

MRID No. 445051-19

DATA EVALUATION RECORD
SEEDLING EMERGENCE EC₂₅ TEST
§ 123-1 (TIER II)

1. **CHEMICAL:** Mesotrione PC Code No.: 122990

2. **TEST MATERIAL:** ZA1296 4SC (WF2381) Purity: 40.7%

3. **CITATION:**
Author: D. Teixeira
Title: ZA1296: Determination of Effects on
Seedling Emergence and Vegetative Vigor
of Ten Plant Species
Study Completion Date: September 22, 1997
Laboratory: Springborn Laboratories, Inc., Wareham,
MA
Sponsor: ZENECA Ag Products, Wilmington, DE
Laboratory Report ID: 97-5-6985
MRID No.: 445051-19
DP Barcode: D245475

4. **REVIEWED BY:** Mark Mossler, M.S., Toxicologist,
Golder Associates Inc.

Signature:  **Date:** 8/25/98

APPROVED BY: Pim Kosalwat, Ph.D., Senior Scientist,
Golder Associates Inc.

Signature:  **Date:** 8/25/98

5. **APPROVED BY:**

Signature:  **Date:** 7/18/00

6. **STUDY PARAMETERS:**

Definitive Study Duration: 14 days

7. **CONCLUSIONS:** This study is scientifically sound and fulfills
the guideline requirements for a Tier II seedling emergence
test with terrestrial plants.

Results Synopsis:

Most sensitive dicot: Lettuce
Most sensitive parameter: Shoot length
EC₂₅: 0.0033 lb ai/A
NOEL: 0.0012 lb ai/A

Most sensitive monocot: Onion
 Most sensitive parameter: Shoot length
 EC₂₅: ~~0.028 lb ai/A~~ 0.032
 NOEL: ~~0.017 lb ai/A~~ 0.001

8. ADEQUACY OF THE STUDY:

A. Classification: Core.

B. Rationale: N/A.

C. Repairability: N/A.

9. **GUIDELINE DEVIATIONS:** Some of the rate progressions were four-fold, rather than the recommended two-fold.

10. SUBMISSION PURPOSE:**11. MATERIALS AND METHODS:****A. Test Organisms**

Guideline Criteria	Reported Information
Species 6 dicots in 4 families, including soybean and a rootcrop; 4 monocots in 2 families, including corn.	<u>Dicots</u> : cabbage, cucumber, lettuce, soybean, tomato, turnip <u>Monocots</u> : corn, oat, onion, ryegrass
Number of seeds per rep 10	10
Source of Seed	Various commercial suppliers
Historical % Germination of Seed	≥84%

B. Test System

Guideline Criteria	Reported Information
Solvent	None
Site of test	Growth chamber
Planting method / type of pot	Planted at 1-cm depth/13-cm polypropylene pots (top diameter)

Guideline Criteria	Reported Information
Method of application	0.084 mL of solution applied to medium surface
Method of watering	Subirrigation
Growth stage at application Seed or plant.	Seed

C. Test Design

Guideline Criteria	Reported Information
Dose range 2x or 3x	2x or 4x: rates ranging from 0.0003 to 0.31 lb active ingredient (ai)/A
Doses At least 5	5, 6, or 7
Controls Negative and solvent	Negative and formulation blank control groups
Replicates per dose At least 3	3 replicates
Duration of test 14 days	14 days
Were observations made at least weekly?	No, observations made on days 10 and 14 of the study
Maximum labeled rate	0.31 lb ai/A

12. REPORTED RESULTS:

Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements were included in the report?	Yes
Was an NOEL observed for each species?	Yes
Phytotoxic observations	Yes

Guideline Criteria	Reported Information
Were initial chemical concentrations measured? (Optional)	Yes, recoveries ranged between 55 and 120% of nominal, mean of 98%
Were adequate raw data included?	Replicate phytotoxicity data were not reported

Results for the most sensitive parameter* of each species

Species	Parameter	EC ₂₅ (lbs ai/A)	NOEL (lbs ai/A)
Cabbage	shoot length	0.013	0.012
Cucumber	"	0.059	0.019
Lettuce	"	0.0033	0.0012
Soybean	emergence=length	>0.34	0.34
Tomato	shoot length	0.023	0.017
Turnip	"	0.034	0.023
Corn	emergence=length	>0.34	0.34
Oat	shoot length	0.071	0.019
Onion	"	0.028	0.017
Ryegrass	"	0.057	0.032

*Determination of the most sensitive parameter is based on EC₂₅ values.

