DATA EVALUATION RECORD

1. Chemical: Cyhalothrin

2. Test Material: Cyhalothrin 97.9 w/w

   Chemical structure: (R,S) a-cyano-3-phenoxybenzyl (+)-cis-3,3(z-2-chloro-3,3,3-trifluoroprop-1-en)-2,2-dimethylcycloproponecarboxylate.

   Cis/trans ratio: 96.8:3.2

3. Study Type: Avian Reproduction on the mallard

   Species Tested: Anas platyrhynchos


5. Reviewed By: Candy Brassard

   Signature: Candy Brassard

   Date: 3/1/88

   FRR/HRD

6. Approved By: Douglas J. Urban

   Signature: Douglas Urban

   Date: 3/1/88

   Head, Section III

   FRR/HRD

7. Conclusion:

   This study is classified as supplemental. There are data discrepancies that detract from the study. It appears the lowest NOFL = 5 ppm and LOFL = 50 ppm for eggs laid and eggs set. The NOFL may even be less than 5 ppm depending on the raw data that needs to be submitted with regards to terminal findings.

8. Recommendations:

   The study author should submit all raw data with regard to gross postmortem examination, and specifically the underdeveloped ovaries found in both treatment groups. The raw data on 17A Week 7 should also be submitted so that a complete ANOVA can be conducted.

9. Background:

   This study was submitted to support registration of Karate or PP321 on cotton and soybeans.
10. Discussion of Individual Tests: N/A

11. Materials and Methods:

a. Test Animals - The mallard ducks were obtained from Mr. J. Coles, The County Game Farms, Home Farm, Rothfield, Ashford, Kent, England and were young adults approaching their first laying season. All the birds were wild caught. The birds arrived > 9 weeks prior to test initiation.

b. Test System - Adults - The adult mallards were housed by replicate group in wooden pens measuring approximately 1.6 x 0.6 x 1.7 m, with concrete floors. Each pen contained an automatic nipple drinker and a food hopper. Sawdust was used as bedding. Ambient temperature ranged from 8 to 25 °C (x = 15) and the relative humidity ranged from 48 to 85 percent (x = 66%).

Ventilation fans were adjusted as necessary. The following photoperiod regime was used.

<table>
<thead>
<tr>
<th>Days of study</th>
<th>Hours light</th>
<th>Hours dark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 71</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>72 – 78</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>79 – 92</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>93 – 99</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>100 – 106</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>107 – 175</td>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>

The basal diet without test compound consisted of the following ingredients:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground wheat</td>
<td>38.25</td>
</tr>
<tr>
<td>Ground maize</td>
<td>30.00</td>
</tr>
<tr>
<td>Wheatings (Wheatfeed)</td>
<td>5.00</td>
</tr>
<tr>
<td>Provimi 66 fishmeal</td>
<td>10.00</td>
</tr>
<tr>
<td>Soya bean meal</td>
<td>10.00</td>
</tr>
<tr>
<td>Limestone flour</td>
<td>5.50</td>
</tr>
<tr>
<td>Pantoribin 537*</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Water was available ad libitum.

* Mineral vitamin and trace element supplement (R.P. Nutrition (UK) Ltd.).
Diet Preparation - The test compound was mixed with corn oil in the final diet. Corn oil, at a rate of 0.1 percent w/w, was incorporated in all diets (as well as control). Diets were generally mixed on a weekly basis, and the diet was analyzed on four weekly intervals and from the final hatch of diets mixed to check inclusion levels.

Eggs

The eggs were incubated at weekly intervals in a "Wester Incubator." Temperature was 37 °C (no range reported) and relative humidity ranged from 34 to 93 percent (X = 63%).

Eggs were turned every 45 minutes through an angle of 90° throughout incubation period. Eggs were incubated for 23 to 24 days before transferring to hatchers.

Hatching

Hatchers were air Bristol Incubator Models PH 90 and PH 150, which operated at 37 °C (temp.). The ducklings hatched approximately 27 to 29 days after eggs were set in incubator. After hatching, ducklings were handed with color-coded plastic leghands for identification.

Ducklings were housed in wooden pens that were 2.4 x 3.0 m with concrete floors, with two drinkers and two food hoppers. Wood shavings were used as bedding. Each pen contained two 300-watt infrared lamps placed at bird level to supply additional heat. The temperature ranged from 18 to 40 °C (X = 28 °C). The relative humidity ranged from 47 to 95 percent (X = 68%). Continuous controlled artificial lighting pattern was adopted for the duckling. Ventilation fans were used as necessary.

