



## Effect of Interspiking on Fertility and Hatchability of Vanaraja Chicken Parents

SMITA PATIL, V.N. KHUNE\*, SHARAD MISHRA, NISHMA SINGH, M.D. BOBADE, VANDANA BHAGAT

*College of Veterinary Science and Animal Husbandry, Anjora, Durg (Chhattisgarh), India.*

**Abstract** | The experiment was conducted on Vanaraja chicken breeder flock maintained in three separate experimental pens in which two ( $T_1$  and  $T_2$ ) were treatment pens and  $T_0$  was control pen with 1:8 male to female mating ratio and total birds ranging from 88 to 90 in each pen. At the end of 48<sup>th</sup>, 49<sup>th</sup>, 52<sup>nd</sup> and 55<sup>th</sup> Weeks Of Age (WOA), 150 eggs were randomly selected from each pen and a sum of 450 eggs from the three pens, were set in incubator for incubation. At the end of 48<sup>th</sup> week for interspiking 3 roosters from experimental pen  $T_1$  were transferred to  $T_2$  and another 3 roosters from pen  $T_2$  were transferred to  $T_1$ . Increase in fertility rates were observed at 52 and 55 WOA after the initial reduction at 49 WOA after interspiking in all the groups. However more increase was observed in the interspiked  $T_1$  and  $T_2$  groups. The hatchability values on Total Eggs Set (TES) basis at 52 and 55 WOA of interspiked groups were found higher than those of the non interspiked control group of birds. There was gradual increase in TES hatchability after interspiking from 49 to 55 WOA in  $T_1$  and  $T_2$  groups than those before interspiking. However, in all the age groups there were no significant differences in TES hatchability rates among the treatments. While evaluating the hatchability rate on Fertile Eggs (FES) basis in all the age groups, no significant differences were found among the treatments. An increase in FES hatchability rate of all the treatment groups has been found as the age advances. However, more increase was observed in interspiked groups ( $T_1$  and  $T_2$ ) compared with control  $T_0$  group. The findings indicate that interspiking of Vanaraja roosters can be advantageous especially in flocks showing lower fertility rates.

**Keywords** | Interspiking, Fertility, Hatchability, TES, FES, Vanaraja fowl

**Editor** | Asghar Ali Kamboh, Sindh Agriculture University, Tandojam, Pakistan.

**Received** | November 27, 2018; **Accepted** | May 13, 2019; **Published** | June 08, 2019

\***Correspondence** | V N Khune, College of Veterinary Science and Animal Husbandry, Anjora, Durg (Chhattisgarh), India; **Email:** doc\_vik@rediffmail.com

**Citation** | Patil S, Khune VN, Mishra S, Singh N, Bobade MD, Bhagat V (2019). Effect of interspiking on fertility and hatchability of vanaraja chicken parents. *J. Anim. Health Prod.* 7(2): 65-69.

**DOI** | <http://dx.doi.org/10.17582/journal.jahp/2019/7.2.65.69>

**ISSN** | 2308-2801

**Copyright** © 2019 Patil et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Poultry production is the fastest growing sector of Indian agriculture. As per 19<sup>th</sup> livestock Census (2012) poultry population in India is 729.2 millions, the total poultry population has increased by 12.39 percent over the previous census. Having realized the importance of backyard farming, a long-term program has been initiated at Project Directorate on Poultry (PDP), Hyderabad to develop a suitable germplasm for backyard/free range farming. The Directorate has evolved "Vanaraja" variety utilizing the Red Cornish as male line and random bred meat control population as dam line. Vanaraja was released in the year 1998 at 46<sup>th</sup> Livestock and poultry show (Rao

and Preetam, 2009). The male and female breeder parents of Vanaraja are the strain crosses.