Observations: Signs of test material toxicity included chlorosis and necrosis.

Statistical Results

Statistical Method: Dunnett's test was used for mean separation, and regression analysis was used to determine the EC values. Comparisons were made to the negative control.

Most sensitive dicot: lettuce Parameter: shoot length
EC₂₅ 95% C.L.: 0.0003 - 0.028 lb ai/A Probit slope: N/A

Most sensitive monocot: onion Parameter: shoot length
EC₂₅ 95% C.L.: 0.011 - 0.066 lb ai/A Probit slope: N/A

13. **VERIFICATION OF STATISTICAL RESULTS:** All analyses were based on measured application rates and comparisons were made to the formulation blank control. Williams' test or visual interpretation was used to determine NOEL values. Linear interpolation or probit analysis was used for initial EC₂₅ determination and appropriate responses were remodeled using non-linear regression analysis.

Results for the most sensitive parameter of each species

Species	Parameter	EC ₂₅ (lbs ai/A)	NOEL (lbs ai/A)
Cabbage	shoot length	0.019	0.012
Cucumber	"	0.053	0.019
Lettuce	"	0.016	0.004
Soybean	"	>0.31	0.31
Tomato	"	0.028*	0.017
Turnip	phytotoxicity	0.034*	0.006**
Corn	"	0.34**	0.09**
Oat	shoot length	0.056	0.004***
Onion	"	0.032*	0.001
Ryegrass	"	0.048*	0.017

*Determined using linear interpolation.

**Based on visual evaluation.

***Based on the EC₅ value from the probit model.

Results for most sensitive parameter of most sensitive species

	Monocot	Dicot
Species	onion	lettuce
Parameter	shoot length	shoot length
EC ₂₅ (lb ai/A)	0.028 0.032	0.0033
95% C.I. (lb ai/A)	0.011 - 0.066 ?	0.0003 - 0.028
NOEL (lb ai/A)	0.017 0.001	0.0012

14. **REVIEWER'S COMMENTS:** The results are scientifically sound and fulfill the guideline requirements. The study is classified as **Core**.

cabbage shoot length

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WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	1.633	1.633	1.633
2	0.0056 lb ai/A	3	1.600	1.600	1.600
3	0.012 lb ai/A	3	1.367	1.367	1.367
4	0.023 lb ai/A	3	0.700	0.700	0.767
5	0.042 lb ai/A	3	0.833	0.833	0.767
6	0.090 lb ai/A	3	0.700	0.700	0.700
7	0.11 lb ai/A	3	0.333	0.333	0.433
8	0.23 lb ai/A	3	0.533	0.533	0.433

cabbage shoot length

File: cab 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
Form. Con.	1.633				
0.0056 lb ai/A	1.600	0.111		1.75	k= 1, v=16
0.012 lb ai/A	1.367	0.890		1.83	k= 2, v=16
0.023 lb ai/A	0.767	2.893	*	1.86	k= 3, v=16
0.042 lb ai/A	0.767	2.893	*	1.87	k= 4, v=16
0.090 lb ai/A	0.700	3.116	*	1.88	k= 5, v=16
0.11 lb ai/A	0.433	4.006	*	1.89	k= 6, v=16
0.23 lb ai/A	0.433	4.006	*	1.89	k= 7, v=16

s = 0.367

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

NOEL = 0.012 lb ai/A

cabbage shoot length

Estimated EC Values and Confidence Limits

Point	Conc.	Lower	Upper
		95% Confidence Limits	95% Confidence Limits
EC 1.00	0.0022	0.0009	0.0038
EC 5.00	0.0051	0.0027	0.0077
EC10.00	0.0080	0.0048	0.0112
EC15.00	0.0108	0.0070	0.0145
EC50.00	0.0391	0.0320	0.0476
EC85.00	0.1414	0.1054	0.2175
EC90.00	0.1917	0.1364	0.3191
EC95.00	0.3009	0.1991	0.5654
EC99.00	0.7012	0.4014	1.6668

$$EC_{25} = 0.017 \text{ } \mu\text{m}/\text{A}$$

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OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4	Y5	Y6
1	0.000	-1.92082	1.8	1.7	1.4	.	.	.
2	0.012	-1.37675	1.1	1.7	1.3	.	.	.
3	0.042	-1.37675	0.8	1.1	0.6	.	.	.
4	0.110	-0.95861	0.5	0.0	0.5	.	.	.