The chick diet was as follows:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>% w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground wheat</td>
<td>30.00</td>
</tr>
<tr>
<td>Ground maize</td>
<td>25.00</td>
</tr>
<tr>
<td>Ground barley</td>
<td>10.00</td>
</tr>
<tr>
<td>Provim 66 fishmeal</td>
<td>15.00</td>
</tr>
<tr>
<td>Extracted soya bean meal</td>
<td>13.75</td>
</tr>
<tr>
<td>Wheatings (Wheatfeed)</td>
<td>5.00</td>
</tr>
<tr>
<td>Pantorbin 537*</td>
<td>1.25</td>
</tr>
</tbody>
</table>

* Mineral, vitamin, and trace element supplement (R.P. Nutrition (UK) Ltd.).
The diet was offered ad libitum and was known not to contain antibiotics or growth promoters in the formulation. Water was also available ad libitum.

c. Dose - A control and two treatment levels were used -- 5 and 50 ppm cyhalothrin.

d. Study Design - Each pen contained two males and five females. Each treatment level included six replicates (a total of 12 males and 30 females per dose). The birds were randomly assigned to each pen.

Observations

Adult bird observations were as follows:

1. Mortalities - daily.
2. Bird health - daily.
3. Group mean food consumption - weekly per replicate.
4. Individual body weights - Days 0, 14, 28, 42, 56, 70, and 175.
5. Macroscopic postmortem - All birds were examined postmortem for gross abnormalities.

Egg observations were as follows:

1. Egg collection - Eggs collected daily during 12-week egg production period.
2. Egg weight - At 7-day intervals the collected eggs were weighed and the replicate group total weight, mean egg weight, and number of eggs weighed were recorded. Broken eggs were not weighed.
3. Egg quality - At 7-day intervals the collected eggs were candled after weighing to check for cracks and breakages.
4. Eggshell thickness - All eggs collected in the first 2 days of Weeks 1, 3, 5, 7, 9, and 11 were examined. The eggs, after cracked at widest point, were washed, dried for 48 hours, and measured to the nearest 0.01 mm at four points around the circumference.

Candling and hatching - The incubated eggs were candled on Days 14 and 21.
The following observations were recorded:

1. **Infertile eggs** - Appearing as clear at Day 14 candling.

2. **Early embryonic mortalities** - Day 14 - Any embryos observed to be dead were removed.

3. **Late embryonic mortalities** - Day 21 - Any embryos observed to be dead were removed. At this stage the embryos were fully differentiated.

4. **"Dead in shells"** - Any eggs that failed to hatch after the infertile and embryonic death eggs were removed. Pipped eggs were also noted.

5. **Ducklings hatched** - Live and dead ducklings that hatched were recorded. Abnormalities were recorded.

Ducklings - Ducklings were reared for 14 days. The following observations were recorded:

1. **Individual body weight** - Within 24 hours of hatching and 14 days later.

2. **Bird health** - Daily

3. **Mortalities** - Daily

4. **Macroscopic postmortem examination** - Only sporadic mortalities were examined for gross abnormalities. No examination was made at termination.

**Summary of Study Duration** (excerpted from submission)

**Adults** 13-week pre-egg production period 12-week egg production period.

**Incubation** Eggs collected over the 12-week egg production period were incubated weekly. The incubation period lasted 27 to 29 days.

**Ducklings** The weekly hatches of ducklings from the 12-week egg production period were reared until they were 14 days old.
The total study duration from the start of the adult observation period to the final duckling observations was 31 weeks approximately.

e. **Statistical Analysis** (excerpted from submission) -

"A statistical analysis of the following responses was carried out:

1. Adult food consumption
2. Adult bodyweight
3. Number of eggs laid and proportion damaged
4. Egg weight
5. Egg shell thickness
6. Number of infertilities, embryonic mortalities and hatchings
7. Number of 14-day old surviving ducklings
8. Duckling bodyweights

12. **Reported Results:**

Any birds that died during the pre-egg-laying period (Days 1 to 91) were replaced by spare birds maintained for this purpose. See Table 1 for distribution of adult mortalities. These mortalities were considered not to be from cyhalothrin but from bullying between male birds. Replicate 8C (Cyhalothrin 50 ppm) had problems with the waterer on Days 122 and 123.

Summary of body weights are shown in Table 2. All body weight changes were within normal limits and no treatment-related effects were found.

Food consumption was within normal limits for all groups (except 8C [Cyhalothrin 50 ppm] at Week 18) throughout the study and no treatment-related effects were observed. See Tables 3 and 4.

Gross postmortem examination showed evidence of bullying (bruising, feathers missing from head, neck, and back,) was noted in three controls, three at treatment level 5 ppm, and seven at 50 ppm.

**Terminal findings** (excerpted from submission):

"Pale livers and/or intestines were noted in a number of birds in both control and test groups. They were not considered to be abnormalities. Other observations noted at termination were as follows:
<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment (ppm)</th>
<th>Pen No.</th>
<th>Bird No.</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>521F</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Cyhalothrin (5)</td>
<td>5</td>
<td>533F</td>
<td>Ovary small or underdeveloped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>596F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>598F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>584F</td>
<td>Broken egg found in body cavity</td>
</tr>
<tr>
<td>C</td>
<td>Cyhalothrin (50)</td>
<td>13</td>
<td>589F</td>
<td>Ovary underdeveloped; bird had been bullied</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>574F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>505F</td>
<td>Bird small or light in weight, ovary underdeveloped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>506F</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
<td>587F</td>
<td>Ovary underdeveloped</td>
</tr>
</tbody>
</table>

An underdeveloped ovary in a bird would indicate that at the time of sacrifice the bird was not producing eggs. The bird may, however, have produced eggs earlier in the study. Although underdeveloped ovaries were not found in any of the control birds it is doubtful that the above observations were related to treatment with cyhalothrin in view of the egg production results obtained.

