**Data Evaluation Report on the acute toxicity of Penoxsulam metabolite (5-Hydroxy-XDE-638) to aquatic vascular plants *Lemna gibba***

PMRA Submission #:{.....} EPA MRID#: 45831104

**Data Requirement:**

| | |
|---|---|
| PMRA Data Code: | {.....} |
| EPA DP Barcode: | D288160 |
| OECD Data Point: | {.....} |
| EPA MRID: | 45831104 |
| EPA Guideline: | 123-2 |

**Test material:** Penoxsulam metabolite Purity: 100%
Common name: 5-Hydroxy-XDE-638
Chemical name: IUPAC: Not reported
CAS name: Not reported
CAS No.: Not reported
Synonyms: Not reported

**Primary Reviewer:** Rebecca Bryan
Staff Scientist, Dynamac Corporation
**Signature:** Rebecca Bryan
**Date:** 11/21/03

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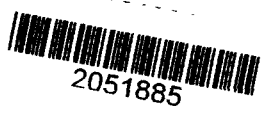
Staff Scientist, Dynamac Corporation
**Signature:** Dana Worcester
**Date:** 11/21/03

**Primary Reviewer:** ~~Bill Erickson~~ J. GOODYEAR
**{EPA/OECD/PMRA}**
**Date:** {.....} Goodyear

**Secondary Reviewer(s):**{.....}
**{EPA/OECD/PMRA}**
**Date:** {.....}

**Company Code** {.....} [For PMRA]
**Active Code** {.....} [For PMRA]
**EPA PC Code** ~~19903~~ 119031
**Date Evaluation Completed:** {dd-mmm-yyyy}

**CITATION:** Hoberg, J.R. 2002. 5-Hydroxy-XDE-638 - Toxicity to Duckweed, *Lemna gibba*. Unpublished study performed by Springborn Laboratories, Inc., Wareham, Massachusetts. Laboratory Project Identification No. 12550.6167/Project No. 011234. Study submitted by The Dow Chemical Company for Dow AgroSciences, LLC Midland, Michigan. Experimental start date December 21, 2001 and experimental termination date January 7, 2002. The final report issued February 8, 2002.



**EXECUTIVE SUMMARY:**

In a 14-day acute toxicity study, freshwater aquatic vascular plants Duckweed, *Lemna gibba* G3, were exposed to Penoxsulam metabolite (5-Hydroxy-XDE-638) at mean measured concentrations <0.013-0.016 (<LOQ, negative and solvent controls), 0.081, 0.22, 0.62, 1.6, 4.6, and 11 mg/L under static conditions. Nominal concentrations were 0 (negative and solvent controls), 0.10, 0.26, 0.64, 1.6, 4.0, and 10 mg/L. After 14 days The percent reductions for frond density were significant in the 0.62, 1.6, 4.6, and 11 mg/L treatment groups. The most sensitive variable was frond numbers. The percent reductions for growth rate and dry weight were not significant in any treatment group.

The NOAEC was 0.22 mg/L, LOAEC was 0.62 mg/L/L, $EC_{05}$ was 0.095 mg/L, and the $EC_{50}$ >11 mg/L. This toxicity study is scientifically sound and satisfies the guideline §123-2 for an aquatic vascular plant study with *Lemna gibba*. The study is classified as Core.

## Results Synopsis

Test Organism: *Lemna gibba* G3
Test Type: Static

### Number of fronds:

NOAEC: 0.22 mg/L
LOAEC: 0.62 mg/L
$EC_{05}/IC_{05}$: 0.095 mg/L 95% C.I.: 0.0014-6.4 mg/L
$EC_{50}/IC_{50}$ : >11 mg/L 95% C.I.: N/A
Slope: 0.256±0.109

### Growth rates (day 7):

NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: >11 mg/L 95% C.I.: N/A
$EC_{50}/IC_{50}$ : >11 mg/L 95% C.I.: N/A
Slope: N/A

**Plant biomass (dry weight):**

NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: could not be determined 95% C.I.: N/A
$EC_{50}/IC_{50}$ : >11 mg/L 95% C.I.: N/A
Slope: N/A

Endpoint(s) Affected: Frond number

## I. MATERIALS AND METHODS

**GUIDELINE FOLLOWED:** The test protocol was based on the following guidelines: OECD Proposed Guideline 221 and U.S. EPA-FIFRA Pesticide Assessment Guidelines, Subdivision J, Hazard Evaluation: Nontarget Plants Guidelines 122-2 and 123-2. The following deviations from U.S. EPA Guideline 123-2 are noted:

1. The pretest health of the test organism was not reported.

2. The definitive test was conducted under static conditions and the test solution was not renewed as recommended.

These deviations do not affect the acceptability or the validity of the study.

