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## **Reproductive Performances of Red-Legged Partridges (*Alectoris Rufa*) in Relation to Age and Season**

B. Fronte, M. D'Agata, M. Bagliacca

*Animal Production, Pise, Italy*

The purpose of the study was to evaluate the effect of breeder's age and laying period on captive red-legged partridge reproduction performances.

The deposition of yearling, 2- and 3-years-old breeders was monitored during 14 weeks. Pairs had been allocated in outdoors cages (45x80x35 cm - 1x1 cm wire mesh floor) under artificially extended photoperiod (natural + artificial 16 L : 8 D; 35 lux of artificial light intensity). The eggs were collected daily, stored (14 °C and 70% RH) and incubated once a week (setters 99.7 °F; 47% RH, hatchers 99 °F, 43→56→47% RH).

In comparison to the yearlings, results showed that the number of eggs laid per pairs increased slightly in 2 years-old breeders but, it significantly decreased in the 3 years-old (41.8, 44.4 and 38.1, respectively). Fertility and hatching percentages (on total incubated eggs) were influenced by breeders age (fertility: 85.8% vs. 83.6% vs. 80.5%; hatch: 74.7% vs. 71.7% and 70.3%, in yearling, in 1-, 2- and 3-years-old breeders, respectively;  $P < 0.05$ ). During the starting period, the oldest breeders showed a higher percentage of culled eggs at candling (25.2% vs. 12.5% and 14.2%) while the older parents showed higher hatching rates during the lasting season (67.5% vs. 62.7% and 62.9%).

Results confirmed that to keep the red-legged partridges for one year or longer is useful. It is a fact that the reproductive performances may improve during the second year. Furthermore, a different lighting program applied to the oldest male, could reduce the loss of fertility during the starting period.



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## Reproductive Performances of Red-Legged Partridges (*Alectoris Rufa*) in Relation to Age and Season

B. Fronte, M. D'Agata, M. Bagliacca

*Animal Production, Pise, Italy*

[bfronte@vet.unipi.it](mailto:bfronte@vet.unipi.it)

Running title: Age, Season and Partridge egg-laying.

**Summary** - The deposition of yearling, 2- and 3-years-old breeders was monitored during 14 weeks. Pairs had been allocated in outdoors cages (45x80x35 cm - 1x1 cm wire mesh floor) under artificially extended photoperiod (natural + artificial 16 L : 8 D; 35 lux of artificial light intensity). The eggs were collected daily, stored (14°C and 70% RH) and incubated once a week (setters 99.7 °F; 47% RH, hatchers 99 °F, 43→56→47% RH).

In comparison to the yearlings, results showed that the number of eggs laid per pairs increased slightly in 2 years-old breeders but, it significantly decreased in the 3 years-old (41.8, 44.4 and 38.1, respectively). Fertility and hatching percentages (on total incubated eggs) were influenced by breeders age (fertility: 85.8% vs. 83.6% vs. 80.5%; hatch: 74.7% vs. 71.7% and 70.3%, in yearling, in 1-, 2- and 3-years-old breeders, respectively;  $P < 0.05$ ). During the starting period, the oldest breeders showed a higher percentage of culled eggs at candling (25.2% vs. 12.5% and 14.2%) while the older parents showed higher hatching rates during the lasting season (67.5% vs. 62.7% and 62.9%).

Results confirmed that to keep the red-legged partridges for one year or longer is useful. It is a fact that the reproductive performances may improve during the second year. Furthermore, a different lighting program applied to the oldest male, could reduce the loss of fertility during the starting period.