Other observations were as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment (ppm)</th>
<th>Pen No.</th>
<th>Bird No.</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Control (0)</td>
<td>9</td>
<td>560F</td>
<td>Four broken eggs found in body cavity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>509M</td>
<td>No abnormality found</td>
</tr>
<tr>
<td>B</td>
<td>Cyhalothrin (5)</td>
<td>5</td>
<td>532F</td>
<td>Intestine apparently ruptured. Body cavity filled with faecal matter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>531F</td>
<td>Egg yolk found in body cavity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>534F</td>
<td>Body cavity filled with faecal matter</td>
</tr>
<tr>
<td>Group</td>
<td>Treatment (ppm)</td>
<td>Pen No.</td>
<td>Bird No.</td>
<td>Observation</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>---------</td>
<td>----------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>C</td>
<td>Cyhalothrin (50)</td>
<td>6</td>
<td>541F</td>
<td>Blotchy liver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>555F*</td>
<td>No abnormality found</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>552F*</td>
<td>Liver orange/red in colour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>553F*</td>
<td>Punctured yolk sac in abdomen probably produced peritonitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>554F*</td>
<td>Pericardial fibrillation A developing egg was dark greenish in colour</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>590F</td>
<td></td>
<td>Bird was egg bound i.e. passage of eggs through the oviduct prevented probably by a broken egg leading eventually to peritonitis</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>624F</td>
<td></td>
<td>Broken egg found in body cavity.</td>
</tr>
</tbody>
</table>

* Birds which died as a result of low water pressure in pen drinker.

Throughout the results sections for eggs and ducklings the data from pen 8C has been excluded from the statistical analysis. The data has, however, been included in Tables 5 to 13."

Eggs laid - Over Weeks 1 to 6 and 7 to 12 the birds given cyhalothrin at 50 ppm produced significantly fewer eggs than the control. The study author reported that it was probably not biologically significant since the total number of eggs produced was high in comparison with historical control data.

The number of broken and cracked eggs were considered to be within normal limits. See Table 6.

The mean egg weights were not statistically different. However, there was a statistically significant difference in egg mass due to the number of eggs produced and not biologically significant in comparison with historical data. See Table 7.
Eggshell thickness - The data indicate there were no statistically significant differences between treatments. See Table 8.

Infertile eggs - The statistical analysis indicated that Group B (cyhalothrin 5 ppm) had a significantly lower proportion of infertile eggs than the control. See Table 9.

Early embryonic mortalities - The proportions of early embryonic mortalities were marginally higher for treatment group 5 ppm; however, there were no statistically significant differences between treatments. See Table 10.

Late embryonic mortalities - No statistically significant differences were found between treatment groups. See Table 11.

Hatchlings - Number of hatchlings were lower for treatment group cyhalothrin 50 ppm. This difference was not statistically significant.

Bird health and mortalities - Bird health was generally good and the numbers of mortalities were within normal limits. See Table 11A.

Number of 14-day survivors - The percentage of ducklings surviving to 14 days were within normal limits, and there was no statistical difference. See Table 12.

Body weights of ducklings at hatching and after 14 days were within normal limits and no statistically significant difference was noted between treatments. See Table 13.

Postmortem examination - Except for observations outlined in Bird Health, no abnormalities were detected.

13. Study Authors' Conclusions/OA Measures: (excerpted from submission):

"Under the conditions of this study there was no evidence that dietary administration of cyhalothrin at dose levels of 5 ppm and 50 ppm had any adverse effects on reproduction in the mallard duck.

"To the best of my knowledge and belief, this study was conducted in compliance with Good Laboratory Practice regulations as set forth in Title 21 of the U.S. Code of Federal Regulations, Part 58 with the exception of possible minor items, none of which is considered to have an impact on the validity of the data, or the interpretation of the results in the report" - signed N.L. Roberts.
14. Reviewer's Discussion and Interpretation of Study:

The following discrepancies were noted in the study:

A. Test Procedures:

- The primary concern is that the gross postmortem examination (Terminal Findings section) reported four females in Test Group B and five females in Group C as having underdeveloped ovaries. The gross mortem examination should have included information as to whether the follicles were "ruptured." Ruptured follicles indicate that the hens at one time have laid eggs and the ovaries have regressed (Rick Bennett, personal communications, February 18, 1988, U.S. Environmental Protection Agency, Corvallis, Oregon). A total of 13 percent of females were apparently affected at the lowest level tested (5 ppm) and 17 percent at the highest level tested (50 ppm). These results are partially confirmed by the statistically significant difference in number of eggs laid, even when Replicate 8C is eliminated from data.

