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Effect of Sex Ratio on the Production and Hatchability of Broiler Breeder Flock

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ABSTRACT

Trials to compare mating ratios are important for optimizing the breeding efficiency of broilerbreeder flocks.The study provides information on the reproductive performance of broiler breeder flock (Ross308) maintained at different male: female (M: F) ratios. 381, thirty week-old broiler breeders were randomly divided into three experimental groups with three replicates each and were assigned to one of the following male: female ratio, 1M: 13.3F, 1M: 11.6F and 1M: 10.5F. The birds were randomly allotted to 9, 2m x 2m floor pens in an environmentally controlled house. Eggs were collected daily and weekly egg production/bird was calculated for each group. Hatchability and egg production were significantly affected ($P<0.05$) by sex ratio. 1M: 13.3Fgrouphad significantly ($P<0.05$) higher egg production. Hatchability of 1M: 10.5F were significantly ($P<0.05$) the highest followed by 1M: 11.6Fand that of 1M: 13.3F sex ratio were the lowest from week 33.Increasing the sex ratio had the effect that although average egg production/female was lower, but hatchability were improved, possibly as a result of more frequent sexual interactions of males and females.

Key words: Sex ratio, Broiler breeder, Hatchability, Production.

INTRODUCTION

Several factors have been reported to affect the fertility and the hatchability of chicken eggs. In breeding flocks of birds, mating ratio of male to females plays a pivotal role in optimizing fertility and hatchability in the eggs produced by a flock (Altan and Oguz, 1993). Management at the breeder farm as well as at the hatchery should be adjusted according to the strains, because every strain responded differently to hatchability.

For commercial broiler breeder flocks, Breedersgenerally recommend around 8 to 9 males per100 females at 20 to 30 weeks of age with areduction to 6 to 7 males by the end of thelaying period (the Cobb Breeding Company, 1997; Ross Breeders Ltd., 1998 and Hubbard Farms Inc., 1996). At greater than 10 malesper 100 females, fertility may be adversely affectedby excessive male aggression and competition for mating and territory (Hubbard Farms Inc., 1996; Newcombe, 1996 and Kiers, 1997). Althoughratios as low as 7 males per 100 femalescan give adequate fertility in older flocks (The Cobb Breeding Company, 1997; Ross Breeders Ltd., 1998 and Hubbard Farms Inc., 1996), there is a danger which in some conditions,there may be insufficient males to impregnatean acceptable number of females.

There is a hypothesis that fluctuating selection driven by sex ratio dynamics contributes to describe the maintenance of genetic variation in personality traits, so, any change in the ratio exhibits a marked effect onhatchability and fertility of eggs (Newcombe, 1996; Kiers, 1997 and Giudicw, 2012).

Males to females ratio in a poultry flock is a major factor in clarifyingthe behavior in animals. Too few or too many males in a unit place may be cause a higher percent of infertile eggs. Female to male ratios for havingbest results inhatchability and fertility varies from species to species.However Wilson and Holland (1974) indicated there was no significant difference between mating ratios of 1 male to2 females and 1 male to 3 females in quails particularly on hatchability andfertility of incubated eggs as well as on hatchability of fertile eggs.

So, the aim of this experiment was to investigate different effects of sex ration production and hatchability of broiler breeder flock (Ross308).

MATRIAL AND METHODS

Experimental design

351Females (F) and thirty Males (M), 30 weeks-old broiler breeder (Ross308) were obtained and housed in pens of identical size in a deep litter system with wood shaving floor.

The birds were randomly divided into three experimental groups with three replicates each and

were assigned to one of the following cock to hen ratio: 1M:13.3F, 1M: 11.6F and 1M: 10.5F.

The trial lasted for 10 weeks. All birds were fed a standard commercial diet based on corn and soybean meal. The diet was offered to the birds daily at 09:00, whereas water was given *ad libitum* to all the birds. The composition of diets is shown in Table 1.Strict sanitation practices were maintained in the house before and during the course of experiment. The cages were daily cleaned to prevent any disease outbreak. Vaccination and medication were applied when required during the experimental period.

Table 1. The experimental basal diets composition and calculated proximate analysis (kg)

Diet composition	Female(Kg)	Male(Kg)
Corn	668	727
Soybean meal	218	140
wheat bran	10	85
Soybean oil	6	-
Limestone carbonate	68	18
Dicalcium phosphate	16	15
Mineral premix	3	3
Vitamin premix	3	3
Salt (NaCl)	3	3
DL-methionine	1	0.5
L-lysine	0.5	0.1
Choline chloride	2	2
Vitamin D	0.5	0.5
Vitamin E	0.5	2.4
Vitamin K_3	0.5	0.5

Egg production was recorded daily. Weekly egg production/bird was also calculated for each group. Eggs were stored (maximum 6 days) in a store room at 15^{o}C withmean 78% relative humidity, till setting in an incubator. At the end of incubation period(waiting for five days since the appearance of first hatched egg) non-hatched eggs were separated andbroken to inspect for late embryonic mortality, if any.

Data analysis

The data were analyzed statistically through ANOVA and the means were compared by Least Significant Difference Test by using the General Linear Model of Minitab Micro Computer Software (SPSS 11.5 for windows). Differences were considered significant at P<0.05.

RESULTS AND DISCUSSION

Table 2 shows the effects of different sexual ratios on egg production. As it is shown in table 2,male to female sex ratios in all ages do not exhibit a significant (P<0.05) effect on egg production. But the higher number of eggs was produced by the group 1 at mating sex ratio 1:13.3. This means that increasing the sex ratio did not increase egg production. The results of the present study are in line with the findings of Karousa et al. (2015) who reported that quails housed with a mating ratio of1male to 3females produced more eggs than quails housed with mating ratio1male to 2 females but this difference was non-significant. The obtained results revealed that there were no significant differences (P>0.05) in the total egg production due to sex ratio. These results agreed with Al-Rawi (1980) who found that presence of males had no significant effect on egg production.