**Key words:** Partridges, *Alectoris rufa*, age, egg-laying, captive breeding.

### Introduction

Partridges are small game species widely raised in farms and Countries such as Italy, France, Spain, Portugal, England and others. The decline of over-hunted red-legged partridge (*Alectoris rufa*) and grey partridge (*Perdix perdix*) populations, in fact have been contrasted with massive releases of captive-reared birds. In farms partridge's reproductive performance varies greatly due to the seasonal effect and this variability is more intense under natural photoperiod (Pérez 1981; González et al. 2003) than under artificial photoperiod supplementation (Pérez 1981; Bagliacca et al. 1988). The reproductive performance also varies from the more intense systems in which breeding occurs in flat-deck cages (Pérez 1981; González et al. 2003) to the less intensive large-pen systems (González-Redondo,

1995; Gaudioso et al. 2002; Bagliacca et al. 2004). Generally the red-legged partridges remain in production for more than one year (1 through 3/4yr) but there are not many studies available on the performance of partridges of different age or during each laying season (González-Redondo, 2006). In order to provide farmers and technicians information about the most suitable breeding time, we investigated the reproduction performances (egg-laying and artificial hatching) of Red-Legged partridge. Mostly, we paid special attention to the differences observed in relation to the breeder's age and the period of lay.

### **Materials and methods**

A total of 363 pairs of Red-Legged partridge were monitored in a game-bird farm (province of Grosseto in central Italy). The breeding partridges, with ages ranging from 1 to 3 yr old (115, 120, and 128 couples, respectively), were fed with commercial feed (2430 kcal/kg M.E.; 19.6% CP) and were lodged in outdoor pairs cages (size 45x80x35 cm, 1x1 cm wire mesh floor) and were homogeneously distributed and randomly allocated. The partridges were initially subjected to natural lighting, but from Jan 29<sup>th</sup>, when the photoperiod was 10.63 h of light, artificial lighting was added, increasing the photoperiod by 1 h each week until Feb 19<sup>th</sup>, when a complete photoperiod (natural light + artificial light) of 16 h was reached (35 lux artificial light intensity minimum). This lighting program was maintained until May 21<sup>st</sup>, when artificial light was removed since it reached the complete length of photoperiod and the partridges' laying rate start declining.

Egg laying started during the second week of March. From March 12<sup>th</sup> onward, the eggs were collected daily and kept at 14 °C and 70% RH, 1 through 7 days before being loaded in the incubator (weekly loading, 14 weeks total, March through June). All the hatching eggs laid by the partridges since the date of the previous incubator loading were incubated. The eggs were prewarmed for 6 hours, by maintaining them in the room where the incubator itself was located (room temperature 22 to 24 °C and 55 % RH).

The eggs were incubated at 99.7 °F (37.61 °C) and 47% RH (82 °F wet bulb), hatched at 99 °F (37.2 °C) and variable RH 38%→86%→43% (78-56-80 °F wet bulb). After day 8<sup>th</sup> of incubation, the eggs were candled to determine their apparent fertility; on day 24<sup>th</sup>, the number of hatched chicks and unhatched eggs was recorded.

Egg laying period was divided into 3 sub-period (start-laying: Mar 17<sup>th</sup> - Apr 13<sup>th</sup>, 4 weeks; central-laying: Apr 14<sup>th</sup> - May 25<sup>th</sup>, 6 weeks; end-laying: May 26<sup>th</sup> - Jun 22<sup>nd</sup>, 4 weeks). The number of eggs layed per couple was analysed by non parametric methods in relationship to thesis, sub-period and age of the couples. Statistical differences between apparent fertility, total hatchability and hatchability on fertile eggs were analyzed using contingency tables on which Pearson's  $\chi^2$  tests were performed for a confidence level of 95%. All analyses were conducted using Jmp software (SAS Institute Inc., 2008).

### **Results and discussion**

The laying curves, grouped by couple age and the data of the total egg production, are shown on Fig 1. The number of incubated eggs, candled eggs, and hatched chicks, grouped by couple age or by sub-period (main effects) are shown in Table 1 and 2, respectively. Hatching traits, grouped by sub-period and couple age (interaction effect), are shown in Table 3.

