COMPARATIVE STUDY OF FERTILITY AND HATCHABILITY IN WHITE LEGHORN AND WHITE CORNISH BREEDS OF CHICKENS

MASUD MAHMOOD AND M. FAHIM ULLAH*

Fertility was significantly higher in White Leghorn than in White Cornish. However, the hatchability percentage, both over fertile as well as overall eggs set, was approximately the same in the two breeds, the difference being non-significant statistically. The number of dead in shell chicks was more in White Leghorn than in White Cornish, the difference being highly significant. However, the percentage of chicks dead in shell in both White Leghorn and White Cornish breeds was more in males than in female chicks, but the difference was statistically non-significant. The average percentage of dead germs was 2.7 in White Leghorn and 2.3 in White Cornish breeds, which showed non-significant difference between the two breeds. The incidence of mal-positions in White Leghorn was slightly higher than in White Cornish breed.

INTRODUCTION

At present the poultry industry in Pakistan is in its developmental stage, as the bulk of existing chicken population comprises low producing local birds. In commercial hatchery operation, the low fertility of the White Cornish males used with females of heavy breeds in the production of broiler chicks poses an increasing problem. The success and the development of the poultry industry depends upon the quality and number of baby chicks produced by the local hatcheries.

The incubation of the eggs is the vital link in the reproductive cycle of the fowl. The problem of obtaining a high percentage of fertile eggs is of great economic importance for modern poultry production. Therefore, it would be of great benefit to the poultry industry, if eggs with a high percentage of fertility and hatchability could be secured.

With the above object in view, a comparative study on fertility and hatchability of White Leghorn and White Cornish breeds of chickens was made to obtain some of this information in Pakistan.

REVIEW OF LITERATURE

Funk (1934) reported that high summer temperatures were detrimental to hatchability. Van Schalkwyk and Lieben-berg (1952) showed the highest

*Department of Poultry Husbandry, Faculty of Animal Husbandry, West Pakistan Agricultural University, Lyallpur.

overall fertility with 21.09 per cent infertile eggs in purebred White Leghorn and 26.37 per cent in Black Australorps. Mahadevan (1954) found no significant difference in fertility between the Australorps and Rhode Island Reds, but the difference in hatchability of fertile eggs of the two breeds was significant. Hafez and Kamar (1955) reported that the variation in the environmental temperature affected the hatchability percentage.

El-Ayadi and El-Ibiary (1957) observed 87.1 per cent and 62.3 per cent fertility in Leghorns and Baladi eggs respectively. The low figure for the latter were attributed to a shortage of cocks in the flocks. The hatchability was higher in case of Leghorns, being 57.2 per cent as compared with 47.5 per cent in the Baladi. The embryo mortality varied between breeds at different stages of incubation and seasons, but on the whole these results were non-significant. Card (1961) reported that low fertility observed in loose feathered birds was due to feathers about the vent which should be clipped before mating, to secure satisfactory fertility.

Parker (1961) observed low fertility results when Dark Cornish cockerels were crossed with New Hampshire pullets. The fertility was improved when either Delaware or New Hampshire cockerels were used. Micek and Mastihuba (1964) reported increase in hatchability from January to April, which remained high until June and then decreased to a minimum in September. There was no appreciable difference in overall hatchability in mountain districts and in valleys, but hatchability was lower in winter and high in summer in the former than in the latter case. Akhtar (1965) observed 65.00 and 68.75 per cent fertility in White Cornish and 98.18 and 99.67 per cent in desi purebred chickens in his two trials.

Reddy *et al.* (1965) showed significant breed difference for fertility and hatchability in White Leghorns, Rhode Island Reds and White Rocks with the average fertility of 87.1, 76.3 and 69.4 per cent and hatchability of 66.8, 59.6 and 44.1 per cent respectively. Soller *et. al.* (1965) found that fertility difference between Cornish and Rock males in natural mating disappeared when artificial insemination was used, which indicated that the difference might have been due to the varying mating frequency in the two breeds.

