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BREEDING TECHNOLOGY INFLUENCE ON SPERM CONCENTRATION IN BROILER BREEDERS

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Abstract

Researches performed in this study aimed to study semen quality and breeding efficiency and other characters that in conjunction are shaping the fecundity of breeding cocks in ROSS 308 breeding cocks under the influence of some microclimatic factors (light intensity, birds density). Observations during the three trials (A – with analyze parameters sub-standard and litter made of chopped straws B – with analyze parameters above standard and litter made of rice hulls and C – with analyze parameters at the level recommended by the manufacturer of biological material and litter made of wood shavings) were performed during 3 control weeks (25, 35 and 45) during production period (19-64 weeks). The values obtained for sperm concentration were between 0.730 ±0.02 billion/ml, in week 45 – series C of trials and 1.044 ± 0.07 billion/ml in week 35 – series A of trials. Therefore stress due to microclimatic parameters stepping up manifests itself through slight decrease in the concentration but secures a consistency of its value on a longer period which would positively influence the effectiveness of breeding.

Key words*: litter, breeding cocks, density, light intensity, concentration of sperm.*

INTRODUCTION

Concentration in sperm is the number of sperm per volume unit of sperm and varies depending on some factors influenced by species, race, maintenance conditions and not lastly by animal (Bunaciu, 2009; Vacaru Opriș, 2002).
There are large differences between species about spermatogenesis and so about concentration in sperm of the ejaculate. Thus average values are between 9.46 and 3.68 x $l0^9$ sperm/ml (Fujihara, 1991).
Data are showing that there is a positive correlation between sperm volume and sperm concentration (Sonseeda et al, 2013; Churchil, 2014).
Sperm concentration is also dependent on the interval between collections so on intensity of use of the breeding; when pause between collections increases sperm concentration also increases (Bunaciu, 1989).
Sperm is diluted during ejaculation due to sperm liquid consisting of fluids secreted by accessory reproductive organs (Fujihara, 1991).
The concentration of sperm in semen correlates negatively with volume which demonstrates that sperm concentration decreases as semen volume increases, (Bunaciu, 1992; Hermiz et al., 2016).
This phenomenon occurs due to increase secretions attachments not as a consequence of intensifying the spermatogenesis process.
It is therefore necessary that to measure the volume and to determine sperm concentration when males are chosen for breeding purposes.
Male body development has no influence on sperm concentration (Bunaciu, 2009).
Sperm quality and sperm capacity of fertilization are influenced by dietary deficiencies as lack of vitamin E or essential fatty acids (Jensen, 1968), presence of aflatoxin in feed, (Yaroshen et al., 2003) or low calcium level (Bunaciu, 2009).

MATERIALS AND METHODS

Semen quality is often defined by four characteristics: volume, concentration, viability

of sperm (% of live sperm) and sperm motility (Parker et al., 2000; McGovern, 2002).
The number of sperm deposited in the female genital apparatus (concentration of sperm in semen) is of particular significance. Although a single sperm and ovule copulates in the intimate fecundation process a far greater number of seminal cells must attend to this process.
This is because sperm once around follicular development are releasing the ovule from follicular cells which make up the radiated Crown by releasing hyaluronidase. These cells are united between them with a substance containing hyaluronic acid.
The presence of a greater number of sperm around ovule causes the release of a much larger amount of hyaluronidase and so fecundation process is favored.
As shown in numerous studies cited in this paper the ability of fertilization of cocks directly depends on the quality of semen (volume, concentration, mobility, etc.). Technological factors (temperature, humidity, density, intensity and duration of light, litter quality, etc.) may affect the ability of fertilization of cocks.
As in females a significant decline in semen parameters is found from cocks in some stress conditions determined by microclimate factors.
Considering the mentioned facts our own research undertaken in this thesis aimed to study the quality of semen and breeding efficiency in ROSS 308 hybrids cocks in terms of the influence of microclimate factors (light intensity, birds density) and other characters that collectively are determining the fertilization ability of cocks.
Works have been undertaken within the framework of three units one for each series of experiments: Avicola Călăraşi, S.C. Agrafood S.A. and Avicola Focşani and observations and records were carried out in 3 weeks for control (25, 35 and 45), during production period (19-64 weeks) during two years an on an effective of 25 males and 250 females for each experimental series.
Microclimate parameters considered for the series A of trials are:

- litter: chopped straws;
- luminous intensity under the standard: 30 lux;
- birds density under the standard: 3 males/m^2;
- the ratio of sexes under the standard: 25 weeks - 8 heads, 35 weeks – 7.5 heads, 45 weeks – 6.5 heads.