cabbage shoot length
 MODEL: COUNT = CO * PROBNORM ((LOG_EC50 - LOG_CONC) / SIGMA)
 WEIGHTED REGRESSION 14:19 Monday, July 20, 1998

Non-Linear Least Squares Iterative Phase

Iter	Dependent Variable	COUNT	Method: Gauss-Newton	Weighted SS
0	LOG_EC50	SIGMA	CO	0.874926
1	-1.409000	0.539000	1.630000	0.835215
2	-1.373678	0.514604	1.622960	0.837307
3	-1.373401	0.512563	1.621882	0.837335
4	-1.373320	0.512452	1.621790	0.837335
5	-1.373315	0.512445	1.621784	0.837335
6	-1.373315	0.512444	1.621783	0.837335
7	-1.373315	0.512444	1.621783	0.837335

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable	COUNT
Regression	3	12.500000000	4.166666667		
Residual	9	0.837335125	0.093037236		
Uncorrected Total	12	13.337335125			
(Corrected Total)	11	4.648722311			

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Upper	Asymptotic 95 %
LOG_EC50	-1.373314529	0.14369856715	-1.6983860381	-1.0482430204	
SIGMA	0.512444137	0.16822418654	0.1318913503	0.8929969232	
CO	1.621783486	0.21477384411	1.1359271618	2.1076398093	

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1		
SIGMA	-0.675666202	1	
CO	-0.758647485	0.5182784062	1

cabbage shoot length
 MODEL: COUNT = CO * PROBNORM ((LOG_EC50 - LOG_CONC) / SIGMA)
 SUMMARY OF NONLINEAR REGRESSION 14:19 Monday, July 20, 1998

OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-1.37331	0.51244	1.62178	0.83734	0.042334

cabbage shoot length
 MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
 WEIGHTED REGRESSION 14:19 Monday, July 20, 1998

Non-Linear Least Squares Iterative Phase

Iter	Dependent Variable	COUNT	Method: Gauss-Newton	Weighted SS
0	LOG_EC25	SIGMA	CO	0.875974
1	-1.773000	0.539000	1.630000	0.875974

1	-1.720787	0.514637	1.622962	0.835171
2	-1.719121	0.512565	1.621883	0.837307
3	-1.718964	0.512452	1.621790	0.837333
4	-1.718954	0.512445	1.621784	0.837335
5	-1.718953	0.512444	1.621783	0.837335
6	-1.718953	0.512444	1.621783	0.837335
7	-1.718953	0.512444	1.621783	0.837335

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable	COUNT
Regression	3	12.500000000	4.166666667		
Residual	9	0.837335125	0.093037236		
Uncorrected Total	12	13.337335125			
(Corrected Total)	11	4.648722311			

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Upper	Asymptotic 95 %
LOG_EC25	-1.718952975	0.23570523114	-2.2521597888	-1.1857461613	
SIGMA	0.512444137	0.16822418654	0.1318913503	0.8929969232	
CO	1.621783486	0.21477384411	1.1359271618	2.1076398093	

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1		
SIGMA	-0.893309816	1	
CO	-0.71200495	0.5182784062	1

cabbage shoot length
 MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
 SUMMARY OF NONLINEAR REGRESSION 14:19 Monday, July 20, 1998

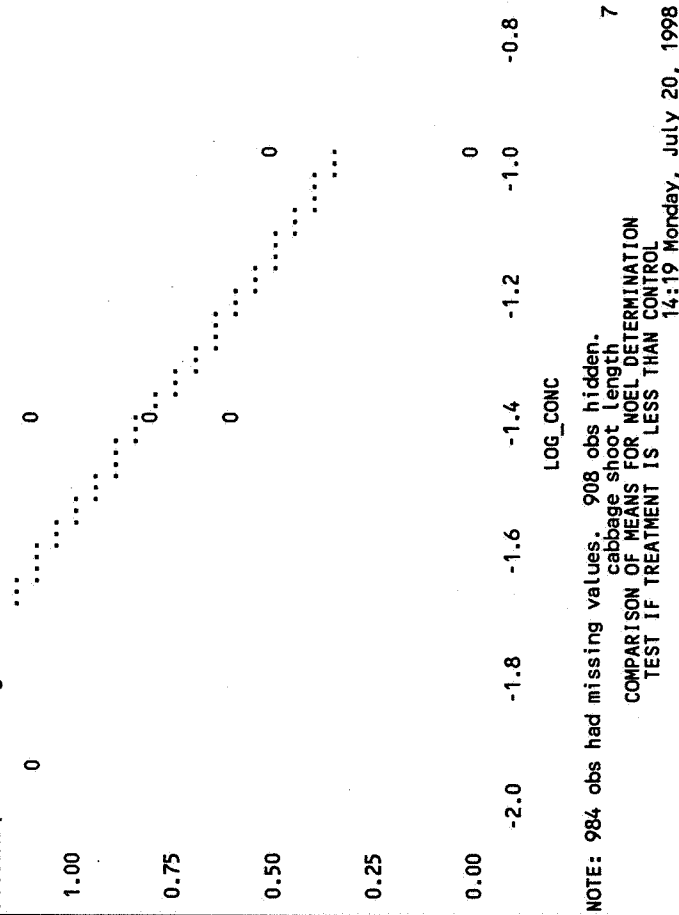
OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.71895	0.51244	1.62178	0.83734	0.019101