MATERIAL AND METHODS

First year laying hens of single comb White Leghorn and White Cornish breeds were used for the experiment. The ratio of cocks to the hens was 1 :15 and 1 : 10 in White Leghorn and White Cornish breeds respectively. More cocks were used in the case of White Cornish, because in heavy breeds comparatively more males are required to get the maximum fertility.

The Lever's Layer Mash was fed *ad libitum.* to the birds throughout experimental period. Both the breeds were kept separately in well ventilated houses under similar environmental conditions. The eggs were collected daily four times a day and stored at the room temperature, ranging from 50—70°F for a period of 1 to 7 days. The eggs used for incubation were of normal shape, colour and size. Their weight ranged from 22 to 24 ounces per dozen.

The eggs were incubated in twentysix hatches and every hatch contained 50 eggs of each breed. A total of 2,544 eggs (1300 eggs of single comb White Leghorn and 1244 eggs of White Cornish) were used throughout the experiment. The fertility was checked by candling the eggs on 18th day of incubation by an electric candler and the dead embryos were calculated among fertile eggs. The infertile eggs and dead embryos were sorted out and record was kept. On the 22nd day of incubation normal chicks were counted. Incidence of malpositions and the number of dead in shell chicks was also noted and their postmortem examination was performed to study the sex ratio.

The hatchability was calculated on the basis of fertile eggs as well as overall eggs set. The data were subjected to statistical analysis using students "t" test for the comparison of fertility and hatchability between the two breeds. Analysis of variance and Chi-Square test was applied to the data on dead in shell chicks and incidence of malposition respectively.

RESULTS AND DISCUSSION

Fertility

Out of 1300 eggs of single comb White Leghorn set in an incubator in 26 hatches, 1117 eggs were found to be fertile. Similarly, 967 eggs out of 1244 White Cornish eggs set in 26 hatches were found to be fertile. The average fertility of White Leghorn and White Cornish eggs was 86.0 and 76.3 per cent respectively (Table 1).

TABLE 1. *Fertility and Hatchability in White Leghorn and White Cornish Breeds.*

Breed	Fertility			Hatchability		
	Total eggs set	No. of fertile eggs	Per cent fertility	No. of chicks hatched	Per cent hatchability over fertile eggs	Per cent hatchability over all eggs se
White Leghorn	1300	1117	86.0	872	77.4	67.1
White Cornish	1244	967	76.3	790	81.0	63.0

The fertility percentages were calculated as the number of fertile eggs observed per 100 eggs set. To bring these percentages to normality, $\sin\phi^2$ transformation was applied and data were converted to degrees for the analysis. The data were subjected to statistical analysis and calculated values of "t" for percentage fertility came to be 13.05. The fertility of single comb White Leghorn breed was observed to be highly significant ($P>0.01$)

The low fertility in White Cornish and high fertility in case of White Leghorn may be attributed to the varying mating frequency in the two breeds. This is in accordance with the results of Soller *et al.* (1965).

The highest fertility for White Leghorn was recorded during February and October, being 96.0 and 94.0 per cent respectively. However, in White Cornish the highest fertility (92.00 per cent) was recorded during the month of October. The lowest fertility in the two breeds was recorded during the months of April and May respectively.

Hatchability

A total number of 872 chicks of White Leghorn and 790 chicks of White Cornish were hatched, out of 1300 and 1244 eggs of the two breeds respectively. The number of fertile eggs of the two breeds was 1117 and 967 respectively. The data were calculated on the basis of all eggs set as well as over fertile eggs. The average hatchability percentage in White Leghorn and White Cornish breeds was 77.4 and 81.0 per cent over fertile eggs and 67.1 and 63.0 per cent overall eggs set (Table 1). The "t" value of per cent hatchability over fertile eggs and overall eggs set was calculated which was 1.11 and 1.23 respectively. The hatchability percentage of the two breeds were approximately the same because of more number of dead in shell chicks in White Leghorn.