**COMPLIANCE:** Signed and dated GLP, Quality Assurance and No Data Confidentiality statements were provided.

### A. MATERIALS:

**1. Test Material** Penoxsulam metabolite (5-Hydroxy-XDE-638)

**Description:** Not reported

**Lot No./Batch No. :** F0512-129A

**Purity:** >99% (used as 100%)

**Stability of Compound**
**Under Test Conditions:** Day 0 measured concentrations ranged from 96 to 110% of nominal concentrations and day 14 measured concentrations ranged from 56 to 125% of nominal concentrations . The mean measured concentrations were 81 to 110% of nominal.

*(OECD requires water solubility, stability in water and light, pKa, Pow, vapor pressure of test compound)* OECD requirements were not reported.

**Storage conditions of test chemicals:** Stored at room temperature in a dark ventilated cabinet.

**2. Test organism**:

**Name:** Duckweed, *Lemna gibba* *(EPA requires a vascular species: Lemna gibba.)*
**Strain, if provided:** G3
**Source:** Laboratory cultures (original supplier: University of Toronto, Toronto, Canada)
**Age of inoculum**: 2 days old
**Method of cultivation:** 20X Algal Assay Procedure (AAP) Medium

### B. STUDY DESIGN:

a) Range-finding Study: No range-finding study was conducted.
b) Definitive Study

**Table 1 . Experimental Parameters**

| **Parameter** | **Details** | **Remarks**<br><br>***Criteria*** |
|---|---|---|
| Acclimation period:<br><br>culturing media and conditions: (same as test or not)<br><br>health: (any toxicity observed) | Continuous culture<br><br>20X Algal Assay Procedure (AAP) Medium; same as test.<br><br>Not reported | |
| Test system<br>static/static renewal/<br>renewal rate for static renewal: | Static | *EPA expects the test concentrations to be renewed every 3 to 4 days (one renewal for the 7 day test, 3-4 renewals for the 14 day test).* |
| Incubation facility | Environmental chamber | |
| Duration of the test | 14 days | *EPA requires a duration of 14 days. Seven day studies will be accepted for review by the Agency.* |
| Test vessel<br>material: (glass/polystyrene)<br>size:<br>fill volume: | Sterile crystallizing dishes<br>270 mL<br>100 mL | |
| Details of growth medium<br>name:<br><br><br>pH at test initiation:<br>pH at test termination:<br>Chelator used:<br>Carbon source: | 20X Algal Assay Procedure (AAP) Medium<br><br>7.6-7.8 (Table 2, p. 23)<br>8.3-8.9<br>Yes<br>$NaHCO_3$ | *EPA recommend the following culture media:*<br>*Modified hoagland's E+ or 20X-AAP.* |
| If non-standard nutrient medium was used, detailed composition provided (Yes/No) | Not applicable | |
| Dilution water<br>source/type:<br>pH:<br>water pretreatment (if any):<br><br>Total Organic Carbon: | Sterile deionized water<br>7.5 ± 0.1<br>pH adjusted using 0.1 *N* hydrochloric acid<br>0.47-1.0 mg/L (December 2001 and January 2002 analysis) | *EPA recommends a pH of ~5.0. A solution pH of 7.5 is acceptable if type 20X-AAP nutrient media is used.* |