**Age of the Couples** - Most females that failed or ended unnaturally their laying period during the study period did so when they were 1 year old (21% of the females), whereas only 16% females failed to lay when they were 2 years old and 17% females when they were 3 years old.

In comparison to the yearlings, results showed that the number of eggs laid per pairs increased slightly in 2 years-old breeders but, it significantly decreased in the 3 years-old (41.8, 44.4 and 38.1, respectively). The positive effects of ageing on reproductive traits (Cabezas-Diaz et al. 2005) was confirmed by our results during the second year. It is well known that the reproductive performance of the Red-Legged partridge varies with age (Cabezas-Diaz et al., 2005). However, even if all the breeders had been fed at an optimum level (a specific commercial feed for partridges were used) the couples started their decline just from the 3<sup>rd</sup> year. Apparent fertility and hatching percentages (on total incubated eggs) were also influenced by the breeders age (fertility: 85.8% vs. 83.6% vs. 80.5%; hatch: 74.7% vs. 71.7% and 70.3%, in yearling, in 2- and 3-years-old breeders, respectively;  $P < 0.05$ ). The trend differ from the laying performance; the best hatching results were reached by one years old couples so the hatching results were inversely related to the age of the couples.

**Period of lay** - Apparent fertility and hatching percentages (on total incubated eggs) were influenced by the period in which the eggs had been layed (fertility: 82.7% and 82.7% vs. 85.5%; hatch: 91.2% and 89.4% vs. 75.0%, in start-laying period, central-laying period and end-laying period, respectively;  $P < 0.05$ ). The well known effect of period of lay was quite reduced, probably due to the fact that the first and last eggs were not incubated. However the eggs layed in the end-laying period confirmed the decrease of the hatching rates observed in incubation experiences of games (Gonzalez Redondo, 2006). In the end-laying period we observed an anomalous decrease of culled eggs at candling. This decline, however, was balanced by the reduced hatch on candled eggs so that total hatching significantly decreased according to what observed in other experiences (Gaudioso et al, 2002; Mori et al., 1985).

**Interaction effect: age x period of lay** - Significant differences were observed in relation to the interaction effect: during the starting period, the oldest breeders showed a significantly higher percentage of culled eggs at candling (25.2% vs. 12.5% and 14.2%;  $P < 0.05$ ) while the older couples showed higher hatching rates during the lasting season (67.5% vs. 62.7% and 62.9%;  $P < 0.05$ ).

## **Conclusions**

Results seem to suggest maintaining in production the breeders of red-legged partridges for a maximum length of 3 years. The maximum production can be obtained by 2 years old couples while the production of 3 years old couples starts declining. The production of yearlings is greater considering fertile couples but since a great number of couples fail or end unnaturally their lay, the production of caged birds is lower than in the 2<sup>nd</sup> year. In addition, a lighting program more anticipated for 3 year old males than females, could reduce the loss of fertility at the starting period of lay.

## **Aknowledgments**

The authors are grateful to Mr. P. Biagini & Mr. S. Rustici of the “Bandite di Scarlino” for hosting the trials in their CPPS “Casolino”, to Mr. L. Ricci and Mr. P. Pazzagli of the CPPS “Casolino” for their skilful assistance during the trials. This research was fund by the province of Grosseto’s grant “Assistenza tecnico-scientifica nella gestione degli Allevamenti pubblici di Montalto e del Casolino”.

**References**

Bagliacca M., Mori B., Gualterio L. (1988). Egg laying under artificial photo-regulation in the red partridge. Proc. 18<sup>th</sup> World's Poultry Congress, Nagoya, Japan.: 657-659.

Bagliacca M., Profumo A., Ambrogi C., Leotta R., Paci G. (2004). Egg-laying differences in two grey partridge (*Perdix perdix* L.) lines subject to different breeding technology: artificial egg hatch or mother egg hatch. European Journal of Wildlife Research 50: 133-136.

