

US EPA ARCHIVE DOCUMENT

**DATA EVALUATION RECORD**  
**EFFECTS ON SOIL NON-TARGET MICRO-ORGANISMS**  
**US EPA Guideline: N/A (Non-guideline)**

1. **CHEMICAL**: Penoxsulam

PC Code No.: 119031  
199031

2. **TEST MATERIAL**: XDE-638

Purity: 97.7%

3. **CITATION**:

Author: Van Der Kolk, J.

Title: XDE-638: Determination of Effects on Soil Microflora  
Acitivity

Study Completion Date: September 10, 2002

Laboratory: Springborn Smithers Laboratories (Europe) Ag  
Seestrasse 21, Postfach  
CH-9326 Horn,  
Switzerland

Sponsor: The Dow Chemical Company  
Midland, MI 48674  
for  
Dow AgroSciences LLC  
9330 Zionsville Road  
Indianapolis, IN 46268

Laboratory Report ID: 1072.001.747

MRID No.: 45831103

DP Barcode: D288160

4. **REVIEWED BY**: Christie E. Padova, Staff Scientist, Dynamac Corporation

Signature: *C. E. Padova*

**Date**: 10/31/03

**APPROVED BY**: Teri S. Myers, Ph.D., Staff Scientist, Dynamac Corporation

Signature: *Teri S. Myers*

**Date**: 10/31/03

5. **APPROVED BY**: ~~William Erickson~~, Biologist, OPP/EFED/ERB - III

Signature: **James J. Goodyear, Ph.D.**  
**Ecological Effects Biologist**  
**Office of Pesticide Programs**  
**703-305-7726**

**Date**:

*Goodyear*



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## 6. STUDY PARAMETERS:

<b>Soil Type:</b>	Loamy sand, Sevelen (method of classification not specified)
<b>Definitive Test Duration:</b>	April 29 - June 10, 2002 (42 days)
<b>Test substance:</b>	XDE-638 (penoxsulam, 97.7% purity)
<b>Application rate:</b>	0.13 and 0.67 mg/kg dry soil (2 and 10X the maximum single application rate of 50 g/ha soil)

## 7. CONCLUSIONS:

In this study, XDE-638 (penoxsulam) was applied to a loamy sand agricultural soil at a single maximum rate of 0.13 or 0.67 mg a.i./kg dry soil (equivalent to 2 or 10X the maximum single application rate of 50 g a.i./ha soil). As indicators of soil microbial biomass metabolic activity, carbon mineralization was measured over a 29-day period, and nitrogen transformation was measured over a 42-day period. Response in the treated groups was compared to response in an untreated control group. Lucerne meal (3.25% nitrogen) was used to amend the experimental soil used in the nitrification portion of the study. The experimental method was validated in a concurrent positive control study using dinoseb acetate at 33.3 mg a.i./kg dry soil.

XDE-635 (penoxsulam) had no lasting effects on respiration and nitrification processes in soil at the concentrations tested. Over the course of the study, the microbial respiration (mg O<sub>2</sub>/kg dry soil/hour) of soil samples treated with 0.13 mg a.i./kg deviated -3, -6, 4, and -9% from the untreated control soil on Days 0, 7, 14, and 29, respectively. The soil treated with 0.67 mg a.i./kg deviated 0, -13\*, 13, and 9% from the control soil on Days 0, 7, 14, and 29, respectively (\*statistical significance at p<0.05). Due to accumulations of ammonium in the 0.13 mg a.i./kg soil on Day 7 and in the 0.67 mg a.i./kg soil on Days 7 and 14, the test was extended to Day 42; no detectable (LOD 0.36 mg NH<sub>4</sub><sup>+</sup>/kg dry soil) ammonium was found on Day 42 in the control or either treated soil group. Nitrate transformation rates in the soil treated at 0.13 mg a.i./kg deviated from the control values by -17.7\*, 3.6, 13.9, and 0% on Days 7, 14, 28, and 42, respectively (\*statistical significance at p<0.05; Table 7, p. 34). In the soil treated at 0.67 mg a.i./kg, rates deviated from the control values by -26.0\*, 0.1, 25.2\*, and 7.7% on Days 7, 14, 28, and 42, respectively. These results indicate that the loamy sand microflora from the control group transformed Lucern meal-bound nitrogen into nitrate-bound nitrogen, without accumulation of nitrite or ammonium. In the treated samples, a transient accumulation of ammonium occurred.

This study is scientifically sound, but it is classified as **Supplemental** because data for this type of study are not required by US EPA and there are no guidelines by which to evaluate it. The information that this study provides on the metabolic activity of soil

microorganisms may be useful for risk assessment purposes.

**8. ADEQUACY OF THE STUDY:**

**A. Classification:** Supplemental

**B. Rationale:** U.S. EPA does not require this type of study and there are no guidelines by which to evaluate it.

**C. Repairability:** N/A

**9. GUIDELINE DEVIATIONS: N/A**

**10. SUBMISSION PURPOSE:** This study was submitted to determine the effects of XDE-638 (penoxsulam) on nitrogen transformation and carbon mineralization by soil microflora, for the purpose of pesticide registration. This study was conducted in accordance with OECD Guidelines 216 and 217 (2000).