It is widely known that fertility levels will naturally decline with age in a normal broiler breeder flock's production (Wood-Gush, 1958; Novikov, 1979; Kirk et al., 1980; Sexton et al., 1989; Weil et al., 1999; McGary et al., 2002). Fertility usually increases (65-75%) at the start of lay (23-24 weeks of age (WOA)) and peaks at 95-98% at 35-37 WOA. Between 40-45 WOA fertility declines, older birds get faster decline in fertility (Wilson, 2002). In broiler flocks, the fertility rate decreases with increasing age from 40 to 45 weeks. Therefore, different methods are used to compensate for the reduced fertility caused by the

aging of the rooster and the most important of them is the movement inside the rooster flocks or interspiking (Sharifi et al., 2018). At this stage the rooster mating frequency is lower and physiologically the hen needs to be mated more often to maintain fertility. Breeder hens begun to lay eggs with relatively low fertility levels of around 65-75 percent (Wilson, 2002). As flocks approached 40 WOA, fertility levels begun to decline, which is usually attributed to a problem with the roosters (Casanovas, 2002; Wilson, 2002; Wolanski et al., 2004). In a normal flock setting, production guides recommended one rooster necessary for every eight to twelve hens. Therefore, the effects of only one infertile rooster will extend to a large population of the flock (eight to twelve hens) and could cause a greater detrimental impact on fertility levels (Wilson et al., 1979). A common practice in industry is to apply a male management practice to an already established flock in order to counteract the decline in fertility levels. One practice that is most commonly used in industry today is known as spiking. This practice requires the introduction of young, unfamiliar, inexperienced birds into an already established flock. A second, less commonly researched male management practice is the use of interspiking. This practice requires the exchange of experienced males between two different poultry houses located on the same farm at two different time points during the life of the flocks, the concept is that the introduction of any new male, regardless of its age, will affect fertility levels of an established flock (Chung, 2010). In view of above findings, present investigation was undertaken with objectives to study the fertility and hatchability traits of and to evaluate the effect of male interspiking on these traits in Vanaraja parents.

## MATERIALS AND METHODS

### BIRDS, HOUSING AND MANAGEMENT

The investigation was carried out at the Poultry farm of Vanaraja parents at Poultry Seed Project, College of Veterinary Science & Animal Husbandry, Anjora, Durg during March and April, 2016. In this study, a total of 270 Vanaraja breeder chickens (240 females, 30 males) were utilised. All chickens were of 48 weeks old at the start of the experiment and were reared under deep litter with standard management practices. Chickens were separated into three different pens (treatments – T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub>) each containing 78-79 females and 10-11 males in order to maintain female to male ratio of 8 to 1. Each pen had an enclosure area of 12 X 20 sq.ft. in the poultry farm of Vanaraja parents at Poultry Seed Project. Identification tags were applied to all the roosters in the three rooms (pens).

Interspiking involves the transfer of roosters between two pens at a time. In this experiment interspiking was applied when birds were 48 WOA. Roosters of pen T<sub>1</sub> and T<sub>2</sub> were

interspiked and T<sub>0</sub> was used as the control pen and were remained undisturbed. At 49<sup>th</sup> WOA, about 30 percent of the rooster populations were transferred between pen two and pen three. Of the total roosters in the T<sub>1</sub> pen three roosters were transferred into T<sub>2</sub> pen and from T<sub>2</sub> pen three roosters were transferred into T<sub>1</sub> pen.

### PARAMETERS STUDIED

On the 8<sup>th</sup> day of the incubation cycle, eggs were candled in order to determine if the eggs were fertile or not. This number was then used to calculate the fertility percentage of individual pens using the following equation-

Fertility percentage =

$$\frac{\text{Total Eggs Set} - \text{Infertile Eggs}}{\text{Total Eggs Set}} \times 100$$

Hatchability was determined at specific interval in the experiment as below:

- Pre-interspike (48 WOA),
- Week of Interspike (49 WOA),
- Post Interspike (52 WOA),
- At the end of Productive life (55 WOA).