Microclimate parameters considered for the series B of trials are:

- litter: rice husks;
- luminous intensity above the standard: 70 lux;
- birds density above the standard: 5 males/m^2;
- the ratio of sexes above the standard: 25 weeks - 9 heads, 35 weeks – 8.5 heads, 45 weeks – 7.5 heads.

Microclimate parameters considered for the series C of trials are:

- litter: wood sawdust;
- luminous intensity standard: 40 lux;
- standard birds density: 4 males/m^2;
- the ratio of sexes standard: 25 weeks - 8,5 heads, 35 weeks - 8 heads, 45 weeks -7 heads.

Raising the birds was carried out in uniform conditions in the three units corresponding to those three series of experiments on permanent bedding (wide captivity) and in upgraded sheds and feed and water have been provided under the technical card of the hybrid. The individuals analyzed in the three series of experiments have benefited from the same feeding conditions in order to ensure comparability of results.
The pointer being chased during production was the quality of semen (sperm concentration) and this indicator has been determined using a spectrophotometer.
Classical statistical methods were used to characterize the phenotypic testing of batches (Sandu, 1995) and Student's test has been used to study the variation of parameters showing a normal distribution for comparing the two samples homogeneity environments (Sandu, 1995).

RESULTS AND DISCUSSIONS

Sperm concentration (or sperm density) is an important indicator of the quality of semen and the setting is the defining reproductive capacity of males and representing the starting point

within the technology of conservation in order to establish the degree of dilution of sperm. Subjectivity is removed entirely in appreciation of this character as evaluation of ejaculates in this direction is done by spectrophotometry.

At this level, however, there is a problem which could justify any variances in relation to semen fecundation ability concerned that the analysis of sperm concentration with spectrophotometer it doesn't take into account mobility and anomalies of morphology.

It is known that a high concentration of semen can be also determined by a large proportion of sperm immobile or with abnormal movements without the opportunity to participate in intimate of fecundation.

In table 1 and the graph in Figure 1 are presented the values obtained for sperm concentration at individuals in the A series of trials durint the 3 control weeks.

Table 1. Average values of concentration of sperm for first experience series

Week	n	$\bar{X} \pm s_{\bar{X}}$ (bl/ml)	s	c.v.%
25	25	1.050 ± 0.07	0.3378	32.17
35	25	1.044 ± 0.07	0.3555	34.05
45	25	0.770 ± 0.06	0.2764	35.89

Data presented in table 1 and the graph in Figure 1 are revealing that the concentration of sperm in the semen has values that can be assigned in the normal range of the species with a large variability in all three control weeks.

It is found a dense sperm confirming the practical correlation between pH values and semen quality (in the series A of experiments has been recorded the lowest pH value).

It has been noticed the significant fall in sperm concentration in week 45 which is also highlighted very well by the pH value in this control week.

The differences observed between the concentrations of sperm in the three control weeks have been tested as statistical significance using the Student test and values are shown in table 2.

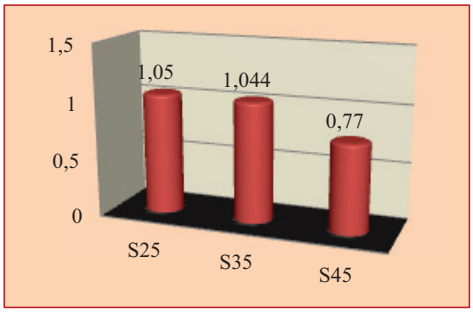

Figure 1. Average values of concentration of sperm for first experience series

Table 2. Testing the significance of differences observed between the three weeks in terms of concentration of sperm, first series

Specification	S25	S35	S45
S25	-	0.87^{NS}	3.25^{***}
S35		-	3.08^{***}

Data in table 2 are showing that there are differences between average values of sperm concentrations during the three control weeks inside series A without statistical significance between weeks 25 and 35 and very significant as for the rest. Differences in terms of statistical significance of the differences between the pH and the concentration in the sperm can be explained by the different degrees of variability of the two characters in the analyzed samples.