cabbage shoot length
 MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
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Plot of COUNT*LOG_CONC. Symbol used is 'O'.

Plot of PRED*LOG_CONC. Symbol used is 'O'.

COUNT	2.00
1.75	0
1.50	0
1.25	0

General Linear Models Procedure
Class Level Information

Class	Levels	Values
DOSE	4	0 0.11 0.012 0.042

Number of observations in data set = 24

NOTE: Due to missing values, only 12 observations can be used in this analysis.

cabbage shoot length
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Dependent Variable: RESPONSE				
Source	DF	Sum of Squares	Mean Square	F Value Pr > F
Model	3	3.00250000	1.00083333	14.13 0.0015
Error	8	0.56666667	0.07083333	
Corrected Total	11	3.56916667		
R-Square		C.V.	Root MSE	RESPONSE Mean
0.841233		25.54995	0.266145	1.041667

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	3	3.00250000	1.00083333	14.13	0.0015
Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	3	3.00250000	1.00083333	14.13	0.0015

cabbage shoot length
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Level of DOSE	N	Mean	SD
0	3	1.63333333	0.20816660
0.11	3	0.33333333	0.28867513
0.012	3	1.36666667	0.30550505
0.042	3	0.83333333	0.25166115

cabbage shoot length
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 8 MSE= 0.070833
Critical Value of Dunnett's T= 2.416
Minimum Significant Difference= 0.5251

Comparisons significant at the 0.05 level are indicated by ****.

DOSE Comparison	Simultaneous Lower Confidence Limit		Difference Between Means		Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit	Mean	Mean	Upper Limit	Lower Limit
0.012 - 0	-0.7918	-0.2667	-0.2667	-0.2667	0.2584	***
0.042 - 0	-1.3251	-0.8000	-0.8000	-0.8000	-0.2749	***
0.11 - 0	-1.8251	-1.3000	-1.3000	-1.3000	-0.7749	***

cucumber shoot length

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WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	9.200	9.200	9.717
2	0.019 lb ai/A	3	10.233	10.233	9.717
3	0.039 lb ai/A	3	7.933	7.933	7.933
4	0.077 lb ai/A	3	5.867	5.867	5.867
5	0.16 lb ai/A	3	4.633	4.633	4.633
6	0.31 lb ai/A	3	3.267	3.267	3.267

cucumber shoot length

File: cuc 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
Form. Con.	9.717				
0.019 lb ai/A	9.717	1.166		1.78	k= 1, v=12
0.039 lb ai/A	7.933	2.859	*	1.87	k= 2, v=12
0.077 lb ai/A	5.867	7.524	*	1.90	k= 3, v=12
0.16 lb ai/A	4.633	10.307	*	1.92	k= 4, v=12
0.31 lb ai/A	3.267	13.392	*	1.93	k= 5, v=12

s = 0.543

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

NOEL = 0.019 lb ai/A

cucumber shoot length

Estimated EC Values and Confidence Limits

Point	Conc.	Lower	Upper
		95% Confidence Limits	Confidence Limits
EC 1.00	0.0047	0.0014	0.0095
EC 5.00	0.0133	0.0059	0.0218
EC10.00	0.0232	0.0124	0.0341
EC15.00	0.0338	0.0203	0.0464
EC50.00	0.1643	0.1344	0.2109
EC85.00	0.7994	0.5169	1.6454
EC90.00	1.1623	0.6991	2.7203
EC95.00	2.0240	1.0907	5.7452
EC99.00	5.7275	2.5007	23.4554

$$EC_{25} = 0.060 \text{ lb ai/A}$$

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OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4	Y5	Y6	11
1	0.000	-1.40894	9.1	9.1	9.4	.	.	.	
2	0.039	-1.11351	8.7	8.2	6.9	.	.	.	
3	0.077	-0.79588	6.5	5.6	5.5	.	.	.	
4	0.160	-0.50864	4.8	4.5	4.6	.	.	.	
5	0.310	-0.50864	2.8	3.4	3.6	.	.	.	