Cabezas-Diaz Sara, Virgos E., Villafuerte R (2005) Reproductive performance changes with age and laying experience in the Red-legged Partridge *Alectoris rufa*. Ibis , 147:316-323

Ferruzzi G., Bagliacca M., Mori B., Chiarcossi M. (1986). Ricerche preliminari per l'effettuazione della doppia deposizione nelle pernici rosse (*Alectoris rufa*). Rivista di Avicoltura 55 (12): 43-46.

Gaudio V. R., Alonso M. E., Robles R., J. Garrido A., Olmedo J. A. (2002). Effects of housing type and breeding system on the reproductive capacity of the Red-Legged partridge (*Alectoris rufa*). Poultry Science 81: 169-172.

González-Redondo P. (1995). La cría de perdices rojas a pequeña escala. Federcaza 117: 65-69.

González-Redondo P., Delgado M., Reina M. (2003). Caracterización de la puesta y su viabilidad en una granja cinegética de perdiz roja (*Alectoris rufa*). Proc. 2<sup>nd</sup> Jornadas Ibér. Razas Autóctonas Prod. Tradic. Ganaderia, Junta de Andalucía, Seville, Spain: 182-183.

González-Redondo P. (2006). Influence of the Laying Date on the Fertility and Hatchability of Red-Legged Partridge (*Alectoris rufa*) Eggs. Journal of Applied Poultry Research 15:579-583.

JMP (2008). Statistics and Graphics Guide. SAS Institute Inc., Cary, NC, USA.

Mori B., Bagliacca M., Chiarcossi M., Romboli I. (1985). Performances riproduttive della pernice rossa allevata in Liguria. Rivista di Avicoltura, 54 (2): 27-32.

Pérez G., Pérez F. (1981). La perdiz roja española. Editorial Científico-Médica. Barcelona, Spain.

Fig 1 - Weekly egg production by partridges forced to lay during the 14-weeks period.