When the number of eggs laid per hen were estimated (taking mortalities into account) Treatment Group C had a decrease in number of eggs laid per hen of 15 percent when compared to the control. See Table A.

The study author should include all raw data with regard to gross postmortem examinations to determine if the hens did indeed lay eggs during the egglaying period.

It appears that until raw data are submitted, that indeed the effect may be at even the lowest level tested and therefore, for this reproductive parameter we do not have a NOEL.

- Exact age not indicated in study. Only that the birds were approaching first breeding season.

- The study author did not report the disease record or history of health observations for the birds prior to study initiation.

- The study author did not indicate if provisions for minimizing food spillage were included.

- The study author did not indicate if the diet was available ad libitum to the adults. The study author did indicate that the water was available ad libitum.

- The study author should account for the variability in the number of eggs measured for thickness in each replicate.
- The recommended temperatures for the adults is 21 °C and 55 percent relative humidity. The study author reported that the adults were housed at 15 °C (mean) with a range of 8 to 25 °C. There is a considerable range as well. The test conditions should have been more constant.

- The duckling housing temperature ranged from 19 to 40 °C (x = 28 °C) and relative humidity ranged from 47 to 95 percent (x = 68%).

- The egg production, candling, and hatching results (Appendix 5) were not reported for replicate 17A, Week 7. Therefore, all the statistical analyses, except for eggs laid, (ANOVA) were incomplete.

- The study author reported 6.4 percent egg cracking for the control group. The historical control data ranged 4.4 to 6.1. This study indicated percent cracking higher than the range.

- The body weight of the 14-day survivors appeared to be significantly lower for Treatment Group C (50 ppm). However, a statistical analysis using ANOVA indicates there was no statistically significant difference.

- The number of pale livers and/or intestines should be reported for both the control and two treatment groups.

- Bullying was reported to have caused three mortalities in the control (though data for adult health observations indicated four), three in Group R (5 ppm), and seven in Group C (50 ppm). It appears that the increase in bullying at the highest dose may have been caused by behavioral changes from exposure to the test compound.

- Control mortality (12%) appeared to be high. Though only one female died (2.3 percent), a total of four males died within the control group, with three males in one pen (the replacement also died).
R. Statistical Analysis - The data were incorporated as replicates, not as weeks, and a statistical analysis using ANOVA and Duncan's multiple range test were conducted on several parameters with the results as follows:

Summary of Statistical Analysis (ANOVA)

**Eggs laid** =

- NOFL = 5 ppm
- LORL = 50 ppm
- MATC > 5 ppm < 50 ppm

**Eggs cracked** = NOFL > 50 ppm

**Eggs set** =

- NOFL = 5 ppm
- LORL = 50 ppm
- MATC > 5 ppm < 50 ppm

**Viable embryos** = NOFL > 50 ppm

**Live embryos** = NOFL > 50 ppm

**Normal hatched** = NOFL > 50 ppm

See Attachment A for ANOVA results. These data analyses include Replicate RC. See Table A for summary of reproductive effects.

- A statistical analysis on adult mortality was conducted using ANOVA arcsin and it was determined that there was no statistical difference between the control and the two treatment groups, even when Replicate RC was deleted from the data. See Attachment R.

- Statistical analysis was conducted on all the reproductive parameters (eggs laid, eggs cracked, eggs set, viable embryos, live embryos, and normal hatchlings) eliminating Replicate RC. It was determined that the NOFL for eggs laid remained the same as if it were included:

  \[
  \text{eggs laid} = \text{NOFL} = 5 \text{ ppm} \\
  \text{LORL} = 50 \text{ ppm}
  \]

However, eggs set did change, the NOFL being > 50 ppm.

The study author claimed that there was a problem with Replicate RC (drinker had failed to supply adequate water). First these waterers should have been maintained on a daily basis. The mortalities occurred over 2 days. Second, there were three other mortalities in that pen that were not attributed to the drinker. This is 43 percent of the adult birds in that pen.
C. Discussion of Results - Currently there are raw data and data discrepancies as outlined in Section 14. Based on the concerns for reported underdeveloped ovaries for both treatment groups and none appeared in the control. The study author should submit all raw data with regard to gross postmortem examination. The data should indicate if the follicles were "ruptured."

The number of pale livers and or intestines should also be reported (along with the raw data).

The results of the statistical analysis indicate that there is an effect on eggs laid at 50 ppm and no effect at 5 ppm.

If the ovaries were actually regressed, then indeed the effect would be at the lowest level tested (5 ppm) and no-observable-effect-level would be lower than the lowest dose tested.

The raw data for the control should be submitted by the study author on Replicate 17A, week 7, so that the ANOVA can be accurate (See Appendix 5 in the study).