MODEL: COUNT = CO * PROBNCM ((LOG_EC50 - LOG_CONC) / SIGMA)
 WEIGHTED REGRESSION 14:19 Monday, July 20, 1998

Non-Linear Least Squares Iterative Phase				
Dependent Variable COUNT Method: Gauss-Newton				
Iter	LOG_EC50	SIGMA	Weighted SS	Weighted SS
0	-0.785000	0.620000	9.200000	0.625829
1	-0.795557	0.711586	9.307104	0.610376
2	-0.794307	0.708498	9.292437	0.610275
3	-0.794421	0.708822	9.293375	0.610303
4	-0.794410	0.708789	9.293279	0.610300
5	-0.794411	0.708792	9.293289	0.610300
6	-0.794411	0.708792	9.293288	0.610300
7	-0.794411	0.708792	9.293288	0.610300

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable COUNT
Regression	3	92.700000000	30.900000000	
Residual	12	0.610300044	0.050858337	
Uncorrected Total	15	93.310300044		
(Corrected Total)	14	12.441717491		

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95 % Confidence Interval
LOG_EC50	-0.794410917	0.05147100238	-0.9065567623 -0.682265071
SIGMA	0.708792160	0.08371900896	0.5263838402 0.891200479
CO	9.293287733	0.39188580437	8.4394406571 10.147134809

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1		
SIGMA	-0.38769161	1	
CO	-0.80812552	0.4939360262	1

MODEL: COUNT = CO * PROBNCM ((LOG_EC50 - LOG_CONC) / SIGMA)
 SUMMARY OF NONLINEAR REGRESSION 14:19 Monday, July 20, 1998

OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-0.79441	0.70879	9.29329	0.61030	0.16054

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
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Non-Linear Least Squares Iterative Phase				
Dependent Variable COUNT Method: Gauss-Newton				
Iter	LOG_EC25	SIGMA	Weighted SS	Weighted SS

0	-1.325000	0.662000	9.200000	0.625029
1	-1.275694	0.712096	9.307605	0.610314
2	-1.272142	0.708457	9.292328	0.610272
3	-1.272519	0.708826	9.293387	0.610303
4	-1.272481	0.708789	9.293278	0.610300
5	-1.272484	0.708793	9.293289	0.610300
6	-1.272484	0.708792	9.293288	0.610300
7	-1.272484	0.708792	9.293288	0.610300

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable COUNT
Regression	3	92.700000000	30.900000000	
Residual	12	0.610300044	0.050858337	
Uncorrected Total	15	93.310300044		
(Corrected Total)	14	12.441717490		

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95 % Confidence Interval
LOG_EC25	-1.272484141	0.08995258241	-1.4684762703 -1.076494012
SIGMA	0.708792160	0.08371900901	0.5263838405 0.891200480
CO	9.293287734	0.39188580442	8.4394406582 10.147134811

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1		
SIGMA	-0.849586617	1	
CO	-0.772478428	0.4939360259	1

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
 SUMMARY OF NONLINEAR REGRESSION 14:19 Monday, July 20, 1998

OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.27248	0.70879	9.29329	0.61030	0.053397

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
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Plot of COUNT*LOG_CONC. Symbol used is 'O'.
 Plot of PRED*LOG_CONC. Symbol used is 'O'.

COUNT	10	9	8	7
	0	0	0	0

6

5

4

3

2

-1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4

LOG_CONC

NOTE: 925 obs had missing values. 859 obs hidden.

cucumber shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION

TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure
Class Level Information

Class	Levels	Values
DOSE	5	0 0.16 0.31 0.039 0.077

Number of observations in data set = 30

NOTE: Due to missing values, only 15 observations can be used in this analysis.

cucumber shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION

TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Dependent Variable: RESPONSE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	69.51733333	17.37933333	62.37	0.0001
Error	10	2.78666667	0.27866667		
Corrected Total	14	72.30400000			

R-Square	C.V.	Root MSE	RESPONSE Mean

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	4	69.51733333	17.37933333	62.37	0.0001
Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	4	69.51733333	17.37933333	62.37	0.0001

cucumber shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION

TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Level of DOSE	N	Mean	SD
0	3	9.20000000	0.17320508
0.16	3	4.63333333	0.15275252
0.31	3	3.26666667	0.41633320
0.039	3	7.93333333	0.92915732
0.077	3	5.86666667	0.55075705

cucumber shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION

TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Dunnnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 10 MSE= 0.278667

Critical Value of Dunnnett's T= 2.466

Minimum Significant Difference= 1.0627

Comparisons significant at the 0.05 level are indicated by '***'.

