

HOW DO YOU USE AVIAN REPRODUCTION PERFORMANCE TO EVALUATE AGROCHEMICAL PRODUCT TOXICITY?

APPLICATION NOTE

Using A Database Of Avian Reproduction Performance To Enhance Evaluation Of Agrochemical Product Toxicity

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INTRODUCTION

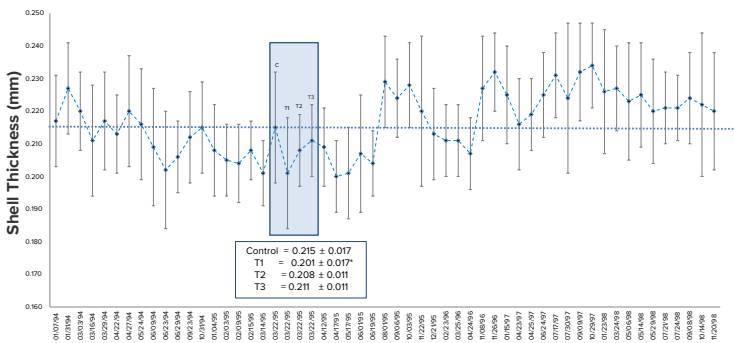
Avian reproduction studies have been conducted for regulatory compliance since the early 1970's. A data set that includes performance results from each set of control group birds began in 1978 at Wildlife International (now EAG Laboratories). This data set includes mean and standard deviations for the reproductive parameters measured in avian reproduction tests. It was initiated to help identify the 'normal' range for measurements that are examined in reproduction tests performed with 'wild-type' birds. Individual data sets are compiled for upland game and waterfowl bird species of Northern bobwhite (*Colinus virginianus*) and mallard (*Anas platyrhynchos*) (1,2).

MEASURED PARAMETERS IN DATABASE

- | | |
|---|---|
| <ul style="list-style-type: none"> Expressed as % Cracked Eggs / Eggs Laid Fertile & Viable Eggs / Eggs Set Live 3-week Embryos / Viable Eggs Hatch / 3-week Embryos & Eggs Set 14-day Olds / Hatch | <p>Mean Measurements</p> <ul style="list-style-type: none"> Eggs Laid / Hen Eggs Laid / Hen / Day Egg Shell Thickness Measurements (mm) Individual Weights of Hatchlings (g) Individual Weights of 14-day Old Survivors (g) |
|---|---|

CASE STUDY #1: EGG SHELL THICKNESS MEASUREMENTS

Historic Control: Egg Shell Measurement [Northern Bobwhite]



- Lowest treatment group (T1) presents a statistically significant reduction ($p < 0.05$, Dunnett's t-test) when compared to the control group.
- Higher treatment groups (T2 & T3) presents no significant differences ($p > 0.05$, Dunnett's t-test) from the control group.
- A four-year range of historical control data indicates a mean of 0.216 (0.200 – 0.234) + 0.009 mm (SD).

Egg Shell Thickness from a Northern Bobwhite Reproduction Study with a Test Substance

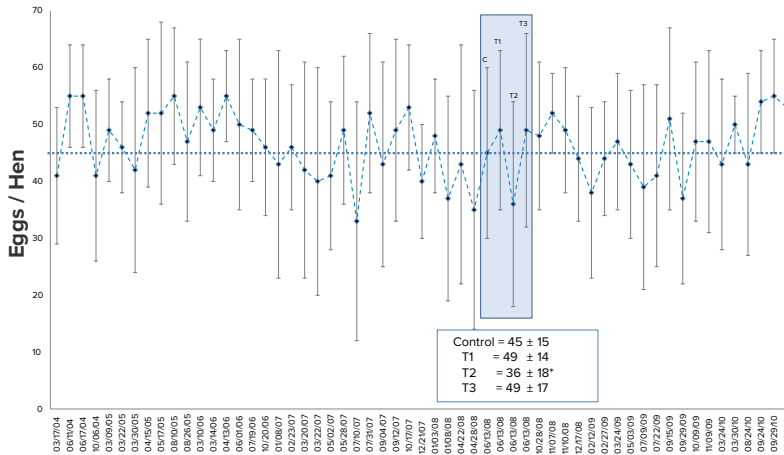
EXPERIMENTAL GROUP (PPM A.I.)				
Reproductive Parameter Measured	Control	T1	T2	T3
Number of Surviving Replicates	18	16	18	18
Number of Eggs Laid ¹	932	750	896	844
Number of Shells Measured	60	58	62	67
Mean Egg Shell Thickness (mm)	0.215 + 0.017	0.201 + 0.017 ²	0.208 + 0.011	0.211 + 0.011

¹Based on 90 days of egg production.
²Significantly different from control at $p \leq 0.05$ (Dunnett's t-test).

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CASE STUDY #2: EGGS LAID PER HEN

Historic Control: Eggs Per Hen [Northern Bobwhite]



Eggs laid per hen from a Northern Bobwhite Reproduction Study with a Test Substance

EXPERIMENTAL GROUP (PPM A.I.)				
Reproductive Parameter Measured	Control	T1	T2	T3
Number of Surviving Replicates	18	18	17	17
Number of Eggs Laid ¹	807	816	613	824
Eggs Laid / Hen (%)	49 + 15	45 + 14	36 + 18 ²	49 + 17

¹Based on 92 days of egg production.

²Significantly different from control at $p \leq 0.05$ (Dunnett's t-test).

- Middle treatment group (T2) presents a statistically significant reduction ($p < 0.05$, Dunnett's t-test) when compared to the control group.
- Low (T1) and high (T3) treatment groups presents no statistically significant differences ($p > 0.05$, Dunnett's t-test) from the control group.
- An eight-year range of historical control data indicates a mean of 46 (33 – 55) + 5 eggs/hen (SD).
- Unclear response in middle treatment group (T2). Additional information is necessary to determine whether reduction is meaningful.

DISCUSSION

- Historical control data presents multiple utilities including:
- Comparison of individual study results with 'norm'.
- Bolstering study results that might seem variable.
- Addressing variability in reproductive performance of 'wild-type' birds.
- Interpreting statistical results.
- Stimulate discussion with the aim of critically evaluating studies for regulatory compliance.

REFERENCES

1. U.S. Environmental Protection Agency. 2012. Series 850 – Ecological Effects Test Guidelines, OCSP Number 850.2300: Avian Reproduction Test.
2. Organization for Economic Cooperation and Development. 1984. Avian Reproduction Test. OECD Guideline for Testing of Chemicals. Guideline 206. Paris.