D. Adequacy of Study

1) Classification – Supplemental for 92 percent w/w cyhalothrin

2) Rationale – See Discussion and Results

3) Repairability – This depends on whether the raw data satisfy concerns.
<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>5 ppm</th>
<th>50 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eggs laid</strong>*</td>
<td>1881</td>
<td>1754</td>
<td>1419</td>
</tr>
<tr>
<td><strong>Eggs laid/hen/season</strong></td>
<td>63.83</td>
<td>59.5</td>
<td>54.36</td>
</tr>
<tr>
<td><strong>Eggs cracked</strong></td>
<td>120</td>
<td>74</td>
<td>84</td>
</tr>
<tr>
<td><strong>Eggs cracked/hen/season</strong></td>
<td>3.96</td>
<td>2.64</td>
<td>3.24</td>
</tr>
<tr>
<td>Percent of eggs laid</td>
<td>6.4</td>
<td>4.2</td>
<td>5.9</td>
</tr>
<tr>
<td><strong>Eggs set</strong></td>
<td>1524</td>
<td>1422</td>
<td>1144</td>
</tr>
<tr>
<td><strong>Eggs set/hen</strong></td>
<td>4.30</td>
<td>4.01</td>
<td>3.65</td>
</tr>
<tr>
<td>Percent of eggs laid</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
</tr>
<tr>
<td><strong>Viable embryos (14-day)</strong></td>
<td>1251</td>
<td>1258</td>
<td>935</td>
</tr>
<tr>
<td>Percent of eggs laid</td>
<td>67%</td>
<td>72%</td>
<td>66%</td>
</tr>
<tr>
<td>Percent of eggs set</td>
<td>87%</td>
<td>88%</td>
<td>82%</td>
</tr>
<tr>
<td><strong>Live 21-day embryos</strong></td>
<td>1165</td>
<td>1136</td>
<td>866</td>
</tr>
<tr>
<td>Percent of viable embryos</td>
<td>93%</td>
<td>90%</td>
<td>93%</td>
</tr>
<tr>
<td><strong>Hatchlings</strong></td>
<td>807</td>
<td>718</td>
<td>610</td>
</tr>
<tr>
<td>Percent of eggs laid</td>
<td>43%</td>
<td>41%</td>
<td>43%</td>
</tr>
<tr>
<td>Percent of eggs set</td>
<td>53%</td>
<td>51%</td>
<td>53%</td>
</tr>
<tr>
<td>Percent of viable embryos</td>
<td>65%</td>
<td>57%</td>
<td>65%</td>
</tr>
<tr>
<td>Percent of 21-day embryos</td>
<td>70%</td>
<td>63%</td>
<td>70%</td>
</tr>
<tr>
<td>**14-day survivors ***</td>
<td>755</td>
<td>677</td>
<td>564</td>
</tr>
<tr>
<td>Percent of normal hatchlings</td>
<td>94</td>
<td>94</td>
<td>97</td>
</tr>
<tr>
<td><strong>Average hatch weight (g)</strong></td>
<td>37</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td><strong>Average 14-day-old survivors' weight (g)</strong></td>
<td>192</td>
<td>188</td>
<td>185</td>
</tr>
<tr>
<td><strong>Adult body weight (g/bird)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(at study termination) Female</td>
<td>1173</td>
<td>1135</td>
<td>1113</td>
</tr>
<tr>
<td>Males</td>
<td>1215</td>
<td>1249</td>
<td>1251</td>
</tr>
<tr>
<td><strong>Adult body weight (g/bird)</strong></td>
<td>Increase compared with Day 0 Females</td>
<td>+211</td>
<td>+173</td>
</tr>
<tr>
<td>Males</td>
<td>+136</td>
<td>+162</td>
<td>+176</td>
</tr>
<tr>
<td><strong>Mean eggshell thickness</strong></td>
<td>0.33</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Mean egg weight</strong></td>
<td>59</td>
<td>59</td>
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### Average Feed Consumption

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>5 ppm</th>
<th>50 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-egg production period</td>
<td>160.2</td>
<td>158.1</td>
<td>163.5</td>
</tr>
<tr>
<td>Egg production period</td>
<td>213.1</td>
<td>225.8</td>
<td>218</td>
</tr>
<tr>
<td>Mean total</td>
<td>185.6</td>
<td>190.6</td>
<td>189.8</td>
</tr>
</tbody>
</table>

* The number of females per week were used to estimate number per hen. Therefore, the mortalities were excluded.

**Eggs cracked include all broken, damaged, and cracked eggs.**

***No. of survivors per hen could not be calculated since there were mortalities within each treatment level and control.***
Page ___ is not included in this copy.