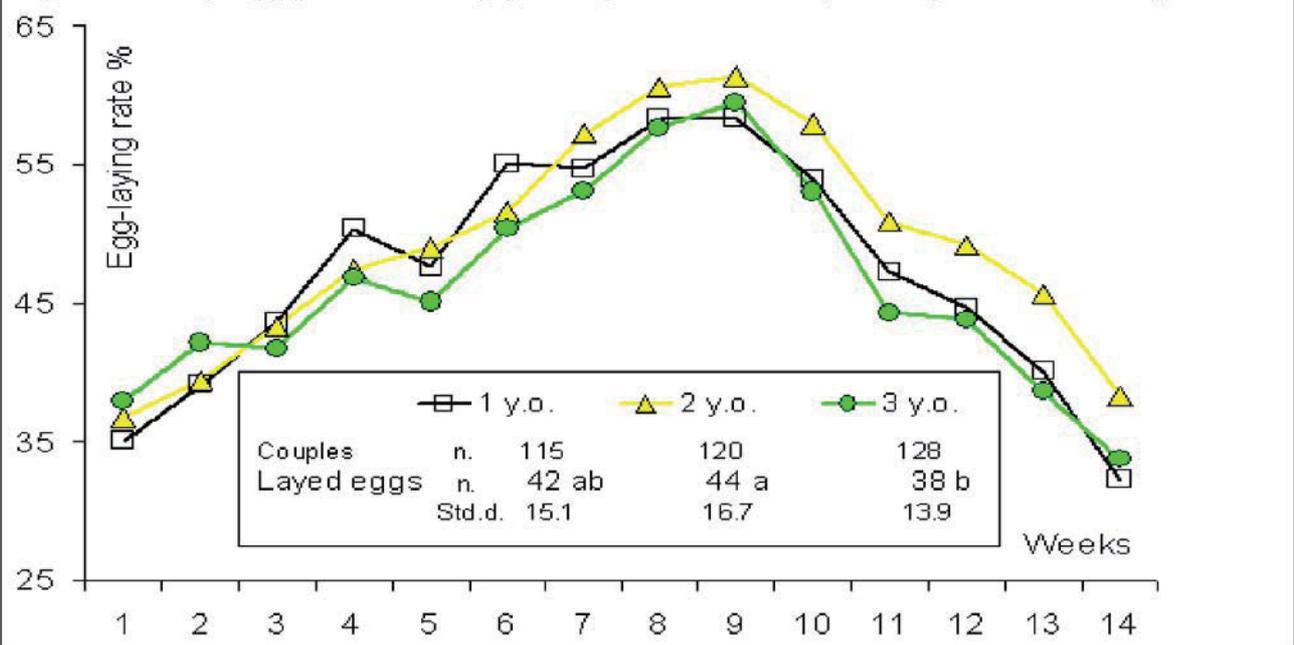


Table 1\* - Average fertility and hatchability of eggs from red-legged partridges in relationship to the age of the couples.

Partridge age y.o.	Eggs n	Candled eggs %	Hatched chicks on	
			candled %	incubated %
1	4803	85.8a	87.0ns	74.7a
2	5323	83.6b	85.7ns	71.7b
3	4878	80.5c	87.4ns	70.3b

Table 2\* - Average fertility and hatchability of eggs from red-legged partridges in relationship to the laying period.

Egg Laying period	Eggs n	Candled eggs %	Hatched chicks on	
			candled %	incubated %
Start	3158	82,7b	91,2a	75,5a
Middle	8704	82,7b	89,4a	73,9a
End	3142	85,5a	75,0b	64,1b

Table 3\* - Fertility and hatchability of red-legged partridge eggs during the laying period.

Egg Laying period	Partridge age y.o.	Eggs n	Candled eggs %	Hatched chicks on	
				candled %	incubated %
Start	1	1082	85.8a	91.6ns	78.6a
	2	1042	87.5a	91.9ns	80.4a
	3	1034	74.8b	90.0ns	67.3b
Middle	1	2777	86.1a	89.7ns	77.2a
	2	2990	81.7b	88.7ns	72.5b
	3	2937	80.6b	89.7ns	72.3b
End	1	944	85.3ns	73.8ns	62.9b
	2	1291	84.9ns	73.8ns	62.7b
	3	907	86.5ns	78.0ns	67.5a

\*Note: means bearing different letters differ per  $p < 0.05$

# Reproductive performances of red-legged partridges (*Alectoris rufa*) in relation to age and season



FRONTE Baldassare, D'AGATA Maria, BAGLIACCA Marco  
 Department of Animal Production, Pisa University, Italy.

## INTRODUCTION

Partridges are small game species, widely raised in farms and Countries such as Italy, France, Spain, Portugal, England and others. The decline of over-hunted red-legged partridge (*Alectoris rufa*) and grey partridge (*Perdix perdix*) populations in fact have been contrasted with massive releases of captive-reared birds. In farms partridge's reproductive performance varies greatly due to the seasonal effect and it is more intense under a natural photoperiod (Pérez 1981; González et al. 2003) than under artificial photoperiod supplementation (Pérez 1981; Bagliacca et al. 1988). The reproductive performance also varies from the more intense systems in which breeding occurs in flat-deck cages (Pérez 1981; González et al. 2003) to the less intensive large-pen systems (González-Redondo, 1995; Gaudioso et al. 2002; Bagliacca et al. 2004). Generally the red-legged partridges remain in production for more than one year but there are not many studies available on the performance of partridges of different age or during each laying season (González-Redondo, 2006). In order to provide farmers and technicians information for the most suitable breeding time, we investigated the reproduction performances of Red-Legged partridge. Mostly, we paid special attention to the differences observed in relation to the breeder's age and the period of lay.