From all the four treatments, eggs were collected separately on daily basis and stored at 21°C temperature. The eggs with visible external abnormalities were discarded. In a week, 150 experimental eggs were randomly selected from each pen and a sum of 450 eggs obtained from the three pens was set in setter of incubator for incubation at the end of week. After hatching chicks were counted. Hatchability percentage was estimated on the basis of total egg set (TES) i.e., both fertile and infertile and on the basis of fertile eggs (FES) as per following formulae:

(a) Hatchability percentage (on total egg set basis):

Hatchability (TES) percentage =

$$\frac{\text{Number of Hatched Chicks}}{\text{Total Eggs Set}} \times 100$$

(b) Hatchability percentage (on fertile egg set basis):

Hatchability (FES) percentage =

$$\frac{\text{Number of Hatched Chicks}}{\text{Fertile Eggs set}} \times 100$$

## STATISTICAL ANALYSIS

The effect of interspiking and age on the fertility and hatchability were calculated by chi-square test for independence { $r \times c$  contingency table with  $(r-1)(c-1)$  d.f.} as per procedure given by Snedecor and Cochran (1994).

## RESULTS AND DISCUSSION

## FERTILITY

In the present study, the mean fertility rate at 48<sup>th</sup> WOA was 86.66 percent in Vanaraja. The mean fertility rates at 49<sup>th</sup>, 52<sup>nd</sup> and 55<sup>th</sup> WOA were 88.00, 91.33 and 92.00 percent respectively. All the fertility values of different treatment groups in their respective age group did not differ significantly. Initial reduction in fertility rates were observed at 49<sup>th</sup> WOA. However, an increase in fertility rates was observed at 52<sup>nd</sup> and 55<sup>th</sup> WOA in the interspiked groups. At 49 WOA, the fertility rates in  $T_1$  (86.66%) and  $T_2$  (85.33%) pens were lower than that of  $T_0$  (88.00%) (Table 1). In subsequent weeks, an increase in the fertility rates was observed in all the groups. However, more increase was observed in the interspiked  $T_1$  and  $T_2$  groups.

As a flock age approaches 40 WOA, fertility levels begin to decline in the roosters. Roosters become less interested and able to complete mating as the age advance. In order to get the same fertility level, older flocks should be paid more attention to rooster management programs, like spiking programme which has been proved helpful (Sluis, 2014). Casanovas, (2002) reported that change in location and social group will cause an increase in mating behavior thereby compensating for the loss in libido and mating interest of older roosters. Wilson, (2002) investigated that as a result of double interspiking, just like when spiking is used, sexual activity increased among males in a flock and an improvement in fertility levels occurred. Due to the first interspike and the transfer of males between the two houses, mating frequency increase for four to eight weeks among all males.

The present study showed variation in fertility rates within a breed in different flocks which may be either due to ability of males to produce viable sperms or frequency of mating in the flock. This finding is congruent with results observed by Sexton et al. (1989), Hocking and Bernard (2000), and McGary et al. (2002). The interspiked flocks also showed a trend of higher fertility levels up to six weeks of experiment. In this context it was observed that the spiking results in a 1-3% increased fertility over a period of 5-10 weeks. Although in broiler breeds more than 90% levels of fertility were observed up to 60<sup>th</sup> WOA (Casanovas, 2002). In present investigation, the interspiking period started by 49<sup>th</sup> WOA. In order to counteract decline in fertility rate in broiler breeder early scheduling of interspiking was

advocated at 40<sup>th</sup> WOA (Wilson, 2002) and 42<sup>nd</sup> WOA (Casanovas, 2002).

In present study, an increasing trend in fertility rates of interspiked groups could be attributed to interspiking of roosters of Vanaraja parents. Therefore, an interspiking of Vanaraja males at 49<sup>th</sup> WOA can be advantageous, especially in flocks showing lower fertility rate.

The results of the present study alludes that the 1:8 cock to hen ratio in all three pens was better in evaluating fertility rate and hatchability before and after interspiking in equally potential fertile Vanaraja parent flock.

## HATCHABILITY (TES)

In the present study, the mean TES hatchability rates at 48<sup>th</sup>, 49<sup>th</sup>, 52<sup>nd</sup> and 55<sup>th</sup> WOA were 75.33, 77.11, 81.55 and 82.89 percent, respectively (Table 1). TES hatchability values at 52<sup>nd</sup> and 55<sup>th</sup> WOA in interspiked groups were higher than those of non interspiked groups. However, all values of TES hatchability were non significant. Besides this in all the treatment groups as the age advances, increase in TES hatchability rates were associated with higher fertility.