| Parameter | Details | Remarks<br>*Criteria* |
|---|---|---|
| particulate matter:<br>metals:<br>pesticides:<br>chlorine: | N/A<br>Not detected<br>Not detected<br>N/A | |
| Indicate how the test material is added to the medium (added directly or used stock solution) | Stock solution | |
| Aeration or agitation | Not reported. | |
| Sediment used **(for rooted aquatic vascular plants)**<br>origin:<br>textural classification (% sand, silt and clay):<br>organic carbon (%):<br>geographic location: | Not applicable | |
| Number of replicates<br>control:<br>solvent control:<br>treatments: | <br>3<br>3<br>3 | |
| Number of plants/replicate | 5 plants per replicate | *EPA requires 5 plants.* |
| Number of fronds/plant | 3 fronds per plant (15 total fronds per replicate) | *EPA requires 3 fronds per plant.* |
| Test concentrations<br>nominal:<br><br><br>measured: | <br>0 (negative and solvent controls), 0.10, 0.26, 0.64, 1.6, 4.0, and 10 mg/L<br><br><0.013-0.016 (<LOQ, negative and solvent controls), 0.081, 0.22, 0.62, 1.6, 4.6, and 11 mg/L | *EPA requires at least 5 test concentrations with a dose range of 2X or 3X progression.* |
| Solvent (type, percentage, if used) | Dimethylformamide (DMF), 0.10 mL/L | |
| Method and interval of analytical verification | HPLC; days 0 and 14. | |
| Test conditions<br>temperature: | <br>23-24°C | <br>*EPA temperature: 25 °C* |

| Parameter | Details | Remarks<br><br>*Criteria* |
|---|---|---|
| photoperiod:<br><br>light intensity and quality: | continuous light<br><br>6400-6800 lux | *EPA photoperiod: continuous*<br>*EPA light: 5.0 Klux (±15%)* |
| Reference chemical (if used)<br>name:<br>concentrations: | None | |
| Other parameters, if any | None | |

**2. Observations:**

**Table 2: Observation parameters**

| Parameters | Details | Remarks/Criteria |
|---|---|---|
| Parameters measured (eg: number of fronds, plant dry weight or other toxicity symptoms) | Number of fronds, toxicity symptoms, and terminal dry weights. | |
| Measurement technique for frond number and other end points | Direct counts and weights. | |
| Observation intervals | Days 7 and 14. | |
| Other observations, if any | None | |
| Indicate whether there was an exponential growth in the control | Yes | |
| Were raw data included? | Replicate data provided. | |

## II. RESULTS and DISCUSSION:

### A. INHIBITORY EFFECTS:

After 14 days, the mean frond number percent inhibitions compared to the pooled controls were 3, 3, 11, 9, 13, and 11% in the 0.081, 0.22, 0.62, 1.6, 4.6, and 11 mg/L treatment groups, respectively. The percent reductions for frond density were significant in the 0.62, 1.6, 4.6, and 11 mg/L treatment groups. The mean growth rate percent inhibitions compared to the pooled controls were -2, -2, 0, 2, -2, and 4% in the 0.081, 0.22, 0.62, 1.6, 4.6, and 11 mg/L treatment groups, respectively. The mean dry weight percent inhibitions compared to the pooled controls were 17, -15, -16, -5, -16, and 5% in the 0.081, 0.22, 0.62, 1.6, 4.6, and 11 mg/L treatment groups, respectively. The percent reductions for growth rate and dry weight were not significant in any treatment group.

**Table 3: Effect of Penoxsulam metabolite (5-Hydroxy-XDE-638) on frond number and dry weight of Duckweed, *Lemna gibba***

| Treatment[1] (estimated measured and nominal concentration) mg/L | Initial frond number/test solution | Mean frond number at | | | Mean Growth Rate ($days^{-1}$) | Mean Biomass (dry weights, g) |
|---|---|---|---|---|---|---|
| | | 7 days | 14 days | % inhibition at 14 days | | |
| Negative control (dilution water) | 15 | 338 | 806 | --- | 0.44 | 0.1049 |
| Solvent control | 15 | 363 | 812 | --- | 0.45 | 0.1298 |
| 0.081 (0.10) | 15 | 375 | 781 | 3 | 0.46 | 0.0971 |
| 0.22 (0.26) | 15 | 394 | 786 | 3 | 0.46 | 0.1350 |
| 0.62 (0.64) | 15 | 358 | 720 | 11* | 0.45 | 0.1364 |
| 1.6 (1.6) | 15 | 331 | 733 | 9* | 0.44 | 0.1234 |
| 4.6 (4.0) | 15 | 376 | 707 | 13* | 0.46 | 0.1361 |
| 11 (10) | 15 | 305 | 719 | 11* | 0.43 | 0.1112 |
| Reference chemical (if used) | Not applicable | | | | | |

[1] Nominal concentrations are in parentheses.
* Significantly reduced compared to the pooled control (Williams' Test).