## MATERIALS AND METHODS

**Animals:** 363 Red-Legged partridge.

**Housing:** outdoor pairs cages (size 45x80x35 cm, 1x1 cm wire mesh floor).

**Age:** from 1 to 3 yr old (115, 120, and 128 couples, respectively).

**Feeding:** commercial feed.

**Lighting:** initially natural and from Jan 29<sup>th</sup> until Feb 19<sup>th</sup> artificial lighting increasing the photoperiod by 1h/week. Artificial light was removed since it reached the complete length of photoperiod.

**Egg laying** started in March and the period was divided in 3 sub-period: *start-laying* (Mar 17<sup>th</sup> - Apr 13<sup>th</sup>, 4 weeks); *central-laying* (Apr 14<sup>th</sup> - May 25<sup>th</sup>, 6 weeks); *end-laying* (May 26<sup>th</sup> - Jun 22<sup>nd</sup>, 4 weeks).

**Eggs were:**

-collected daily, kept weekly and stored at 14°C and 70% RH.

-prewarmed for 6 hours, in the room where the incubator itself was located (at 22 to 24°C and 55% RH).

-incubated at 99.7°F (37.61°C) and 47% RH (82°F wet bulb), hatched at 99°F (37.2°C) and variable RH 38%~86%~43% (78-56-80°F wet bulb).

-candled, after day 8<sup>th</sup> of incubation, to determine their apparent fertility;

-on day 24<sup>th</sup>, the number of hatched chicks and unhatched eggs was recorded.

**Statistical analysis:** eggs number per couple was analysed by non parametric methods in relationship to thesis, sub-period and age of the couples. Statistical differences between apparent fertility, total hatchability and hatchability on fertile eggs were analyzed using contingency tables on which Pearson's  $\chi^2$  tests were performed for a confidence level of 95%. All analyses were conducted using Jmp software (SAS Institute Inc., 2008).



## RESULTS AND DISCUSSION

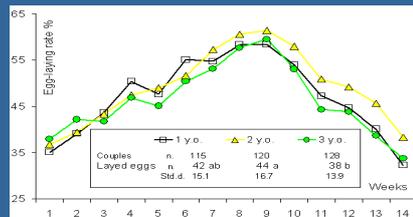


Fig 1 - Weekly egg production by partridges forced to lay during the 14-weeks period.

The laying curves, grouped by couple age and the data of the total egg production, are shown on Fig 1. The number of incubated eggs, candled eggs, and hatched chicks, grouped by couple **age** or by **sub-period** (main effects) are shown in Table 1 and 2, respectively. Hatching traits, grouped by **sub-period and couple age** (interaction effect), are shown in Table 3.

**Age of the Couples** - Table 1 - Most females that failed or ended unnaturally their laying period during the study period did so when they were 1 year old (2% of the females), whereas only 16% females failed to lay when they were 2 years old and 17% females when they were 3 years old. In comparison to the yearlings, results showed that the number of eggs laid per pairs increased slightly in 2 years-old breeders but, it significantly decreased in the 3 years-old. The positive effects of ageing on reproductive traits was confirmed by our results during the second year. It is well known that the reproductive performance of the Red-Legged partridge varies with age (Cabezas-Diaz et al., 2005). However, even if all the breeders had been fed at an optimum level (a specific commercial feed for partridges were used) the couples started their decline just from the 3<sup>rd</sup> year. Apparent fertility and hatching percentages (on total incubated eggs) were also influenced by the breeders age. The trend differ from the laying performance; the best hatching results were reached by one year old couples so the hatching results were inversely related to the age of the couples.

**Period of lay** - Table 2 - Apparent fertility and hatching percentages (on total incubated eggs) were influenced by the period in which the eggs had been laid. The well known effect of period of lay was quite reduced, probably due to the fact that the first and last eggs were not incubated. However the eggs laid in the end-laying period confirmed the decrease of the hatching rates observed in incubation experiences of games (Gonzalez Redondo, 2006). In the end-laying period we observed an anomalous decrease of culled eggs at candling. This decline, however, was balanced by the reduced hatch on candled eggs so that total hatching significantly decreased according to what observed in other experiences (Gaudioso et al. 2002; Mori et al. 1985).