The difference of hatchability percentage both over fertile eggs and overall eggs set in the two breeds was non-significant. The reason for high percentage of embryonic mortality in White Leghorn may be attributed to some genetic and non-genetic effects. This is in accordance with the results of Nalbandov and Card (1943).

The hatchability also had the similar trend as fertility because it remained high when the temperature was favourable and dropped with the increase of environmental temperature.

Dead in Shell Chicks

The number of dead in shell chicks in White Leghorn was more as compared to White Cornish breed and the difference was highly significant. The average death in White Leghorn were 6.28 per cent, whereas it was 4.09 per cent in White Cornish breed (Table 2).

TABLE 2. *Breed Difference for Dead in Shell Analysis of Variance*

Sources of variation.	Degrees of Fraction	Mean Square	F. Ratio.
Weeks	25	37.09	2.65**
Breed	1	211.04	14.56**
Sex	1	19.60	1.35NS
Breed sex	1	23.86	1.65NS
Error	75	14.49	
Total	103		

Sex Ratio of Dead in Shell Chicks

The percentage of male chicks dead in shell was more in both the breeds but the difference was statistically non-significant.

Dead Germs' Comparison

The average percentage of dead germs was 2.7 in White Legborn and 2.3 in White Cornish breed. The calculated "t" value was 0.18 which showed a non-significant difference of dead germs between the two breeds. The percentage of dead germs was highest during April and May probably due to hot summer days and lowest during February and November months having low environmental temperatures.

Incidence of Malpositions

The incidence of malposition in White Leghorn was slightly higher than in White Cornish breed. The difference of malpositions between the two breeds in this study is in accordance with those of Asmundson (1938) which may be due to some genetic factors.

LITERATURE CITED

Akhtar, N. A. 1965. Crossbreeding of White Cornish and Desi purebreed of poultry. M. Sc. Thesis, W.P.A.U., Lyallpur.

Card, L. E. 1961. Poultry Production Lead and Fabiger. Philadelphia.

El-Ayadi, M. N., and H. M. El-Ibiary. 1957. Variation in fertility and hatchability of Baladi and Leghorn eggs. Alexandria *Jour. Agr. Res.* 5 98—88 (*Anl. Breed. Abst.* 26 : 469, 1958).

Funk, E. M. 1934. Factors influencing hatchability in the domestic fowl. *Missouri. Agr. Exp. Sta. Bull.* 341.

Hafez, E. S. E., and G. A. R. Kamar. 1955. Seasonal variation in the fertility mortality and hatchability of Fayoumi eggs in the subtropics. *Poul. Sci.* **34** : 524—530.

Mahadevan, P. 1954. Fertility hatchability and egg production of Poultry at Government Poul. Farm, Ambepussa, Ceylon. *Poul Sci.* **33** : 722—724.

Micek, J., and T. Mastihuba. 1964. The seasonal hatchability curve in slovakia. **2** : 65—73 (*Anl. Breed. Abst.* **34** : 752, 1966).

Parker, J. E. 1961. Observation on the low fertility problem in Cornish cockerels. *Poul. Sci.* **40** : 1214—1219.

Reddy, V. B., D. Subbarayudu, and P. Varadarajulu. 1965. The effect of breed pre-incubation storage time and egg weight on hatchability of poultry eggs. *Ind. Vet. Jour.* **42** : 438—445.

Soller, M., H. Schendler, and S. Borstein. 1965. Semen characteristics, failure of insemination and fertility of Cornish and White Rock males. *Poul. Sci.* **44** : 424—431.

Van, Schalkwyk, W. R., and C. R. Lieben-berg. 1952. The black Australorp, the White Leghorn and their reciprocal crosses hatchability. *Fmgs. Afr.* **27** : 363-364 (*Ani. Breed. Abst.* **21** : 449, 1953).