**Table 4: Statistical endpoint values.**

| Statistical Endpoint[a] | frond No. | growth rate (day 7) | dry weight |
|---|---|---|---|
| NOAEC or $EC_{05}$ (mg/L) | 0.22 | 4.6 | 11 |
| LOAEC (mg/L) | 0.62 | 11 | >11 |
| $EC_{50}$ (mg/L) (95% C.I.) | >11 | >11 | >11 |
| $EC_{25}$ (mg/L) (95% C.I.) | >11 | Not reported | >11 |
| Reference chemical NOAEC $IC_{50}/EC_{50}$ | Not applicable | Not applicable | Not reported |

[a] Statistical data based on measured test concentrations.

**B. REPORTED STATISTICS:** A t-test was used to compare the dilution water (negative) and solvent controls. The controls were pooled for all statistical analyses. The data was analyzed for normality using the Shapiro-Wilk's Test and homogeneity of variance using Bartlett's Test. The Williams' test was used to compare the treatment groups to the pooled control. The NOAEC and LOAEC were determined from significance data. The $EC_{50}$ was empirically estimated to be greater than the highest concentration tested (no concentrations with >50% inhibition). The reported statistics were based on the mean measured test concentrations..

## C. VERIFICATION OF STATISTICAL RESULTS:

Statistical method: Frond number, growth rate, and dry weight data satisfied the assumptions of ANOVA (i.e., normal distribution and variance homogeneity); the NOAEC and LOAEC values were determined using ANOVA (growth rate and dry weight), followed by Bonferroni's test (frond number) via TOXSTAT statistical software. For all endpoints, the solvent control was compared to the negative control using a Student's t-test and no difference was found, so the two were pooled for comparison to treatment. The $EC_{05}$ for frond number was determined using the Probit method via Nuthatch statistical software. The $EC_{05}$ could not be determined for dry weight because the response was not monotonic, so the Probit method could not be used; reductions in growth rate did not exceed 4%, so the $EC_{05}$ for this endpoint was visually determined. Reductions did not exceed 50% for any endpoint, so the $EC_{50}$ could be visually determined for all endpoints.

**Number of fronds:**
NOAEC: 0.22 mg/L
LOAEC: 0.62 mg/L
$EC_{05}/IC_{05}$: 0.095 mg/L 95% C.I.: 0.0014-6.4 mg/L
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: 0.256±0.109

**Growth rates (day 7):**
NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: >11 mg/L 95% C.I.: N/A
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: N/A

**Plant biomass (dry weight):**
NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: could not be determined 95% C.I.: N/A
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: N/A

Endpoint(s) Affected: Frond number

## D. STUDY DEFICIENCIES:

The deviations did not affect the acceptability or the validity of the study.

## E. REVIEWER'S COMMENTS:

With the exception of the growth rate NOAEC, the reviewer's conclusions agreed with the study author's; the reviewer's analysis detected no effect on growth rate at any treatment level, while the study author's detected a significant reduction at the highest treatment level. No endpoints were reduced 50%, so the $EC_{50}$ for this study is 11 mg/L. According to the reviewer's analysis, frond number was the only affected endpoint; the reviewer determined the $EC_{05}$ value for this endpoint to be 0.095 mg/L.

The amount of test substance was limited , so further tests to determine $EC_{50}$ were not performed. The study author reported these test results define the toxicity of the metabolite relative to the parent compound.

The test was conducted according to U.S. EPA Good Laboratory Practice Regulations with the following exception: The data for routine water contaminant screening analysis was not collected in accordance to GLP procedures. A GLP statement was provided.

**F. CONCLUSIONS:** This toxicity study is scientifically sound and satisfies the U.S. EPA Guideline Subdivision J, §123-2 for an aquatic vascular plant study with *Lemna gibba*. As a result, this study is classified as Core.