**11. MATERIALS AND METHODS:****A. Field information and handling procedures.**

<b>Information</b>	<b>Details</b>
Geographic location	Sevelen, Switzerland (p. 15)
Pesticide use history at the collection site	No treatments with plant protectants, organic or mineral fertilizers for 2 years.
Collection procedures	Top layer of soil and turf was removed; collection procedures of the underlying soil were not described.
Sampling depth (cm)	8- to 20-cm depth.
Storage conditions	Room temperature.
Storage length	7 days from time of sampling (April 22, 2002) until study initiation (April 29, 2002).
Soil preparation	Sieved (2 mm).

**B. Properties of the soil.**

<b>Property</b>	<b>Details</b>
Soil texture*	Loamy sand (Table 1, p. 28)
% sand (63 $\mu$ m - 2 mm)	68.5
% silt (2 $\mu$ m - 63 $\mu$ m)	25.8
% clay (<2 $\mu$ m)	5.7
pH (0.01 M CaCl <sub>2</sub> )	7.38 (control at test initiation; Table 2, p. 29)
Organic carbon (%)	0.92
CEC (mEq/100 g)	Not specified
Maximum water holding capacity (%)	44.8
Bulk density (g/cm <sup>3</sup> )	Assumed to be 1.5 (p. 15)
Total nitrogen content (mg N/g soil):	1.2
Total biomass (mg C/g soil):	0.18

Property	Details
Microbial biomass (%):	2.0% (pp. 21-22)
Soil Taxonomic classification	Not reported.
Soil mapping unit (for EPA)	Not reported.
Other:	N/A

\* The method used for soil classification was not reported.

### C: Experimental design.

Parameter	Details
Duration of the test	42 Days (final pH measurements for the nitrification samples were taken on Day 49).
Condition of soil:	Air dried/fresh: Fresh. The water content, measured 4 days prior to testing, was 43.5% of maximum water holding capacity (p. 15).
	Sterile/Non-sterile: Non-sterile.
Test concentrations (mg a.i./kg soil): Nominal: Measured:	0.13 and 0.67 mg a.i./kg dry soil (2 and 10X the maximum application rate of 50 g XDE-638/ha, p. 15). Not reported.
Dark controls used (Yes/No): Method to maintain darkness:	Yes. Samples were incubated in brown-glass flasks in a temperature-controlled climate chamber.
Replications	Triplicate.
Identity and concentration of co-solvent:	Acetone, 1.1% (v:w), evaporated completely Quartz sand, 8.3% (w:w)
Pesticide application	Volume of test solution used/treatment Control: 5 mL acetone + 38.4 g quartz sand + 4588 g wet soil (3840 g dry soil equivalent, p. 16). 2X Treatment: 5 mL of 0.103 mg a.i./mL stock solution + 38.4 g quartz sand + 4588 g wet soil (3840 g dry soil equivalent). 10X Treatment: 5 mL of 0.517 mg a.i./mL stock solution + 38.4 g quartz sand + 4588 g wet soil (3840 g dry soil equivalent).
	Method of application

Parameter		Details
Test apparatus: Type/Material/ Volume	Nitrogen transformation:	Sub-samples (238.60 g moist; 200 g dry) of soil from each treatment group were placed into brown glass flasks. The soil samples were amended with 1 g of Lucerne meal (3.25% nitrogen), and incubated in a temperature-controlled climate chamber.
	Carbon mineralization:	Sub-samples (1192.8 g moist; 1000 g dry) of soil from each treatment group were placed into brown glass flasks, and incubated in a temperature-controlled climate chamber.
Any indication of the test material adsorbing to the walls of the test apparatus		Not indicated.
Experimental Conditions	Temperature:	19.0 to 21.0°C (p. 11).
	Moisture content:	43% of maximum water holding capacity (19.28% based on dry weight).
	Moisture maintenance method	Method not specified.
	Duration of light/darkness:	Continuous.
Other details, if any		The microbial biomass of the soil was determined prior to test initiation (p. 17). Sub-samples (100 g dry weight) of soil were transferred to 500 mL flasks, and amended with 0, 500, 1000, 2001, 3003, or 4002 mg glucose/kg. Flasks were fitted with a OxiTop measuring head and a trap containing lime soda and incubated for an unspecified time in a temperature-controlled climate chamber. The highest initial hourly CO <sub>2</sub> production rate was 0.437 mL CO <sub>2</sub> /100 g dry soil equivalent in the 2001 mg/kg glucose-amended soil at 22°C (p. 22).

**D: Sampling details.**

Criteria	Nitrogen transformation	Carbon mineralization
Sampling intervals	0, 7, 14, 28, and 42 Days post-treatment.	0, 7, 14, and 29 Days post-treatment.
Sampling method	At each sampling interval, a 20-g (dry weight equivalent) sub-sample of soil per replicate was transferred to a centrifuge tube, and extracted twice with 0.1 M potassium chloride (p. 18).	At each sampling interval, a 100-g (dry weight equivalent) sub-sample of soil per replicate was transferred to a 500-mL Duran glass bottle, and amended with 200 mg of glucose and 0.5 g talc (p. 17).