Furthermore increase hatchability was observed in interspiked groups ( $T_1$  and  $T_2$ ) than the control ( $T_0$ ). This increasing trend in TES hatchability rates of interspiked groups might be due to differences in the fertility rates as observed in interspiking of roosters of Vanaraja parents. Hence interspiking of Vanaraja males could be beneficial at 48<sup>th</sup> WOA.

In contrast to this Hocking and Bernard (2000) did not observed significant effect on hatchability after application of double spiking of the flock. Further they stated that aging roosters are not the cause of declining hatchability levels. The results of present investigation were at par with the findings observed by Chung et al. (2010). While, Kumar, (2010) observed lower mean TES hatchability percentage of 71.67 percent in Vanaraja parents at 28-35 weeks of age as compared to present findings.

## HATCHABILITY (FES)

In the present study, the mean FES hatchability rates at 48<sup>th</sup>, 49<sup>th</sup>, 52<sup>nd</sup> and 55<sup>th</sup> WOA were 86.92, 87.62, 89.29 and 90.10 percent in Vanaraja breeders. In all the age groups at 48<sup>th</sup>, 49<sup>th</sup>, 52<sup>nd</sup> and 55<sup>th</sup> weeks, there were no significant differences in hatchability rates on the basis of fertile eggs set among the treatments. Although with the advancement of age higher fertility rates in all the groups were associated with increased hatchability of fertile eggs (Table 1).

Similar to the findings of present experiment, Casanovas (2002) had observed increase in hatchability levels follow-

ing interspiking which were lasted for 15 weeks in broiler breeders. In present investigation, high hatchability rates were observed in Vanaraja parents could be attributed to interspiking.

**Table 1:** Percentage of fertility and hatchability before and after interspiking in Vanaraja chicken parents (from 48 to 55 weeks of age).

Pens	Weeks of Age (WOA)			
	48 WOA	49 WOA	52 WOA	55 WOA
Fertility %				
T <sub>0</sub>	88.00	90.00	90.66	90.66
T <sub>1</sub>	86.66	87.33	92.66	93.33
T <sub>2</sub>	85.33	86.66	90.66	92.00
Overall	86.66	88.00	91.33	92.00
Hatchability (TES) %				
T <sub>0</sub>	76.00	78.67	79.33	80.00
T <sub>1</sub>	75.33	76.66	83.33	84.66
T <sub>2</sub>	74.66	76.00	82.00	84.00
Overall	75.33	77.11	81.55	82.88
Hatchability (FES) %				
T <sub>0</sub>	86.36	87.40	87.50	88.23
T <sub>1</sub>	86.92	87.78	89.92	90.71
T <sub>2</sub>	87.50	87.69	90.44	91.30
Overall	86.92	87.62	89.29	90.09

TES: Fertility on Total Egg Set basis; FES: Fertility on Fertile Egg Set basis.

## CONCLUSION

It can be concluded from present study that the interspiking of Vanaraja male parents has been found advantageous to increase the fertility and hatchability rates.

## CONFLICT OF INTEREST

There is no conflict of interest.

## ACKNOWLEDGEMENT

The authors thank Dean, College of Veterinary Science and A.H., Anjora, Durg and the Principal Investigator, Poultry Seed Project, Durg for providing all the necessary facilities for the study.

## AUTHORS CONTRIBUTION

The research article is a part of MVSc thesis submitted by the first author under the guidance of the next. Other authors have equally contributed in analyzing the experi-

mental data.