Pages 16 through 24 are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.
_____ Identity of product inert impurities.
_____ Description of the product manufacturing process.
_____ Description of quality control procedures.
_____ Identity of the source of product ingredients.
_____ Sales or other commercial/financial information.
_____ A draft product label.
_____ The product confidential statement of formula.
_____ Information about a pending registration action.
X _____ FIFRA registration data.
_____ The document is a duplicate of page(s) _____.
_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.
13

<table>
<thead>
<tr>
<th>OBS</th>
<th>TRT</th>
<th>EL</th>
<th>EC</th>
<th>ES</th>
<th>VE</th>
<th>LE</th>
<th>NH</th>
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<td>289</td>
<td>26</td>
<td>223</td>
<td>167</td>
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<td>108</td>
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<tr>
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<td>A</td>
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<td>255</td>
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<td>3</td>
<td>A</td>
<td>246</td>
<td>17</td>
<td>204</td>
<td>139</td>
<td>128</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>339</td>
<td>28</td>
<td>272</td>
<td>257</td>
<td>247</td>
<td>183</td>
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<td>8</td>
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<td>268</td>
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<td>182</td>
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<td>B</td>
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<td>8</td>
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<tr>
<td>11</td>
<td>B</td>
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<td>15</td>
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<td>241</td>
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<td>9</td>
<td>226</td>
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<td>194</td>
<td>117</td>
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<td>13</td>
<td>C</td>
<td>184</td>
<td>3</td>
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<td>98</td>
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<tr>
<td>14</td>
<td>C</td>
<td>264</td>
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<td>209</td>
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<td>248</td>
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<td>17</td>
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<td>303</td>
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<td>244</td>
<td>185</td>
<td>171</td>
<td>137</td>
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</tbody>
</table>

1. ANALYSIS OF EL DATA

***************

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT   3   A B C

NUMBER OF OBSERVATIONS IN DATA SET = 17

1. ANALYSIS OF EL DATA

***************

GENERAL LINEAR MODELS PROCEDURE

DEPDEPENT VARIABLE: RESP

SOURCE    DF    SUM OF SQUARES    MEAN SQUARE    F VALUE

PR > F    R-SQUARE    C.V
GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE
ALPHA=0.05 DF=14 MSE=1615.63
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625
NUMBER OF MEANS 2 3
CRITICAL RANGE 51.3107 53.8051
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
A 318.17 6 A
A
B 291.00 6 B
B
262.00 5 C

2. ANALYSIS OF EC DATA
16:01 THURSDAY, FEBRUARY 18, 1988

***************
GENERAL LINEAR MODELS PROCEDURE
CLASS LEVEL INFORMATION
CLASS LEVELS VALUES
TRT 3 A B C
NUMBER OF OBSERVATIONS IN DATA SET = 17
2. ANALYSIS OF EC DATA
16:01 THURSDAY, FEBRUARY 18, 1988

***************
**GENERAL LINEAR MODELS PROCEDURE**

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

\[ \text{ALPHA}=0.05 \quad \text{DF}=14 \quad \text{MSE}=52.9548 \]

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625

NUMBER OF MEANS = 2 3
CRITICAL RANGE = 9.28944 9.74102

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

**GENERAL LINEAR MODELS PROCEDURE**

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT 3 A B C

NUMBER OF OBSERVATIONS IN DATA SET = 17

3. ANALYSIS OF ES DATA

**GENERAL LINEAR MODELS PROCEDURE**

DEPENDENT VARIABLE: RESP
GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=14 MSE=962.867

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625

NUMBER OF MEANS 2 3
CRITICAL RANGE 39.6114 41.537

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
A 247.33 6 A
A 237.00 6 B
A 211.80 5 C

4. ANALYSIS OF VE DATA
16:01 THURSDAY, FEBRUARY 18, 1988

**************************

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES
TRT 3 A B C

NUMBER OF OBSERVATIONS IN DATA SET = 17
4. ANALYSIS OF VE DATA
16:01 THURSDAY, FEBRUARY 18, 1988
DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=14 MSE=2728.9

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625

NUMBER OF MEANS = 2
CRITICAL RANGE = 66.6054 69.9271

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
  A  200.33  6 A
  A  198.00  6 B
  A  164.60  5 C

DAY, FEBRUARY 18, 1988  14

*****

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES
  C

NUMBER OF OBSERVATIONS IN

5. ANALYSIS OF LE DATA

DEPENDENT VARIABLE: RESP

SOURCE DF SUM OF SQUARES RE F VALUE PR > F R-SQUARE C.V.
**GENERAL LINEAR MODELS PROCEDURE**

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05  DF=14  MSE=2728.9

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625

NUMBER OF MEANS  2  3
CRITICAL RANGE  66.6854  69.9271

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING  MEAN  N  TRT

A  200.33  6  A
A
A  198.00  6  B
A  164.60  5  C

DAY, FEBRUARY 18, 1988  14

*****

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS  VALUES

C

NUMBER OF OBSERVATIONS IN

5. ANALYSIS OF LE DATA

THURSDAY, FEBRUARY 15

*************

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESP

SOURCE  DF  SUM OF SQUARES  RE  F VALUE  PR > F  R-SQUARE  C.V.