Criteria	Nitrogen transformation	Carbon mineralization
	The samples were centrifuged, and extracts were filtered prior to analysis.	The bottles were fitted with OxITop measuring heads and soda lime traps, and incubated in a temperature-controlled room. Data were measured over a period of 20 hours, beginning ~1 hour following glucose supplement.
Sampling intervals/times for: Sterility check, if any Moisture content:	Sterile controls were not used. Days 7, 14, 22 and 28, 36, and 42 (p. 16).	Sterile controls were not used. Days 7, 14, 22 and 29.
Sample storage before analysis	None specified.	N/A
Other observations, if any	None	None

### E. Analytical methods.

#### Nitrification:

Criteria	Conditions
Ammonium (mg NH <sub>4</sub> <sup>+</sup> /kg dry soil):	Instrument: Dionex DX-100 Ion Chromatograph (p. 19) Column: Dionex IonPac CS12 Mobile Phase: 20.0 mMol/L methanesulfonic acid LOD: 0.36 mg NH <sub>4</sub> <sup>+</sup> /kg dry soil.
Nitrite (mg NO <sub>2</sub> <sup>-</sup> /kg dry soil):	Instrument: Dionex DX-100 Ion Chromatograph (p. 18) Column: Dionex IonPac AS12A Mobile Phase: 2.7 mMol Na <sub>2</sub> CO <sub>3</sub> /L mixed with 0.3 mMol NaHCO <sub>3</sub> /L LOD: 0.40 mg NO <sub>2</sub> <sup>-</sup> /kg dry soil.
Nitrate (mg NO <sub>3</sub> <sup>-</sup> /kg dry soil):	Instrument: Dionex DX-100 Ion Chromatograph (p. 18) Column: Dionex IonPac AS12A Mobile Phase: 2.7 mMol Na <sub>2</sub> CO <sub>3</sub> /L mixed with 0.3 mMol NaHCO <sub>3</sub> /L LOD: Not specified

### F. Statistical analysis.

Values that appeared to differ from other replicate values were analyzed using the Dixon Test (Sachs, 1969) to determine if these values could be classified as outliers (p. 21). Differences between the control and the treated soils were then analyzed using ANOVA followed by Dunnett's t-test.

### G. Supplementary experiment:

The suitability of dinoseb acetate [2-(1-methylpropyl)-4,6-dinitrophenyl acetate; purity 99.5%) as a reference substance was concurrently determined using the experimental procedures described in the main study (p. 13, and Appendix I, pp. 40-49). Dinoseb acetate was applied to the Sevelen loamy sand soil at a concentration of 33.3 mg a.i./kg dry soil (equivalent to a field application rate of 25 kg a.i./ha). Samples were collected for analysis as previously described on Days 0, 7, 14, and 28 (nitrification)/29 (respiration).

Effects of the treated soil at differences >25% from untreated soil were observed. After 29 days of incubation, respiration rates (mg O<sub>2</sub>/kg dry soil/hour) of the treated soil were -52% different than the untreated soil (Table 8, p. 43). After 28 days of incubation, nitrate transformation rates (mg NO<sub>3</sub>-/kg dry soil/day) were 88% different than the untreated soil (Table 12, p. 47). Therefore, the study author concluded that the procedures used to determine the effects of test items on respiration and nitrification of the soil microflora at this laboratory were appropriate.

## 12. REPORTED RESULTS:

### A. General Results

Over the course of the study, the microbial respiration (mg O<sub>2</sub>/kg dry soil/hour) of soil samples treated with 0.13 mg a.i./kg deviated -3, -6, 4, and -9% from the untreated control soil on Days 0, 7, 14, and 29, respectively (p. 23 and Table 3, p. 30). The soil treated with 0.67 mg a.i./kg deviated 0, -13\*, 13, and 9% from the control soil on Days 0, 7, 14, and 29, respectively (\*statistical significance at p<0.05). These deviations in respiration rates were below the guideline trigger value of 25% from the control after 29 days; therefore, it was concluded that XDE-638 had no lasting effects on respiration (p. 25).

Concentrations of ammonium decreased in the control samples during the study, from 8.23 mg NH<sub>4</sub><sup>+</sup>/kg dry soil on Day 0, to 2.68, 0.71, and 1.60 mg NH<sub>4</sub><sup>+</sup>/kg dry soil on Days 7, 14, and 28, respectively (p. 23 and Table 4, p. 31). In the 0.13 mg a.i./kg treated soil, ammonium concentrations were comparable to control values on Days 0, 14, and 28;



however, concentrations increased to 13.45 mg NH<sub>4</sub><sup>+</sup>/kg dry soil on Day 7. In the 0.67 mg a.i./kg treated soil, ammonium concentrations were comparable to control values on Days 0 and 28; however, concentrations increased to 21.75 mg NH<sub>4</sub><sup>+</sup>/kg dry soil on Day 7 and were 6.18 mg NH<sub>4</sub><sup>+</sup>/kg dry soil on Day 14. Since an accumulation of ammonium was found in the 0.13 mg a.i./kg soil on Day 7 and in the 0.67 mg a.i./kg soil on Days 7 and 14, the test was extended to Day 42. No detectable (LOD 0.36 mg NH<sub>4</sub><sup>+</sup>/kg dry soil) ammonium was found on Day 42 in the control or either treated soil group.