**Number of fronds:**
NOAEC: 0.22 mg/L
LOAEC: 0.62 mg/L
$EC_{05}/IC_{05}$: 0.095 mg/L 95% C.I.: 0.0014-6.4 mg/L
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: 0.256±0.109

**Growth rates (day 7):**
NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: >11 mg/L 95% C.I.: N/A
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: N/A

**Plant biomass (dry weight):**
NOAEC: 11 mg/L
LOAEC: >11 mg/L
$EC_{05}/IC_{05}$: could not be determined 95% C.I.: N/A
$EC_{50}/IC_{50}$: >11 mg/L 95% C.I.: N/A
Slope: N/A

Endpoint(s) Affected: Frond number

## III. REFERENCES:

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Williams, D.A. 1971. A test for differences between treatment means when several dose levels are compared with a zero dose control. *Biometrics* 27: 103-117.

Williams, D.A. 1972. A comparison of several dose levels with a zero control. *Biometrics* 28: 519-531.

**APPENDIX I. OUTPUT OF REVIEWER'S STATISTICAL RESULTS:**

frond production
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ANOVA TABLE

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 38167.458 | 6361.243 | 4.814 |
| Within (Error) | 17 | 22465.500 | 1321.500 | |
| Total | 23 | 60632.958 | | |

Critical F value = 2.70 (0.05,6,17)
Since F > Critical F REJECT Ho:All groups equal

frond production
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BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | CALCULATED IN ORIGINAL UNITS | T STAT | SIG |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 809.167 | 809.167 | | |
| 2 | 0.081 | 781.000 | 781.000 | 1.096 | |

| | | | | |
|---|---|---|---|---|
| 3 | 0.22 | 786.000 | 786.000 | 0.901 |
| 4 | 0.62 | 719.667 | 719.667 | 3.482 * |
| 5 | 1.6 | 732.667 | 732.667 | 2.976 * |
| 6 | 4.6 | 707.333 | 707.333 | 3.962 * |
| 7 | 11 | 719.333 | 719.333 | 3.495 * |

Bonferroni T table value = 2.65 (1 Tailed Value, P=0.05, df=17,6)

frond production
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BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | Minimum Sig Diff (IN ORIG. UNITS) | % of CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | | | |
| 2 | 0.081 | 3 | 68.247 | 8.4 | 28.167 |
| 3 | 0.22 | 3 | 68.247 | 8.4 | 23.167 |
| 4 | 0.62 | 3 | 68.247 | 8.4 | 89.500 |
| 5 | 1.6 | 3 | 68.247 | 8.4 | 76.500 |
| 6 | 4.6 | 3 | 68.247 | 8.4 | 101.833 |
| 7 | 11 | 3 | 68.247 | 8.4 | 89.833 |

frond production
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WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

| GROUP | IDENTIFICATION | ORIGINAL N | ORIGINAL MEAN | TRANSFORMED MEAN | ISOTONIZED MEAN |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | 809.167 | 809.167 | 809.167 |
| 2 | 0.081 | 3 | 781.000 | 781.000 | 783.500 |
| 3 | 0.22 | 3 | 786.000 | 786.000 | 783.500 |
| 4 | 0.62 | 3 | 719.667 | 719.667 | 726.167 |
| 5 | 1.6 | 3 | 732.667 | 732.667 | 726.167 |
| 6 | 4.6 | 3 | 707.333 | 707.333 | 713.333 |
| 7 | 11 | 3 | 719.333 | 719.333 | 713.333 |

frond production
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WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

| IDENTIFICATION | ISOTONIZED MEAN | CALC. WILLIAMS | SIG P=.05 | TABLE WILLIAMS | DEGREES OF FREEDOM |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| GRPS 1&2 POOLED | 809.167 | | | | |
| 0.081 | 783.500 | 0.999 | | 1.74 | k= 1, v=17 |
| 0.22 | 783.500 | 0.999 | | 1.82 | k= 2, v=17 |
| 0.62 | 726.167 | 3.229 | * | 1.85 | k= 3, v=17 |
| 1.6 | 726.167 | 3.229 | * | 1.87 | k= 4, v=17 |
| 4.6 | 713.333 | 3.728 | * | 1.87 | k= 5, v=17 |
| 11 | 713.333 | 3.728 | * | 1.88 | k= 6, v=17 |

s = 36.352
Note: df used for table values are approximate when v > 20.

