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Effect of Light Regimens on Turkey Performance in the Subtropics. III. Semen Characteristics.

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MEDIUM-WEIGHT BBW Studler turkey toms exposed to stimulatory light produced significantly ($P \leq .01$) more semen volume, sperm concentration per mm3, number of sperm per ejaculate and more viscous semen than the group exposed only to natural day length. The gradual increase in day length resulted in larger semen volumes than the abrupt increase in day length. A gradual increase in semen volume, sperm concentration per mm3, number of sperm per ejaculate and semen viscosity was observed for every increase in light intensity up to 33 lux. There was a very high significant correlation ($r = .97$) between the semen viscosity and the sperm concentration per mm3. The sperm concentration per mm3 can be accurately estimated from the viscosity of semen by using the following prediction equation :

Sperm conc. $(10)^6$ per $mm^3 = 2.4 + 3.36$ (semen viscosity).

Semen production of turkey toms is extremely important since most modern turkey operations use only artificial insemination (Nestor and Brown, 1971). The effect of varying day lengths on spermatogenesis and semen production has been reviewed by numerous investigators including Amoroso and Marshall (1960) and Romanoff (1960).

Best reproductive performance was obtained from turkey toms when exposed to 16 hr of light (natural plus artificial) from 1 to 13 months of age (Pigarev *et al.*, 1974). Wall and Jones (1976) concluded that natural light was less desirable than controlled light for growing Nicholas turkey toms. Semen production was significantly lower for toms subjected to natural day length from 8 to 28 weeks of age than that of toms subjected to either 6 hr daily artificial light or to artificial day length.

The purpose of this study was to evaluate the semen characteristics of medium-weight Broad Breasted White (BBW) Studler turkey toms under subtropical conditions. This evaluation was carried out under different light conditions and intensities.

Material and Methods

Medium Studler BBW turkey poults, hatched March 1, 1978, were used in this study. The birds were reared under similar conditions. (See Stino *et al.*, 1981, for detailed management procedures).

Twenty-four 30-week-old toms were chosen at random and exposed to 6 hr of restricted natural light for 4 weeks. Thereafter, the birds were divided at random into 6 equal groups (4 toms/group) of similar body weights. The toms were then exposed to the following light regimes :

Group 1 was exposed abruptly to 17 hr of light daily : 8 hr of natural light plus 9 hr of artificial light of 11 lux.

Group 2 was exposed to the same light regimes as Group 1 but with a light intensity of 22 lux.

Group 3 was exposed to the same light regimen as in Group 1, but with a light intensity of 33 lux.

Group 4 was exposed to 8 hr of natural light, plus 2 hr of artificial light daily. The 10-hr day length of this group was increased 1 hr weekly for 7 weeks until the birds were exposed to 17 hr of light. This level remained constant for the remainder of the experiment, with a light intensity of 11 lux.

Group 5 was exposed to the same light regimen as in Group 4, but with a light intensity of 22 lux.

Group 6, the controls, was exposed to natural day length only. Day length ranged from 10 hr and 39 min in November to 13 hr and 39 min in May.

Semen test techniques

Semen was collected according to the methods of Burrows and Marsden (1938) and modified by Parker (1946). Semen was collected twice weekly starting 55 days after the light stimulation from each male between 8 a.m. and 12 noon after feeding. Soon after the semen was collected, the samples were examined for the following characteristics in the following order :

1. The viscosity was graded visually. The viscosity was classified as follows : Grade 1 was given to watery semen; Grade 2 to milky semen; Grade 3 to milky-creamy semen; and Grade 4 to creamy semen.
2. Semen volume was measured by a tuberculine syringe graduated to 0.01 ml.
3. Semen initial pH was obtained by comparative pH papers.
4. Motility rating was scored using a spermotherm adjusted at 39°, according to an arbitrary scheme of classification ration from 0 to 10 grades (Kamar, 1960).
5. Sperm concentration was measured by using a hemocytometer.
6. Percentage live sperm was calculated in fresh semen using semen films stained by a buffered bromephenol blue and nigrosine solution (Kamar, 1959).
7. Total abnormality percentage was measured according to the method of Kamar and Badreldin (1959).

Statistical analysis was carried out according to Steel and Torrie (1960). The separation of means was done according to Duncan (1955).

Results and Discussion

Semen volume

The medium-weight turkey toms that were exposed to stimulatory light produced significantly ($P \leq .01$) more semen volume than those exposed to natural day length (Table 1). These results are in agreement with those of McCartney *et al.* (1961).

The semen volume of the toms exposed to gradual increase in day length was larger than that of the toms exposed to an abrupt increase in day length (Table 1). Within each treatment of gradual or abrupt increase in day length, the higher the light intensity, the larger the semen volume was. This agrees with the results of Nestor and Brown (1971) with medium-weight turkey toms. However, when heavy-weight turkey toms were used, opposite results were obtained.

Sperm concentration

In general, all the light-treated groups had higher sperm concentrations per mm^3 than the group housed under natural day length (Table 1). Toms exposed to an abrupt increase in day length had higher sperm concentrations (12.776 million/mm^3) than those exposed to a gradual increase in day length (12.131 million/mm^3) regardless of the light intensity.

There was also a gradual increase in sperm concentration per mm^3 for both the gradually and abruptly increased day length groups for every increase in light intensity. The highest sperm concentration was obtained from the toms exposed to an abrupt increase in day length with a light intensity of 33 lux (Table 1). Comparable results were reported by Nestor and Brown (1971) for medium-weight turkey toms.