Aside from one sample on Day 0 in the 0.13 mg a.i./kg treated soil (at 1.48 mg NO<sub>2</sub><sup>-</sup>/kg dry soil), no nitrite was detected in the control or test samples (p. 24 and Table 5, p. 32).

Concentrations of nitrate increased in the control samples during the study, from 38.3 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Day 0, to 137, 212, 283, and 343 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Days 7, 14, 28, and 42, respectively (p. 24 and Table 6, p. 33). In the 0.13 mg a.i./kg treated soil, nitrate concentrations increased from 40.4 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Day 0 to 345 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Day 42, and in the 0.67 mg a.i./kg treated soil, nitrate concentrations increased from 38.9 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Day 0 to 367 mg NO<sub>3</sub><sup>-</sup>/kg dry soil on Day 42.

Nitrate transformation rates in the soil treated at 0.13 mg a.i./kg deviated from the control values by -17.7\*, 3.6, 13.9, and 0% on Days 7, 14, 28, and 42, respectively (\*statistical significance at p<0.05; Table 7, p. 34). In the soil treated at 0.67 mg a.i./kg, rates deviated from the control values by -26.0\*, 0.1, 25.2\*, and 7.7% on Days 7, 14, 28, and 42, respectively.

These results indicate that the loamy sand microflora from the control group transformed Lucern meal-bound nitrogen into nitrate-bound nitrogen, without accumulation of nitrite or ammonium (p. 24). In the treated samples, a transient accumulation of ammonium occurred.

## Effects Data

### Respiration rates (mg CO<sub>2</sub>/kg dry soil/hour, n=3).

Treatment Group	Days			
	0	7	14	29
Control	5.2	5.0	3.9	3.7
0.13 mg a.i./kg dry soil (% difference from control)	5.0 (-3)	4.7 (-6)	4.0 (4)	3.4 (-9)
0.67 mg a.i./kg dry soil (% difference from control)	5.2 (0)	4.4 (-13*)	4.4 (13)	4.0 (9)

\* p<0.05



**Analysis of ammonium levels in soil (mg NH<sub>4</sub><sup>+</sup>/kg dry soil, n=3).**

Treatment Group	Days				
	0	7	14	28	42
Control	8.28	2.68	0.71	1.60	<LOD
0.13 mg a.i./kg dry soil	7.63	13.45	0.85	1.75	<LOD
0.67 mg a.i./kg dry soil	7.03	21.75	6.18	1.78	<LOD

**Analysis of nitrite levels in soil (mg NO<sub>2</sub><sup>-</sup>/kg dry soil, n=3).**

Treatment Group	Days				
	0	7	14	28	42
Control	<LOD	<LOD	<LOD	<LOD	<LOD
0.13 mg a.i./kg dry soil	<LOD	<LOD	<LOD	<LOD	<LOD
0.67 mg a.i./kg dry soil	<LOD	<LOD	<LOD	<LOD	<LOD

**Analysis of nitrate levels in soil (mg NO<sub>3</sub><sup>-</sup>/kg dry soil, n=3).**

Treatment Group	Days				
	0	7	14	28	42
Control	38.3	137	212	283	343
0.13 mg a.i./kg dry soil	40.4	121	220	319	345
0.67 mg a.i./kg dry soil	38.9	112	213	345	367

**Nitrate Transformation Rates in soil (mg NO<sub>3</sub><sup>-</sup>/kg dry soil/day, n=3).**

Treatment Group	Days			
	7	14	28	42
Control	14.1	12.4	8.7	7.3
0.13 mg a.i./kg dry soil (% difference from control)	11.6 (-17.7*)	12.9 (3.6)	10.0 (13.9*)	7.3 (0)
0.67 mg a.i./kg dry soil (% difference from control)	10.4 (-26.0*)	12.4 (0.1)	10.9 (25.2*)	7.8 (7.7)

\*p&lt;0.05

**13. VERIFICATION OF STATISTICAL RESULTS:**

Method: Respiration rate, ammonium concentration, nitrate concentration, and nitrate transformation rate data were analyzed at each measurement period (i.e., days 0, 7, 14, 28, and 42) to determine if the control group differed from the treatment groups. Data were analyzed to determine if they satisfied the assumptions of ANOVA; if the assumptions of normality and variance homogeneity were met, ANOVA was conducted, followed by William's test (if necessary). Data for ammonium concentration on day 14 had to be transformed (inverse transformation) prior to conducting ANOVA. These analyses were conducted using TOXSTAT statistical software.