**Estimates of EC%**

| Parameter | Estimate | 95% Bounds Lower | Upper | Std.Err. /Estimate | Lower Bound |
|---|---|---|---|---|---|
| **EC5** | **0.095** | **0.0014** | **6.4** | **0.88** | **0.015** |
| EC10 | 2.5 | 0.26 | 24. | 0.47 | 0.10 |
| EC25 | 5.8E+02 | 5.7 | 6.0E+04 | 0.97 | 0.0097 |
| EC50 | 2.5E+05 | 15. | 4.1E+09 | 2.0 | 6.1E-05 |

**Slope = 0.256 Std.Err. = 0.109**

Goodness of fit: p = 0.37 based on DF= 4.0 17.

1104F : frond production

Observed vs. Predicted Treatment Group Means

| Dose | #Reps. | Obs. Mean | Pred. Mean | Obs. -Pred. | Pred. %Control | %Change |
|---|---|---|---|---|---|---|
| 0.00 | 6.00 | 809. | 811. | -1.60 | 100. | 0.00 |
| 0.0810 | 3.00 | 781. | 772. | 9.29 | 95.2 | 4.82 |
| 0.220 | 3.00 | 786. | 762. | 24.2 | 94.0 | 6.04 |
| 0.620 | 3.00 | 720. | 750. | -29.9 | 92.5 | 7.54 |
| 1.60 | 3.00 | 733. | 736. | -3.82 | 90.8 | 9.16 |
| 4.60 | 3.00 | 707. | 720. | -12.2 | 88.8 | 11.2 |
| 11.0 | 3.00 | 719. | 704. | 15.7 | 86.8 | 13.2 |

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

**growth rate**
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ANOVA TABLE

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 0.0026 | 0.0004 | 2.000 |

| | | | |
|---|---|---|---|
| Within (Error) | 17 | 0.0027 | 0.0002 |
| Total | 23 | 0.0053 | |

Critical F value = 2.70 (0.05,6,17)
**Since F < Critical F FAIL TO REJECT Ho:All groups equal**

growth rate
File: 1104g Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | CALCULATED IN ORIGINAL UNITS | T STAT | SIG |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 0.448 | 0.448 | | |
| 2 | 0.081 | 0.457 | 0.457 | -0.833 | |
| 3 | 0.22 | 0.467 | 0.467 | -1.833 | |
| 4 | 0.62 | 0.450 | 0.450 | -0.167 | |
| 5 | 1.6 | 0.440 | 0.440 | 0.833 | |
| 6 | 4.6 | 0.457 | 0.457 | -0.833 | |
| 7 | 11 | 0.430 | 0.430 | 1.833 | |

Bonferroni T table value = 2.65 (1 Tailed Value, P=0.05, df=17,6)

growth rate
File: 1104g Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | Minimum Sig Diff (IN ORIG. UNITS) | % of CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | | | |
| 2 | 0.081 | 3 | 0.027 | 5.9 | -0.008 |
| 3 | 0.22 | 3 | 0.027 | 5.9 | -0.018 |
| 4 | 0.62 | 3 | 0.027 | 5.9 | -0.002 |
| 5 | 1.6 | 3 | 0.027 | 5.9 | 0.008 |
| 6 | 4.6 | 3 | 0.027 | 5.9 | -0.008 |
| 7 | 11 | 3 | 0.027 | 5.9 | 0.018 |

growth rate
File: 1104g Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

| GROUP | ORIGINAL | TRANSFORMED | ISOTONIZED |
|---|---|---|---|

| | IDENTIFICATION | N | MEAN | MEAN | MEAN |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | 0.448 | 0.448 | 0.455 |
| 2 | 0.081 | 3 | 0.457 | 0.457 | 0.455 |
| 3 | 0.22 | 3 | 0.467 | 0.467 | 0.455 |
| 4 | 0.62 | 3 | 0.450 | 0.450 | 0.450 |
| 5 | 1.6 | 3 | 0.440 | 0.440 | 0.448 |
| 6 | 4.6 | 3 | 0.457 | 0.457 | 0.448 |
| 7 | 11 | 3 | 0.430 | 0.430 | 0.430 |