Table 2. Influence of male to female sex ratios on egg production of broiler breeders (Ross 308)

Groups	Age (week)										
	30	31	32	33	34	35	36	37	38	39	40
1	85.8^{b}	88^{a}	87.8^{a}	87^{a}	86.7^{a}	85.4^{a}	83.8^{a}	83.2^{a}	82.1^{a}	79.8^{a}	79.7^{a}
2	87^{a}	86^{b}	85.2^{b}	84.6^{b}	83.3^{b}	82.1^{b}	81.3^{b}	80.4^{b}	78.6^{b}	78.1^{b}	77.6^{b}
3	86.8^{a}	86^{b}	83^{c}	82.3^{c}	81.1^{c}	81.4^{b}	80.1^{c}	78.8^{c}	77^{c}	76.2^{c}	75^{c}
CV*(%)	0.4	0.6	0.3	0.5	0.8	0.5	0.5	0.6	0.6	0.6	0.6
P-valve	0.02	0.0049	0.0001	0.0001	0.0002	0.0001	0.0001	0.0002	0.0001	0.0004	0.0001
SEM**	±0.2	±0.3	±0.1	±0.2	±0.4	±0.2	±0.2	±0.3	±0.2	±0.2	±0.3

Group 1: 1male: 13.3 female,Group 2: 1 male: 11.6 female,Group 3: 1male: 10.5 female, Mean values in a column with different superscripts are significantly (P<0.05) different; *CV: Coefficient of Variation; **SEM: Standard Error of Mean.

Table 3 shows the effects of different sexual ratios on hatchability. Sex ratio used in the present study exerted a significant effect on mounting numbers (mating) in different treatment groups. As it is indicated in table 3, hatchability is increased by increasing the number of males in the mating ratiofrom week 37 to the end of the study. Our results were similar to the results of the studies by Seker et al. (2005), who found statistically higher effect of mating ratio in terms of hatchability.

Also our results are contradictory to the results reported by Deeming and Wadl (2002). They investigated the effect of two mating ratios, i.e. 1M: 8F and 1M: 12F, in commercial pheasant flocks. Hatchability of the flocks with a mating ratio of 1M: 8F had improved significantly. Also it is in disagreement with the report made by Baser et al. (2002) who concluded that the best mating ratio of male and females was 1:3 for optimum hatchability of Japanese quail eggs. Also, Raji et al. (2014) found that

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hatchability of fertile eggs were higher in the mating ratio (male: female) of 1:3 (71.48%) than 1:2 (26.32%). Another study showed that the effect of sex ratio, the hatchability percentage of total eggs set was 49±1.89 and 52.5±1.89% for a sex ratio of 1:2 and 1:3 (male to females), respectively (Karousa et al., 2015). Although Ali et al. (2013) indicated the highest fertility (79%) and hatchability (78%) in 1M: 1Fwhile the lowest fertility (70%) and hatchability (62%) were obtained in 1M: 4F.

The results of present study revealed that hatchability percentage of total eggs set were higher in a sex ratio1:3 than 1:2, but there was non-significant difference (P>0.05) in the hatchability of total eggs set due to sex ratio. These results agreed with those reported by Ipek et al. (2004) andRaji et al., (2014) who found that hatchability of total eggs higher in mating a ratio (male: female) of 1:3 (65.87%) than 1:2 (20.83%).

Present study shows the maximum hatchability was between weeks 31 until 33, this is agreement with also Bayeland Albadry (2012) that showed hatchability reached their highest values at 32 weeks of age; thereafter it significantly (P<0.05) decreased with advancing age and reached its lowest value at 40 weeks of age.

Table 3. Influence of male to female sex ratios on hatchability of broiler breeders (Ross 308)

Groups	Age (week)										
	30	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
1	89.6	90.1	90.0	89.6 ^{b}	88.2 ^{b}	87.6 ^{b}	87.0 ^{b}	87.1 ^{c}	87.0 ^{c}	85.0 ^{c}	83.7 ^{c}
2	89.7	90.5	90.8	90.6 ^{a}	90.7 ^{a}	90.4 ^{a}	90.2 ^{a}	89.8 ^{b}	89.2 ^{b}	88.8 ^{b}	87.4 ^{b}
3	89.2	90.4	90.9	91.0 ^{a}	90.8 ^{a}	90.8 ^{a}	90.8 ^{a}	90.5 ^{a}	90.2 ^{a}	90.0 ^{a}	88.8 ^{a}
CV*(%)	0.4	0.6	0.3	0.5	0.8	0.5	0.5	0.6	0.6	0.6	0.6
P-valve	0.02	0.0049	0.0001	0.0001	0.0002	0.0001	0.0001	0.0002	0.0001	0.0004	0.0001
SEM**	±0.2	±0.3	±0.1	±0.2	±0.4	±0.2	±0.2	±0.3	±0.2	±0.2	±0.3

Group 1: 1 male: 13.3 female, Group 2: 1 male: 11.6 female and Group 3: 1 male: 10.5 female; Mean values in a column with different superscripts are significantly (P<0.05) different; *CV: Coefficient of Variation; **SEM: Standard Error of Mean.

CONCLUSION

From the obtained results it could beconcluded thatalthough increasing the sex ratio had caused the average egg production/female to lower, but hatchability had improved, possibly as a result of more frequent sexual interactions of males and females.

Competing interests

The authors have no competing interests to declare.

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