No significant differences were detected for respiration rate at any time period. Significant ammonium concentrations were detected in the treatment groups at days 7 and 14, but not at days 28 and 42. Nitrate transformation rates in the treatment groups were significantly higher than control at day 28, but there were no differences from control at day 42.

**14. REVIEWER'S COMMENTS:**

While this study provides supplemental information and there are no US EPA guidelines to evaluate it, the reviewer considered the following to be deficiencies in the experimental method and the study report:

1. The method used for soil texture classification was not reported, and the cation exchange capacity of the soil was not reported.
2. Data were not provided to confirm that environmental conditions were maintained throughout the study. Although the study author reported that the soil moisture was monitored and maintained, no data was reported.
3. The test substance was applied by adding aliquots of a stock solution to quartz sand, which was then mixed with a hand mixer into the wet soil (38.4 g quartz sand per 3840 g dry soil). The final concentration of quartz sand in the soil was 10% (w:w), which may significantly alter the texture classification of the soil tested.
4. The storage stability of the test substance was not confirmed. Also, the possibility that the test substance may absorb to the walls of the test apparatus were not determined.

5. The nominal application rates of the test substance (0.13 and 0.67 mg a.i./kg dry soil) were not verify by measuring the test substance in the soil systems.

The study author reported the maximum single application rate of XDE-638 to an unspecified target is 50 g a.i./ha soil (p. 13). In this study, XDE-638 was applied in a single application rate equivalent to two or ten times the maximum (0.13 or 0.67 mg a.i./kg dry soil; conversion calculation provided on p. 15). No further rational was provided.

The reviewer's results were similar to the study author's; respiration rates were not adversely impacted during the study and reductions in nitrate transformation rates (at both treatment levels) were transient, disappearing after day 7. Furthermore, accumulation of ammonium in the treatment groups disappeared by day 28.

## 15. REFERENCES:

- Anderson, J.P.E., and K.H. Domsch. 1978. *A Physiological Method for the Quantitative Measurement of Microbial Biomass in Soils*. Soil. Biol. Biochem. 10:215-221.
- Eidgenossisches Departement des Innern, Switzerland. March 2000. Swiss Ordinance relating to Good Laboratory Practice, adopted February 2, 2000 [RS 831.016.5].
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- OECD. 1998. OECD Principles of Good Laboratory Practice and Compliance Monitoring. Number 1. OECD Principles of Good Laboratory Practice (as revised in 1997). Environment Directorate. OECD. Paris. France. 41 pp.
- OECD. 2000a. OECD Guideline for the testing of chemicals, No. 216. Soil Microorganisms: Nitrogen Transformation Test. Adopted January 21, 2000.
- OECD. 2000b. OECD Guideline for the testing of chemicals, No. 217. Soil Microorganisms: Carbon Transformation Test. Adopted January 21, 2000.
- Sachs, L. 1969. *Statistische Auswertungsmethoden*. Springer-Verlag, Berlin, Heidelberg, New York, 2. Auflage, 1969.

**APPENDIX I. OUTPUT OF REVIEWER'S STATISTICAL VERIFICATION:**  
**respiration rate day 7**

File: 1103r7 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.602	0.301	2.333
Within (Error)	6	0.773	0.129	
Total	8	1.376		

Critical F value = 5.14 (0.05,2,6)

Since  $F < \text{Critical F}$  FAIL TO REJECT  $H_0$ : All groups equal

respiration rate day 7

File: 1103r7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	5.033	5.033		
2	0.13	4.733	4.733	1.023	
3	0.67	4.400	4.400	2.160	

Dunnett table value = 2.34 (1 Tailed Value,  $P=0.05$ ,  $df=6,2$ )

respiration rate day 7

File: 1103r7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.686	13.6
3	0.67	3	0.686	13.6

respiration rate day 7



DP Barcode: D288160

MRID No.: 45831103

File: 1103r7 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1 control	3	5.033	5.033	5.033
2 0.13	3	4.733	4.733	4.733
3 0.67	3	4.400	4.400	4.400

respiration rate day 7

File: 1103r7 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE P=.05	DEGREES OF FREEDOM
control	5.033				
0.13	4.733	1.023	1.94	k= 1, v= 6	
0.67	4.400	2.161 *	2.06	k= 2, v= 6	

s = 0.359

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

respiration rate (day 29)

File: 1103r29 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.667	0.333	1.088
Within (Error)	6	1.833	0.306	
Total	8	2.500		

Critical F value = 5.14 (0.05,2,6)

Since F < Critical F FAIL TO REJECT Ho:All groups equal

respiration rate (day 29)

File: 1103r29 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	3.733	3.733		
2	0.13	3.400	3.400	0.738	
3	0.67	4.067	4.067	-0.738	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

respiration rate (day 29)

File: 1103r29 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	1.057	28.3
3	0.67	3	1.057	28.3

respiration rate (day 29)