growth rate
File: 1104g Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

| IDENTIFICATION | ISOTONIZED MEAN | CALC. WILLIAMS | SIG P=.05 | TABLE WILLIAMS | DEGREES OF FREEDOM |
|---|---|---|---|---|---|
| GRPS 1&2 POOLED | 0.455 | | | | |
| 0.081 | 0.455 | 0.745 | | 1.74 | k= 1, v=17 |
| 0.22 | 0.455 | 0.745 | | 1.82 | k= 2, v=17 |
| 0.62 | 0.450 | 0.186 | | 1.85 | k= 3, v=17 |
| 1.6 | 0.448 | 0.000 | | 1.87 | k= 4, v=17 |
| 4.6 | 0.448 | 0.000 | | 1.87 | k= 5, v=17 |
| 11 | 0.430 | 2.050 | * | 1.88 | k= 6, v=17 |

s = 0.013
Note: df used for table values are approximate when v > 20.

**dry weight**
File: 1104d Transform: NO TRANSFORMATION

ANOVA TABLE

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 4066.492 | 677.749 | 1.489 |
| Within (Error) | 17 | 7736.922 | 455.113 | |
| Total | 23 | 11803.413 | | |

Critical F value = 2.70 (0.05,6,17)
**Since F < Critical F FAIL TO REJECT Ho:All groups equal**

dry weight
File: 1104d Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | T STAT | SIG |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 117.350 | 117.350 | | |
| 2 | 0.081 | 97.100 | 97.100 | 1.342 | |
| 3 | 0.22 | 135.000 | 135.000 | -1.170 | |
| 4 | 0.62 | 136.367 | 136.367 | -1.261 | |
| 5 | 1.6 | 123.400 | 123.400 | -0.401 | |
| 6 | 4.6 | 136.100 | 136.100 | -1.243 | |
| 7 | 11 | 111.200 | 111.200 | 0.408 | |

Bonferroni T table value = 2.65 (1 Tailed Value, P=0.05, df=17,6)

dry weight
File: 1104d Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | Minimum Sig Diff (IN ORIG. UNITS) | % of CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | | | |
| 2 | 0.081 | 3 | 40.051 | 34.1 | 20.250 |
| 3 | 0.22 | 3 | 40.051 | 34.1 | -17.650 |
| 4 | 0.62 | 3 | 40.051 | 34.1 | -19.017 |
| 5 | 1.6 | 3 | 40.051 | 34.1 | -6.050 |
| 6 | 4.6 | 3 | 40.051 | 34.1 | -18.750 |
| 7 | 11 | 3 | 40.051 | 34.1 | 6.150 |

dry weight
File: 1104d Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

| GROUP | IDENTIFICATION | ORIGINAL N | ORIGINAL MEAN | TRANSFORMED MEAN | ISOTONIZED MEAN |
|---|---|---|---|---|---|
| 1 | GRPS 1&2 POOLED | 6 | 117.350 | 117.350 | 123.238 |
| 2 | 0.081 | 3 | 97.100 | 97.100 | 123.238 |
| 3 | 0.22 | 3 | 135.000 | 135.000 | 123.238 |
| 4 | 0.62 | 3 | 136.367 | 136.367 | 123.238 |
| 5 | 1.6 | 3 | 123.400 | 123.400 | 123.238 |
| 6 | 4.6 | 3 | 136.100 | 136.100 | 123.238 |
| 7 | 11 | 3 | 111.200 | 111.200 | 111.200 |

dry weight
File: 1104d Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

| IDENTIFICATION | ISOTONIZED MEAN | CALC. WILLIAMS | SIG P=.05 | TABLE WILLIAMS | DEGREES OF FREEDOM |
|---|---|---|---|---|---|
| GRPS 1&2 POOLED | 123.238 | | | | |
| 0.081 | 123.238 | 0.390 | | 1.74 | k= 1, v=17 |
| 0.22 | 123.238 | 0.390 | | 1.82 | k= 2, v=17 |
| 0.62 | 123.238 | 0.390 | | 1.85 | k= 3, v=17 |
| 1.6 | 123.238 | 0.390 | | 1.87 | k= 4, v=17 |
| 4.6 | 123.238 | 0.390 | | 1.87 | k= 5, v=17 |
| 11 | 111.200 | 0.408 | | 1.88 | k= 6, v=17 |

s = 21.333
Note: df used for table values are approximate when v > 20.

$EC_{05}$
**!!!Failure #3: Data not suitable for probit model fit.**

**Criterion is 3 or more distinct isotone means.**