## REFERENCES

- All India Report (2012). Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi. 19<sup>th</sup> Livestock Census.
- Carvalho E, Zilli J, Mendes A, Morello G, Bonamigo D (2015). Main factors that affect the economic efficiency of broiler breeder production. *Brazilian J. Poult. Sci.* 17: 11-16. <https://doi.org/10.1590/1516-635x170111-16>
- Casanovas P (2002). Management techniques to improve male mating activity and compensate for the age-related decline in broiler breeder fertility: Intra-Spiking. *The Poultry Informed Professional.*
- Chung KM, Smith MO, Kattesh HG (2012). The influence of double interspiking on production and behavior in broiler breeder flocks in elevated temperature conditions. *J. Appl. Poult. Res.* 21 (1): 63-69. <https://doi.org/10.3382/japr.2011-00347>
- Chung KM (2010). Effect of double interspiking on fertility, behavior, and blood parameters in broiler breeder males reared under heat stress conditions. Masters Theses submitted to University of Tennessee, Knoxville.
- Hocking P, Bernard R (2000). Effects of the age of male and female broiler breeders on sexual behaviour, fertility and hatchability of eggs. *Brit. Poult.* 41:370-376. <https://doi.org/10.1080/713654925>
- Karianne M, Chung Y (2010). Effect of double interspiking on fertility, behavior, and blood parameters in broiler breeder males reared under heat stress condition. Master's Thesis, University of Tennessee. 694 Pp.
- Kirk S, Emmans GC, McDonald R, Amot D (1980). Factors affecting the hatchability of eggs from broiler breeders. *Brit. Poult. Sci.* 21: 37-53. <https://doi.org/10.1080/00071668008416633>
- Kumar A (2010). Fertility and hatchability of some breeds of chicken suitable for backyard farming, M.V.Sc. Thesis submitted to Indira Gandhi Agricultural University, Raipur.
- McGary S, Estevez I, Bakst M, Pollock D (2002). Phenotypic traits as reliable indicators of fertility in male broiler breeders. *Poult. Sci.* 8: 102-111. <https://doi.org/10.1093/ps/81.1.102>
- Novikov B (1979). Hypothalamic mechanisms of reproductive function in poultry. *World's Poult. Sci. J.* 35: 214-226. <https://doi.org/10.1079/WPS19790016>
- Rao STV, Preetam VC (2009). Breeding strategies for improved bird in backyard poultry. Proceed. National Workshop on "Synthesizing experiences in promotion of backyard poultry", 9<sup>th</sup>-10<sup>th</sup> July, Project Directorate on Poultry, ICAR, Rajendranagar, Hyderabad.
- Sexton K, Renden J, Marple D, Kempainen R (1989). Effects of dietary energy on semen production, fertility, plasma testosterone, and carcass composition of broiler breeder males in cages. *Poult. Sci.* 68:1688-1694. <https://doi.org/10.3382/ps.0681688>
- Sharifi, Seyed R, Mahdavi D, Evrigh HN, Seifdavati J, Sahraei M (2018). Investigating the effect of Intra spiking Flocks Productivity in Economic Viewpoint. *Anim. Sci.* 10(2): 73-78.
- Snedecor GW, Cochran WG (1994). *Statistical methods.* 6<sup>th</sup> Edn, Oxford and IBH Publishing Co. Calcutta.
- Sluis W (2014). Spiking reduces fertility drop in older

- flocks. *World Poultry*, 30(7): 20-21.
- Weil S, Rozenboim I, Degen A, Dawson A, Friedländer M, Rosenstrauch A (1999). Fertility decline in aging roosters is related to increased testicular and plasma levels of estradiol. *Gen. Comparat. Endocrinol.* 115: 23-28. <https://doi.org/10.1006/gcen.1999.7276>
  - Wilson HR, Piesco NP, Miller ER, Nesbeth WG (1979). Prediction of the fertility potential of broiler breeder males. *World's Poult. Sci. J.* 35: 95-118. <https://doi.org/10.1079/WPS19790008>
  - Wilson J (2002). Understanding the factors that influence broiler breeder flock fertility. The University of Georgia Cooperative Extension Service.
  - Wolanski N, Renema R, Robinson F, Wilson J (2004). End-of-season carcass and reproductive traits in original and replacement male broiler breeders. *J. Appl. Poult. Res.* 13: 451-460. <https://doi.org/10.1093/japr/13.3.451>
  - Wood-Gush D (1958). The effect of experience on the mating behaviour of the domestic cock. *Anim. Behav.* 6:68-71. [https://doi.org/10.1016/0003-3472\(58\)90010-1](https://doi.org/10.1016/0003-3472(58)90010-1)