File: 1103r29 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	3.733	3.733	3.567
2	0.13	3	3.400	3.400	3.567
3	0.67	3	4.067	4.067	4.067

respiration rate (day 29)

File: 1103r29 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS FREEDOM
control	3.567			
0.13	3.567	0.369	1.94	k= 1, v= 6
0.67	4.067	0.739	2.06	k= 2, v= 6



s = 0.553

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

**ammonium day 0**

File: 1103a0 Transform: NO TRANSFORMATION

**ANOVA TABLE**

SOURCE	DF	SS	MS	F
Between	2	2.358	1.179	53.591
Within (Error)	6	0.134	0.022	
Total	8	2.492		

Critical F value = 5.14 (0.05,2,6)

Since F > Critical F REJECT Ho:All groups equal

**ammonium day 0**

File: 1103a0 Transform: NO TRANSFORMATION

**DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment**

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	8.280	8.280		
2	0.13	7.627	7.627	5.395	*
3	0.67	7.027	7.027	10.349	*

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

**ammonium day 0**

File: 1103a0 Transform: NO TRANSFORMATION

**DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment**

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.283	3.4
3	0.67	3	0.283	3.4



ammonium day 0  
 File: 1103a0 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	8.280	8.280	8.280
2	0.13	3	7.627	7.627	7.627
3	0.67	3	7.027	7.027	7.027

ammonium day 0  
 File: 1103a0 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	8.280					
0.13	7.627	5.351	*	1.94	k= 1, v= 6	
0.67	7.027	10.265	*	2.06	k= 2, v= 6	

s = 0.150

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

ammonium day 7  
 File: 1103a7 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	548.929	274.465	1115.711
Within (Error)	6	1.474	0.246	
Total	8	550.403		

Critical F value = 5.14 (0.05,2,6)  
 Since F > Critical F REJECT Ho:All groups equal



ammonium day 7  
 File: 1103a7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	2.680	2.680		
2	0.13	13.453	13.453	-26.603	
3	0.67	21.757	21.757	-47.106	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

ammonium day 7  
 File: 1103a7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.948	35.4
3	0.67	3	0.948	35.4

ammonium day 7  
 File: 1103a7 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	2.680	2.680	2.680
2	0.13	3	13.453	13.453	13.453
3	0.67	3	21.757	21.757	21.757

ammonium day 7  
 File: 1103a7 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2



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

control	2.680					
0.13	13.453	26.621	*	1.94	k= 1, v= 6	
0.67	21.757	47.139	*	2.06	k= 2, v= 6	

s = 0.496

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

ammonium day 14

File: 1103a14 Transform: 1/Y (INVERSE)

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	2.628	1.314	1314.000
Within (Error)	6	0.008	0.001	
Total	8	2.637		

Critical F value = 5.14 (0.05,2,6)

Since F > Critical F REJECT Ho:All groups equal

ammonium day 14

File: 1103a14 Transform: 1/Y (INVERSE)

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	1.404	0.713		
2	0.13	1.181	0.847	8.612	*
3	0.67	0.162	6.187	48.074	*

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

ammonium day 14

File: 1103a14 Transform: 1/Y (INVERSE)

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum (IN ORIG. UNITS)	Sig Diff	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3			
2	0.13	3	-0.032	-4.5	-0.133
3	0.67	3	-0.032	-4.5	-5.473

ammonium day 14  
 File: 1103a14 Transform: 1/Y (INVERSE)

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1 control	3	0.713	1.404	1.404
2 0.13	3	0.847	1.181	1.181
3 0.67	3	6.187	0.162	0.162

ammonium day 14  
 File: 1103a14 Transform: 1/Y (INVERSE)

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	1.404				
0.13	1.181	7.331	*	1.94	k= 1, v= 6
0.67	0.162	40.924	*	2.06	k= 2, v= 6

s = 0.037

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

ammonium day 28  
 File: 1103a28 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.054	0.027	2.250
Within (Error)	6	0.070	0.012	



-----  
 Total            8            0.124  
 -----

Critical F value = 5.14 (0.05,2,6)  
 Since F < Critical F FAIL TO REJECT Ho:All groups equal

ammonium day 28  
 File: 1103a28    Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2            Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	1.603	1.603		
2	0.13	1.743	1.743	-1.565	
3	0.67	1.783	1.783	-2.012	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

ammonium day 28  
 File: 1103a28    Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2            Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.209	13.1
3	0.67	3	0.209	13.1

ammonium day 28  
 File: 1103a28    Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	1.603	1.603	1.603
2	0.13	3	1.743	1.743	1.743
3	0.67	3	1.783	1.783	1.783



ammonium day 28

File: 1103a28 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS FREEDOM
control	1.603				
0.13	1.743	1.585	1.94	k= 1, v= 6	
0.67	1.783	2.038	2.06	k= 2, v= 6	

s = 0.108

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

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	118.222	59.111	1.622
Within (Error)	6	218.667	36.444	
Total	8	336.889		

Critical F value = 5.14 (0.05,2,6)

Since F < Critical F FAIL TO REJECT Ho:All groups equal

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	212.000	212.000		
2	0.13	220.000	220.000	-1.623	
3	0.67	212.667	212.667	-0.135	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

