reproductive performance of broiler breeders maintained in cages or floors through 59 weeks of age. *Poult. Sci.*, 59: 1524-1526.
- King, L.M., J.P. Brillard, W.M. Garret, M.R. Bakst and A.M. Donoghue, 2002. Segregation of spermatozoa within sperm storage tubules of fowl and turkey hens. *Reprod.*, 123: 79-86.
- Lake, P.E., 1978. *Artificial Insemination in Poultry: The male Reproductive organs and semen characteristics*. Ministry of Agriculture, Fisheries and Food. Bulletin, 213: 5-7. London, Her Majesty's Stationery Office.
- Lake, P.E. and J.M. Stewart, 1978. Artificial insemination in poultry. Bulletin, Ministry of Agriculture, Fisheries and Food, No. 213.
- Mahmoud, K.Z., M.M. Beck, S.E. Scheideler, M.F. Forman, K. Anderson and S.D. Kachman, 1996. Acute High Environmental Temperature and Calcium-Estrogen Relationships in the Hen. *Poult. Sci.*, 75: 1555-1562.
- McDaniel, C.D., R.K. Bramwell, J.C. Wilson and B. Howarth, 1996. Fertility of male and female broiler breeders following exposure to elevated ambient temperature. *Poult. Sci.*, 74: 1029-1033.
- National Animal Production Research Institute Shika, Zaria, 2000. Shikabrown Parent Stock: Management Guide, pp: 1-16.
- Penfold, L.M., D.E. Wildt, T.L. Herzog, W. Lynch, L. Ware, S.E. Derrickson and S.L. Monfort, 2000. Seasonal patterns of LH, testosterone and semen quality in the Northern Pintail duck. *Reproduction, Fertility Development*, 12: 229-235.
- Piccione, G. and G. Caola, 2002. Biological rhythm in Livestock. *J. Vet. Sci.*, 3: 145-157.
- Surai, P.F. and G.J. Wishart, 1996. Poultry artificial insemination technology in the countries of the former USSR. *World's Poult. Sci. J.*, 52: 27-43.
- Tona, K., F. Bamelis, B. De Ketelaere, V. Bruggeman, V.M.B. Moraes, J. Buyse, O. Onagbesan and E. Decuypere, 2003. Effects of egg storage time on spread of hatch, chick quality and chick juvenile growth. *Poult. Sci.*, 82: 736-741.
- Van Krey, H.P. and P.B. Siegel, 1980. A revised artificial insemination schedule for broiler breeder hens. *Poult. Sci.*, 55: 725-728.