2
6. ANALYSIS OF NH DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVELS VALUES

NS IN DATA SET = 17

16:01 THURSDAY, FEBRUARY 18, 1988

DEPENDENT VARIABLE: RESP

SOURCE DF SQUARE 744 MODEL 2 1370.39803922 1885.19901961

CORRECTED TOTAL 16 16923.76470588 URCE DF TYPE 1

F VALUE FR > F TYP 2 1370.39803922 0.62 0.5537 2 1370.398

IABLE: RESP

NOTE: THIS TEST CONTROLS THE TYPE I COMPAR THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=14 MSE=1110.95

CELL SIZES ARE NOT EQUAL.

HARMONOFC Cell SIZES=5.625

NUMBER OF MEANS 3

CRITICAL RANGE 42.5486 44.617

ITLY DIFFERENT.

DUNCAN GROUPING ME A 131.83

119.33 6 B

109.60 5 C

7. ANALYSIS OF ES/EL DATA 16:01 THURSDAY, FEBRUARY 18, 1988

GENERAL CLASS LEVEL INFORMATION

798 790

NUMBER OF OBSERVATIONS IN DATA SET = 17

7. ANALYSIS OF 794

DEPENDENT VARIABLE: RESPONSE

MODEL DF SUM OF SQN SQUARE C.V.

2 6746.0355054 3373.01827527 2.06 0.1646 22941.61171987

3 68.3655142 807 16 29681.6427041 63.38263844 40.480

2
1. ANALYSIS OF EL DATA  

***************

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT 3 A B C

NUMBER OF OBSERVATIONS IN DATA SET = 18

1. ANALYSIS OF EL DATA

***************

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESP

SOURCE DF SUM OF SQUARES MEAN SQUARE F VALUE PR > F R-SQUARE C.V

MODEL 2 20795.4444444 10377.72222222 3.70 0.0496 0.330071 18.799

ERROR 15 42126.33333333 2808.4222222 20.39 0.0002 0.27093 13.69

CORRECTED TOTAL 17 62881.77777778 3693.045714 52.99454899 281.8888888
**GENERAL LINEAR MODELS PROCEDURE**

**DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP**

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

\[ \alpha = 0.05 \quad DF = 15 \quad MSE = 2808.42 \]

NUMBER OF MEANS 2 3

CRITICAL RANGE 65.0989 68.2889

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

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<th>MEAN</th>
<th>N</th>
<th>TRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>318.17</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>291.00</td>
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<td>B</td>
</tr>
<tr>
<td>B</td>
<td>236.50</td>
<td>6</td>
<td>C</td>
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</table>

**GENERAL LINEAR MODELS PROCEDURE**

**CLASS LEVEL INFORMATION**

CLASS LEVELS VALUES

| TRT | 3 | A | B | C |

NUMBER OF OBSERVATIONS IN DATA SET = 18

2. ANALYSIS OF EC DATA 8:53 THURSDAY, FEBRUARY 18, 1988

**GENERAL LINEAR MODELS PROCEDURE**

**DEPENDENT VARIABLE: RESP**

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<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARE</th>
<th>F VALUE</th>
<th>PR &gt; F</th>
<th>R-SQUARE</th>
<th>C.V</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL</td>
<td>2</td>
<td>150.11111111</td>
<td>75.05555556</td>
<td>1.41</td>
<td>0.2754</td>
<td>0.157666</td>
<td>46.765</td>
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<td>800.16666667</td>
<td>53.34444444</td>
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<td></td>
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<tr>
<td>TOTAL</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. CORRECTED TOTAL 17 950.27777778 7.30372812 15.611111

8:53 THURSDAY, FEBRUARY 18, 1988
GENERAL LINEAR MODELS PROCEDURE

DUNCAN S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

\[ \text{ALPHA}=0.05 \quad \text{DF}=15 \quad \text{MSE}=53.3444 \]

\[ \text{NUMBER OF MEANS} = 2 \quad 3 \]
\[ \text{CRITICAL RANGE} = 8.97196 \quad 9.4116 \]

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
A 19.667 6 A
A 14.000 6 C
A 13.167 6 B

3. ANALYSIS OF ES DATA

***************

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES
TRT 3 A B C

NUMBER OF OBSERVATIONS IN DATA SET = 18

3. ANALYSIS OF ES DATA

***************

GENERAL LINEAR MODELS PROCEDURE

DF SUM OF SQUARES MEAN SQUARE F VALUE PR > F R-SQUARE C.V

5a1 SOURCE 2 10929.3333333 5464.6666667 3.05 0.0774 0.289075 18.813

5a2 SOURCE 2 26878.6666667 1791.9111111 ROOT MSE RESP MEAN

5a3 SOURCE 17 37808.0000000 42.33097106 0.0000000

34
3. ANALYSIS OF ES DATA

GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

\[ \alpha = 0.05 \quad \text{DF} = 15 \quad \text{MSE} = 1791.91 \]