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nitrate day 14  
 File: 1103n14 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum (IN ORIG. UNITS)	Sig Diff	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3			
2	0.13	3	11.534	5.4	-8.000
3	0.67	3	11.534	5.4	-0.667

nitrate day 14  
 File: 1103n14 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	212.000	212.000	212.000
2	0.13	3	220.000	220.000	216.333
3	0.67	3	212.667	212.667	216.333

nitrate day 14  
 File: 1103n14 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE P=05	DEGREES OF WILLIAMS	FREEDOM
control	212.000					
0.13	216.333	0.879	1.94	k= 1, v= 6		
0.67	216.333	0.879	2.06	k= 2, v= 6		

s = 6.037

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

nitrate day 7  
 File: 1103n7 Transform: NO TRANSFORMATION

ANOVA TABLE



SOURCE	DF	SS	MS	F
Between	2	980.667	490.333	16.973
Within (Error)	6	173.333	28.889	
Total	8	1154.000		

Critical F value = 5.14 (0.05,2,6)  
 Since F > Critical F REJECT Ho:All groups equal

nitrate day 7  
 File: 1103n7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	137.000	137.000		
2	0.13	121.333	121.333	3.570	*
3	0.67	111.667	111.667	5.773	*

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

nitrate day 7  
 File: 1103n7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	10.269	7.5
3	0.67	3	10.269	7.5

nitrate day 7  
 File: 1103n7 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN

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DP Barcode: D288160

MRID No.: 45831103

1	control	3	137.000	137.000	137.000
2	0.13	3	121.333	121.333	121.333
3	0.67	3	111.667	111.667	111.667

nitrate day 7

File: 1103n7 Transform: NO TRANSFORMATION

**WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2**

IDENTIFICATION	MEAN	WILLIAMS	SIG	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	137.000					
0.13	121.333	3.570	*	1.94	k= 1, v= 6	
0.67	111.667	5.773	*	2.06	k= 2, v= 6	

s = 5.375

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

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

**ANOVA TABLE**

SOURCE	DF	SS	MS	F
Between	2	118.222	59.111	1.622
Within (Error)	6	218.667	36.444	
Total	8	336.889		

Critical F value = 5.14 (0.05,2,6)

Since F < Critical F FAIL TO REJECT Ho:All groups equal

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

**DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment**

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	212.000	212.000		

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DP Barcode: D288160

MRID No.: 45831103

2	0.13	220.000	220.000	-1.623
3	0.67	212.667	212.667	-0.135

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	11.534	5.4 -8.000
3	0.67	3	11.534	5.4 -0.667

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	212.000	212.000	212.000
2	0.13	3	220.000	220.000	216.333
3	0.67	3	212.667	212.667	216.333

nitrate day 14

File: 1103n14 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	212.000					
0.13	216.333	0.879	1.94	k= 1, v= 6		
0.67	216.333	0.879	2.06	k= 2, v= 6		

s = 6.037

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

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**nitrate day 28**

File: 1103n28 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	5874.889	2937.444	54.286
Within (Error)	6	324.667	54.111	
Total	8	6199.556		

Critical F value = 5.14 (0.05,2,6)  
 Since F > Critical F REJECT Ho:All groups equal

**nitrate day 28**

File: 1103n28 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	283.000	283.000		
2	0.13	319.000	319.000	-5.994	
3	0.67	345.333	345.333	-10.378	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

**nitrate day 28**

File: 1103n28 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	14.054	5.0 -36.000
3	0.67	3	14.054	5.0 -62.333

**nitrate day 28**

File: 1103n28 Transform: NO TRANSFORMATION



**WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2**

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	283.000	283.000	283.000
2	0.13	3	319.000	319.000	319.000
3	0.67	3	345.333	345.333	345.333

nitrate day 28

File: 1103n28 Transform: NO TRANSFORMATION

**WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2**

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	283.000					
0.13	319.000	5.994	*	1.94	k= 1, v= 6	
0.67	345.333	10.378	*	2.06	k= 2, v= 6	

s = 7.356

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

nitrate day 42

File: 1103n42 Transform: NO TRANSFORMATION

**ANOVA TABLE**

SOURCE	DF	SS	MS	F
Between	2	1081.556	540.778	6.153
Within (Error)	6	527.333	87.889	
Total	8	1608.889		

Critical F value = 5.14 (0.05,2,6)

Since F > Critical F REJECT Ho:All groups equal

nitrate day 42

File: 1103n42 Transform: NO TRANSFORMATION



DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	343.000	343.000		
2	0.13	345.333	345.333	-0.305	
3	0.67	367.333	367.333	-3.179	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

nitrate day 42

File: 1103n42 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	17.912	5.2 -2.333
3	0.67	3	17.912	5.2 -24.333

nitrate day 42

File: 1103n42 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	343.000	343.000	343.000
2	0.13	3	345.333	345.333	345.333
3	0.67	3	367.333	367.333	367.333

nitrate day 42

File: 1103n42 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	343.000				
0.13	345.333	0.305	1.94	K= 1, v= 6	
0.67	367.333	3.179 *	2.06	K= 2, v= 6	



s = 9.375

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

nitrate transformation day 7

File: 1103t7 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	20.562	10.281	25.199
Within (Error)	6	2.447	0.408	
Total	8	23.009		