Number of sperm per ejaculate

As a function of semen volume and sperm concentration, the number of sperm per ejaculate is expected to be affected by light duration and intensity. The gradually increased photoperiod resulted in a higher number of sperm than the abrupt increase (Table 1). The higher the light intensity within the abrupt or gradual increase in the photoperiod, the higher the number of sperm per ejaculate (Table 1). The increase in sperm production due to the increase in day length may be due to the increased output of gonadotropic hormones which activate spermatogenesis (Carson *et al.*, 1955).

Semen viscosity

There was a very high correlation ($r = 0.97$) between the semen viscosity and the sperm concentration per mm^3 (Table 1).

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Table 1. Effect of different light treatments on semen characteristics of medium-weight turkey toms.

Traits	Treatments					
	17 hr abruptly increased day length			17 hour gradually increased day length		
	11 lux	22 lux	33 lux	11 lux	22 lux	Control
Volume (ml)	.296^{bc*}	307^{bc}	.326^{ab}	.314^{abc}	.346^{a}	.146^{d}
Sperm conc. (10^6 sperm/mm^3)	12.543^{ab}	13.009^{ab}	13.735^{a}	11.842^{ab}	12.421^{ab}	7.427^{c}
# sperm per ejaculate (10^7)	372.5^{b}	400.7^{ab}	456.1^{a}	381.8^{ab}	444.4^{ab}	138.0^{c}
Viscosity	3.00^{bc}	3.12^{ab}	3.25^{a}	2.82^{b}	3.18^{ab}	2.07^{d}
Motility of fresh sperm	7.45^{d}	8.15^{b}	8.57^{a}	7.76^{cd}	8.06^{bc}	3.78^{e}
% live sperm in fresh semen	77.9^{bc}	80.5^{ab}	82.7^{a}	76.9^{c}	80.7^{ab}	65.8^{d}
% total abnormal sperm	16.0^{b}	10.7^{d}	8.2^{e}	13.8^{c}	11.7^{d}	17.9^{a}
pH	7.32^{a}	7.30^{a}	7.33^{a}	7.32^{a}	7.28^{a}	7.40^{a}

*Treatment averages within traits followed by different letters differ significantly ($P \leq .01$) from each other (Duncan, 1955).

This is expected since it is logical to assume that the more sperm there are per mm^3, the less plasma there will be. This leads consequently to a more viscous semen. Similar observations were previously reported by Parker *et al.* (1942).

Regression analyses also indicated that sperm concentration per mm^3 can be accurately estimated from the viscosity of the semen. The prediction equation is :

Sperm conc. per mm^3 (10^6) = 2.4 + 3.36 (semen viscosity).

Sperm motility

Sperm motilities of the fresh semen obtained from light-stimulated groups were higher than the group exposed to natural day length (Table 1). There was a gradual increase in sperm motility of fresh semen with every increase in light intensity of both gradually and abruptly increased day length groups.

The best sperm motility was obtained from toms exposed to abruptly increased day length with an intensity of 33 lux. A highly significant difference was observed between this group and all the other treated groups (Table 1). The sperm from toms exposed to natural day length was less than half as motile as any of the other light-treated groups. This might severely affect the fertility of these toms.

Live sperm percentages

Live sperm percentages in the fresh semen from toms exposed to stimulatory light were significantly ($P \leqslant .01$) higher than of those exposed to natural day length (Table 1). Abruptly increased day length had a similar effect on the average live sperm percentages to those exposed to a gradual increase in day length.

Every increase in the light intensity, in both the gradually and abruptly increased day length groups, resulted in an increase in live sperm percentage. The best live sperm percentage was obtained from the semen of the group that received a light intensity of 33 lux.

Abnormal sperm percentages

Toms exposed to natural day length produced semen with a higher total abnormal sperm percentage (17.9%) than those exposed to stimulatory light (Table 1).

The lowest abnormal sperm percentages were obtained when the toms were exposed to an abrupt increase in day length with the highest light intensity (33 lux).

Semen pH

The pH of the fresh semen ranged from 7.28 to 7.40 for all the groups including the control group. There were no significant differences in semen pH among all the groups (Table 1).

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تأثير الاضاءة على أنتاجية الرومى فى المناطق شبه الحارة
٣ ـ خواص السائل المنوى

فريد كمال رمزى استينو ، مختار عبد الفتاح قيقة ، جمال الدين عبد الرحمن قمر وسردار ياسين طه السردارى .

كلية الزراعة ـ جامعة القاهرة

عند تعريض ديوك الرومى من النوع عريض الصدر الابيض ذى الحجم المتوسط (ستودلر) للتنبيه الاضائى انتجت كميات اكبر معنويا ($P \leq 0.01$) بالنسبة لحجم السائل المنوى ـ تركيز الحيوانات المنوية فى المم٣ ـ حجم القذفة وعدد الحيوانات المنوية فى القذفة ـ لزوجة السائل المنوى عن المجموعة التى عرضت للاضاءة الطبيعية فقط .

وكانت الزيادة فى حجم السائل المنوى اكبر فى حالة الزيادة التدريجية للاضاءة عن الزيادة الفجائية للاضاءة .

كما لوحظ ان زيادة الكثافة الضوئية حتى ٣٣ وحدة ضوئية ادت الى زيادة كل من حجم السائل المنوى ـ تركيز الحيوانات المنوية (مم٣) عدد الحيوانات المنوية فى القذفة ولزوجة السائل المنوى .

كذلك كان هناك ارتباط معنوى موجب (ر = ٩٧ ر) بين لزوجة السائل المنوى وتركيز الحيوانات المنوية فى المم٣ .

ولقد اقترحت المعادلة التالية للتنبؤ بعدد الحيوانات المنوية / مم٣ باستخدام قيمة اللزوجة للسائل المنوى .

تركيز الحيوانات المنوية (٦١٠) لكل مم٣ = ٤ر٢+ ٣٦ر٣× (قيمة اللزوجة للسائل المنوى) .