NUMBER OF MEANS = 2
CRITICAL RANGE = 51.9997

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
\[ \begin{array}{cccc}
A & 247.33 & 6 & A \\
B & 237.00 & 6 & B \\
B & 190.67 & 6 & C \\
\end{array} \]

4. ANALYSIS OF VE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES
TRT  3  A B C

NUMBER OF OBSERVATIONS IN DATA SET = 18

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESP

SOURCE    DF    SUM OF SQUARES    MEAN SQUARE    F VALUE    PR > F    R-SQUARE    C.V
\[ \begin{array}{ccccccc}
\text{MODEL} & 2 & 9555.1111111 & 4777.5555556 & 1.62 & 0.2312 & 0.177387 & 29.718 \\
\text{ERROR} & 15 & 44310.6666667 & 2954.0444444 & & & & \\
\end{array} \]

CORRECTED TOTAL  17  53865.7777778  54.35112183  182.8688888

SOURCE    DF    TYPE I SS    F VALUE    PR > F    DF    TYPE III SS    F VALUE    PR > F
\[ \begin{array}{ccccccc}
\text{TRT} & 2 & 9555.1111111 & 1.62 & 0.2312 & 2 & 9555.1111111 & 1.62 & 0.231 \end{array} \]
4. ANALYSIS OF VE DATA

GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
    NOT THE EXPERIMENTWISE ERROR RATE

\[ \alpha = 0.05 \quad DF = 15 \quad MSE = 2954.04 \]

NUMBER OF MEANS \(2\)  \(3\)
CRITICAL RANGE \(66.7654\) \(70.037\)

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

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<th>TRT</th>
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<td>A</td>
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<tr>
<td>A</td>
<td>198.00</td>
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<td>B</td>
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<tr>
<td>A</td>
<td>150.33</td>
<td>6</td>
<td>C</td>
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5. ANALYSIS OF LE DATA Y 18, 1988 14

***************

CLASS LEVEL INFORMATION

VALUES

DATA SET = 18

5. ANALYSIS OF LE DATA 8:53 THURSDAY, FEBRUARY

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESP

<table>
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<tr>
<th>MEAN SQUARE</th>
<th>F VALUE</th>
<th>PR &gt; F</th>
<th>R-SQUARE</th>
<th>C.V.</th>
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<td>2701.06666667</td>
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<td>8284.00000053</td>
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5. ANALYSIS OF LE DATA 18, 1988 16

GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP
NOT THE EXPERIMENTWISE ERROR RATE

NUMBER OF MEANS \(2\)  \(ITICAL RANGE\) \(63.8426\) \(66.9709\)

MEANS WITH \(699\) DUNCAN GROUPING MEAN
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<th>N</th>
<th>TR</th>
<th>MEAN</th>
</tr>
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<tbody>
<tr>
<td>6</td>
<td>A</td>
<td>189.33</td>
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<tr>
<td>6</td>
<td>B</td>
<td>144.33</td>
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</table>
6. ANALYSIS OF NH DATA

GENERAL LINEAR MODELS PROCEDURE: DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP

NOTE: THIS

ALPHA=0.05 DF=15 MSE=1173.57

NUMBER OF MEANS 2 3

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANT

DUNCAN GROUPING

8:53 THURSDAY, FEBRUARY 18, 1988

7. ANALYSIS OF ES/EL DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT 3 A B C

NUMBER OF OBSERVATIONS IN DATA SET = 18

8:53 THURSDAY, FEBRUARY 18, 1988

DEPENDENT VARIABLE: RESPD

GENERAL LINEAR MODELS PROCEDURE

R-SQUARE C.V.

DF SUM OF SQUARES MEAN SQUARE F VALUE PR

37
GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT  3  A & B & C

NUMBER OF OBSERVATIONS IN DATA SET = 60

NOTE: ALL DEPENDENT VARIABLES ARE CONSISTENT WITH RESPECT TO THE PRESENCE OR ABSENCE OF MISSING VALUES. HOWEVER, 17 OBSERVATIONS CAN BE USED IN THIS ANALYSIS.

GENERAL LINEAR MODELS PROCEDURE
GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: EFFECT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=14 MSE=238.669

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=5.625

NUMBER OF MEANS 2 3
CRITICAL RANGE 19.7213 20.68

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING MEAN N TRT
A 76.351 6 A
A
A 72.155 6 B
A
A 68.594 5 C

JOBNAME QUEUE POSITION LINES DESTINATION
RMXX OUTPUT A 217 307 HOLD
RMXX OUTPUT A 1357 323 HOLD
RMXX OUTPUT A 1759 320 HOLD
RMXX OUTPUT A 1364 320 HOLD
RMXX OUTPUT A 1623 1200 HOLD

JES2 JOB LOG -- SYSTEM EPA2 -- NODE NCCIBM1

all
CARY, N.C. 27511-8000
CARY, N.C. 27511-8000
SAS
9:00 THURSDAY, FEBRUARY 18, 1988