Critical F value = 5.14 (0.05,2,6)

Since F > Critical F REJECT Ho:All groups equal

nitrate transformation day 7

File: 1103t7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	14.033	14.033		
2	0.13	11.600	11.600	4.666	*
3	0.67	10.400	10.400	6.967	*

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

nitrate transformation day 7

File: 1103t7 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	1.220	8.7
				2.433



DP Barcode: D288160

MRID No.: 45831103

3	0.67	3	1.220	8.7	3.633
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nitrate transformation day 7  
File: 1103t7 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1 control	3	14.033	14.033	14.033
2 0.13	3	11.600	11.600	11.600
3 0.67	3	10.400	10.400	10.400

nitrate transformation day 7  
File: 1103t7 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	14.033					
0.13	11.600	4.667	*	1.94	k= 1, v= 6	
0.67	10.400	6.968	*	2.06	k= 2, v= 6	

s = 0.639

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

nitrate transformation day 14  
File: 1103t14 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.407	0.203	0.886
Within (Error)	6	1.373	0.229	
Total	8	1.780		

Critical F value = 5.14 (0.05,2,6)

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Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ :All groups equal

nitrate transformation day 14

File: 1103t14 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	12.400	12.400		
2	0.13	12.867	12.867	-1.194	
3	0.67	12.433	12.433	-0.085	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

nitrate transformation day 14

File: 1103t14 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.914	7.4
3	0.67	3	0.914	7.4

nitrate transformation day 14

File: 1103t14 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	12.400	12.400	12.400
2	0.13	3	12.867	12.867	12.650
3	0.67	3	12.433	12.433	12.650

nitrate transformation day 14

File: 1103t14 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2



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

control	12.400				
0.13	12.650	0.640	1.94	k= 1, v= 6	
0.67	12.650	0.640	2.06	k= 2, v= 6	

s = 0.478

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

**nitrate transformation day 28**

File: 1103t28 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	7.296	3.648	57.905
Within (Error)	6	0.380	0.063	
Total	8	7.676		

Critical F value = 5.14 (0.05,2,6)

Since F > Critical F REJECT Ho:All groups equal

**nitrate transformation day 28**

File: 1103t28 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	8.733	8.733		
2	0.13	9.967	9.967	-6.018	
3	0.67	10.933	10.933	-10.735	

Dunnett table value = 2.34 (1 Tailed Value, P=0.05, df=6,2)

**nitrate transformation day 28**

File: 1103t28 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment



GROUP	IDENTIFICATION	NUM OF REPS	Minimum (IN ORIG. UNITS)	Sig Diff	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3			
2	0.13	3	0.480	5.5	-1.233
3	0.67	3	0.480	5.5	-2.200

nitrate transformation day 28  
 File: 1103t28 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	8.733	8.733	8.733
2	0.13	3	9.967	9.967	9.967
3	0.67	3	10.933	10.933	10.933

nitrate transformation day 28  
 File: 1103t28 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS	FREEDOM
control	8.733					
0.13	9.967	6.002	*	1.94	k= 1, v= 6	
0.67	10.933	10.707	*	2.06	k= 2, v= 6	

s = 0.252

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

nitrate transformation day 42  
 File: 1103t42 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.642	0.321	4.586

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DP Barcode: D288160

MRID No.: 45831103

Within (Error)	6	0.420	0.070
Total	8	1.062	

Critical F value = 5.14 (0.05,2,6)  
Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All groups equal

nitrate transformation day 42  
File: 1103t42 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	7.267	7.267		
2	0.13	7.267	7.267	-0.000	
3	0.67	7.833	7.833	-2.623	

Dunnett table value = 2.34 (1 Tailed Value,  $P=0.05$ ,  $df=6,2$ )

nitrate transformation day 42  
File: 1103t42 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2  $H_0$ : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of DIFFERENCE CONTROL FROM CONTROL
1	control	3		
2	0.13	3	0.505	7.0
3	0.67	3	0.505	7.0

nitrate transformation day 42  
File: 1103t42 Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	ORIGINAL N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	3	7.267	7.267	7.267
2	0.13	3	7.267	7.267	7.267
3	0.67	3	7.833	7.833	7.833

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nitrate transformation day 42  
File: 1103t42 Transform: NO TRANSFORMATION

WILLIAMS TEST (isotonic regression model) TABLE 2 OF 2

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

IDENTIFICATION	MEAN	WILLIAMS	SIG	TABLE P=.05	DEGREES OF WILLIAMS FREEDOM
control	7.267				
0.13	7.267	0.000		1.94	k= 1, v= 6
0.67	7.833	2.623	*	2.06	k= 2, v= 6

s = 0.265

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

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