Table 1\* - Average fertility and hatchability of eggs from red-legged partridges in relationship to the age of the couples.

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Start	3158	82.7 b	91.2 a	75.5 a
Middle	8704	82.7 b	89.4 a	73.9 a
End	3142	85.5 a	75.0 b	64.1 b

**Interaction effect: age x period of lay** - Significant differences were observed in relation to the interaction effect: during the starting period, the oldest breeders showed a significantly higher percentage of culled eggs at candling while the older couples showed higher hatching rates during the lasting season.

Table 3\* - Fertility and hatchability of red-legged partridge eggs during the laying period.

Egg Laying period	Partridge age y.o.	Eggs n	Candled eggs %	Hatched chicks on	
				candled%	incubated%
Start	1	1082	85.8 a	91.6 ns	78.6 a
	2	1042	87.5 a	91.9 ns	80.4 a
	3	1034	74.8 b	90.0 ns	67.3 b
Middle	1	2777	86.1 a	89.7 ns	77.2 a
	2	2990	81.7 b	88.7 ns	72.5 b
	3	2937	80.6 b	89.7 ns	72.3 b
End	1	944	85.3 ns	73.8 ns	62.9 b
	2	1291	84.9 ns	73.8 ns	62.7 b
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\*Note: means bearing different letters differ per p<0.05

## CONCLUSIONS

Results seem to suggest maintaining in production the breeders of red-legged partridges for a maximum length of 3 years. The maximum production can be obtained by 2 years old couples while the production of 3 years old couples starts declining. The production of yearlings is greater considering fertile couples but since a great number of couples fail or end unnaturally their lay, the production of caged birds is lower than in the 2<sup>nd</sup> year. In addition, a lighting program more anticipated for 3 years old males than females, could reduce the loss of fertility at the starting period of lay.

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## REFERENCES

- Bagliacca M., Mori B., Gualterio L. (1988). Egg laying under artificial photo-regulation in the red partridge. Proc. 18th World's Poultry Congress, Nagoya, Japan: 657-659. Bagliacca M., Profumo A., Ambrogi C., Leotta R., Paci G. (2004). Egg-laying differences in two grey partridge (*Perdix perdix* L.) lines subject to different breeding technology: artificial egg hatch or mother egg hatch. European Journal of Wildlife Research 50: 133-136. Cabezas-Diaz Sara, Virgos E., Villafuerte R (2005) Reproductive performance changes with age and laying experience in the Red-legged Partridge *Alectoris rufa*. Ibis, 147:316-323 Gaudioso V. R., Alonso M. E., Robles R., J. Garrido A., Olmedo J. A. (2002). Effects of housing type and breeding system on the reproductive capacity of the Red-Legged partridge (*Alectoris rufa*). Poultry Science 81: 169-172. González-Redondo P. (1995). La cría de perdices rojas a pequeña escala. Federcaza 117: 65-69. González-Redondo P., Delgado M., Reina M. (2003). Caracterización de la puesta y su viabilidad en una granja cinegética de perdiz roja (*Alectoris rufa*). Proc. 2nd Jornadas Ibér. Razas Autóctonas Prod. Tradic. Ganadería, Junta de Andalucía, Seville, Spain: 182-183. González-Redondo P. (2006). Influence of the Laying Date on the Fertility and Hatchability of Red-Legged Partridge (*Alectoris rufa*) Eggs. Journal of Applied Poultry Research 15:579-583. JMP (2008). Statistics and Graphics Guide. SAS Institute Inc., Cary, NC, USA. Mori B., Bagliacca M., Chiarocci M., Romboli I. (1985). Performances riproduttive della pernice rossa allevata in Liguria. Rivista di Avicoltura, 54 (2): 27-32. Pérez G., Pérez F. (1981). La perdiz roja española. Editorial Científico-Médica. Barcelona, Spain.