The values obtained for the concentration of sperm in the coming of the individuals within the B series of experiments from the period of adult has been presented in table 3 and graph in Figure 2.

Table 3. Average values of concentration of sperm for second experience series

Week	n	$\bar{X} \pm s_{\bar{X}}$ (mld/ml)	s	c.v.%
25	25	1.037 ± 0.05	0.2516	24.26
35	25	1.032 ± 0.06	0.3201	31.02
45	25	1.014 ± 0.06	0.2924	28.84

The data reveals the existence of sperm concentration in values in the normal range of the species with a great variability of observations during the three control weeks like in trial series A.

Concentrations in sperm obtained in series B are correlated with high pH recorded from these individuals and there are smaller than

those obtained inside series A with the exception of week 45.

Observed differences between character averages inside the three weeks have been tested for statistical significance and calculated values of Student test are shown in table 4.

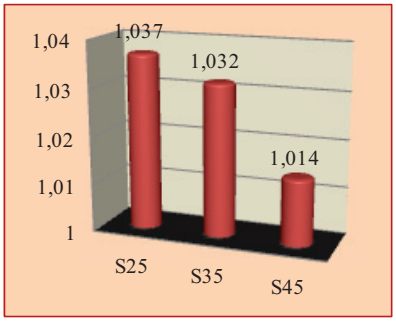

Figure 2. Average values of concentration of sperm for second experience series

Table 4. Testing the significance of differences observed between the three weeks in terms of concentration of sperm, second series

Specification	Week 25	Week 35	Week 45
Week 25	-	0.11^{NS}	1.93^{*}
Week 35		-	1.72^{*}

Calculated values of the Student test (table 4) are revealing the existence of significant differences in relation to the amount of sperm concentration between week 45 and the other two weeks otherwise they will be caused of random or individual variation without meaning in terms of statistically with no statistical significance.

The smaller values of sperm concentration inside trial series B are correlated with values of pH to individuals in this series. The lower values of concentration might also be due to a higher volume of the ejaculate obtained from cocks in series B. Considering that during the trial the same feeding conditions have been maintained results of sperm concentrations is not in measure to highlight a certain influence of the values of technological parameters and the type of litter (husks of rice) on sperm quality and so further investigations are necessary.

The values obtained for the concentration of sperm in the coming of the individuals in the series C of experiments, from the period of adult, has presented in table 5 and graph in Figure 3.

Table 5. Average values of concentration of sperm for third experience series

Week	n	$\bar{X} \pm s_{\bar{X}}$ (mld/ml)	s	c.v.%
25	25	1.042 ± 0.02	0.11	10.54
35	25	1.036 ± 0.02	0.12	11.27
45	25	0.730 ± 0.02	0.11	15.32

Presented data are revealing the existence of sperm concentration values inside the normal range with the slightest degree of variability registered amongst all trial series most probably due to environmental conditions at standard values and usage of a classical sawdust litter.

Observed differences between average concentrations of semen inside the three control weeks of the period of adult have been tested for statistical significance and calculated values of Student test are shown in table 6.

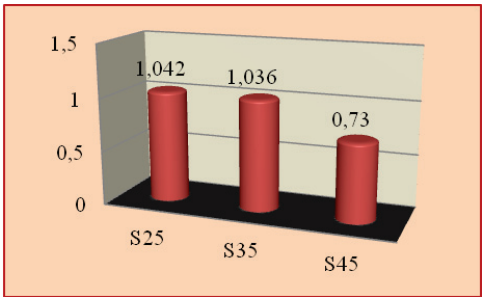

Figure 3. Average values of concentration of sperm for third experience series

Table 6. Testing the significance of differences observed between the three weeks in terms of concentrate of sperm, third series

Specification	Week 25	Week 35	Week 45
Week 25	-	0.17^{NS}	1.85^{*}
Week 35		-	1.69^{*}

Calculated values of Student test (table 6) are revealing the existence of differences statisticaly significant between the three control weeks inside series C with the exception of weeks 25 an 35. Drastic decrease in sperm concentration in week 45 of control is most likely correlated with a higher volume of ejaculate recorded in the same period.

In the graph in Figure 4 we are showing the observed differences between registered averages in the three trial series concerning the concentration of sperm in semen.

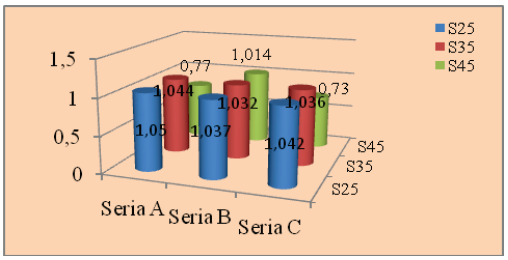

Figure 4. Comparative between the three expreimental series on concentration of sperm

Analyze of values are revealing some aspects of sperm concentration of semen. Thus firstly it is observed that values obtained inside trial series B were not the highest values of the analyzed character but they were the most constant during the three control weeks. This is somewhat in contrast to the pH values obtained under the same series but it seems that the higher values of these influenced just slightly the order of magnitude of concentration in sperm and not at all their frequency. Such results seem to advocate in favor of the usage of microclimate parameters at values above the technological standard and of a litter of rice husks. Secondly during trial series A and C has been noticed a decrease of sperm concentration values in week 45 of life. Results obtained during trial series B are suggesting that stress caused by intensification of microclimate parameters is indeed manifested through a slight decrease of concentration but assures a consistency of its value on a longer period which would beneficially influence biological and economical efficiency of breeding activity.

There were tested for statistical significance the observed differences between averages of sperm concentration from the three trial series during the whole control period with the aim to verify the influence of microclimatic parameters and of the ratio of sexes and of litter type on the quality of semen. We are showing in tables 7-9 calculated values of Student test and their significance.

Calculated values of Student test are showint the existence of some differences with different degrees of statistical significance between averages of sperm concentration from the three trial series. It is noticed the fact that there are differences significant from statistical point of view only during week 45 when sperm concentration is decreasing during series A and C. This fact allows us to state that exposing individuals to values above standard of technological parameters and using rice husks as litter are contributing to stepping up physiological processes which are controlling breeding activity with favourable influences on the effectiveness of the unit.

Table 7. Testing of significance for differences between experimental series, 25th week, for concentration of sperm

Specification	t test value
A-B	0.31^{NS}
A-C	0.54^{NS}
B-C	0.09^{NS}
$t_{49;0,05} = 1.68$; $t_{49;0,01} = 2,40$; $t_{49;0,001} = 3,50$	

Table 8. Testing of significance for differences between experimental series, 35th week, for concentration of sperm

Specification	t test value
A-B	0.07^{NS}
A-C	0.06^{NS}
B-C	0
$t_{49;0,05} = 1.68$; $t_{49;0,01} = 2,40$; $t_{49;0,001} = 3,50$	

Table 9. Testing of significance for differences between experimental series, 45th week, for concentration of sperm

Specification	t test value
A-B	7.18^{***}
A-C	0.91^{NS}
B-C	6.98^{***}
$t_{49;0,05} = 1.68$; $t_{49;0,01} = 2,40$; $t_{49;0,001} = 3,50$	

But we are saying again that a high sperm concentration of semen does not necessarily correspond to with a high reproductive capacity because the spectrophotometry does not necessarily notice the difference between viable spermatozoids and those morphologically abnormal or with aberrant movements and so supplementary investigations are necessary.

CONCLUSIONS

Certain values associated with the effectiveness of the biological characters and economical effectiveness of breeding activity has been determined during the production period. Following conclusions might be drawn concerning the sperm concentration:

- in the series A it is found that there is a dense sperme which is practicly confirming the correlation between pH values and semen quality;
- It is found that there are some differences with no statistical significance between average values of sperm concentration during the three control weeks inside series A between weeks 25 and 35 and very significant as for the rest;
- concentrations in sperm obtained in series B are correlated with the high pH recorded at these individuals and are smaller than those obtained inside series A with excepting week 45;
- Calculated values of Student test are revealing the existence of significant differences concerning sperm concentration inside series B between week 45 and the other two weeks otherwise they will be caused by random or individual variation with no statistical significance.
- The lowest degree of variability between all trial series has been obtained in the series C most probably because of the environmental conditions at standard values and usage of a classical sawdust litter.
- the results obtained in experimental series B suggests that stress caused by intensification of microclimate parameters are indeed manifested by lightly decreasing sperm concentration but this provides more than its value to a consistency which would positively affect biological and economic efficiency of breeding activity;
- Calculated values of Student test are revealing the existence of differences with varying degrees of statistical significance between average sperm concentrations of the three experimental series.

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