DOSE Comparison	Simultaneous Lower Confidence Limit		Difference Between Means	Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit		Lower Limit	Upper Limit
0.039 - 0	-2.3294	-1.2667	-1.2667	-0.2040	***
0.077 - 0	-4.3960	-3.3333	-3.3333	-2.2706	***
0.16 - 0	-5.6294	-4.5667	-4.5667	-3.5040	***
0.31 - 0	-6.9960	-5.9333	-5.9333	-4.8706	***

lettuce shoot length

File: let Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	1.033	1.033	1.167
2	0.0012 lb ai/A	3	1.300	1.300	1.167
3	0.0043 lb ai/A	3	0.867	0.867	0.867
4	0.017 lb ai/A	3	0.800	0.800	0.800
5	0.043 lb ai/A	3	0.633	0.633	0.633
6	0.34 lb ai/A	3	0.000	0.000	0.000

lettuce shoot length

File: let 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
Form. Con.	1.167				
0.0012 lb ai/A	1.167	1.333		1.78	k= 1, v=12
0.0043 lb ai/A	0.867	1.667		1.87	k= 2, v=12
0.017 lb ai/A	0.800	2.333	*	1.90	k= 3, v=12
0.043 lb ai/A	0.633	4.000	*	1.92	k= 4, v=12
0.34 lb ai/A	0.000	10.333	*	1.93	k= 5, v=12

s = 0.122

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

NOEL = 0.004 lb ai/A

lettuce shoot length

Estimated EC Values and Confidence Limits

Point	Conc.	Lower	Upper
		95% Confidence Limits	Confidence Limits
EC 1.00	0.0005	0.0000	0.0015
EC 5.00	0.0022	0.0005	0.0045
EC10.00	0.0050	0.0018	0.0082
EC15.00	0.0086	0.0043	0.0127
EC50.00	0.0850	0.0496	0.2680
EC85.00	0.8388	0.2665	12.2184
EC90.00	1.4420	0.3934	30.4175
EC95.00	3.2180	0.6992	117.7178
EC99.00	14.5024	2.0490	1495.1820

$$EC_{25} = 0.019^6 \text{ lb ai/A}$$

Lettuce shoot length						
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OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4
1	0.0000		1.1	1.1	0.9	
2	0.0043	-2.36653	0.8	0.9	0.9	
3	0.0170	-1.76955	0.9	0.7	0.8	
4	0.0430	-1.36653	0.8	0.6	0.5	

lattice shoot length

MODEL: COUNT = CO * PROBNCM ((LOG_EC50 - LOG_CONC) / SIGMA)

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Non-Linear Least Squares Iterative Phase						
Dependent Variable COUNT Method: Gauss-Newton						
Iter	LOG_EC50	SIGMA	CO	Weighted SS	Weighted MS	Dependent Variable COUNT
0	-1.071000	1.030000	1.030000	0.148391	0.148391	
1	-0.975628	1.172960	1.022640	0.141083	0.141083	
2	-0.944386	1.236200	1.026753	0.140332	0.140332	
3	-0.938590	1.273601	1.027736	0.140289	0.140289	
4	-0.937658	1.276392	1.027914	0.140278	0.140278	
5	-0.937515	1.276813	1.027941	0.140276	0.140276	
6	-0.937494	1.276875	1.027945	0.140276	0.140276	
7	-0.937491	1.276891	1.027946	0.140276	0.140276	
8	-0.937490	1.276886	1.027946	0.140276	0.140276	
9	-0.937490	1.276886	1.027946	0.140276	0.140276	

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable COUNT
Regression	3	10.000000000	3.333333333	
Residual	9	0.140275840	0.015586204	
Uncorrected Total	12	10.140275840		
(Corrected Total)	11	0.432450243		

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Confidence Interval Upper	Asymptotic 95 %
LOG_EC50	-0.937490362	0.32683839611	-1.6768564716	-0.1981242522	
SIGMA	1.276886407	0.59567000223	-0.0706242205	2.6243970345	
CO	1.027946209	0.07272633485	0.8634264102	1.1924660084	

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1	0.7208699344	-0.174842851
SIGMA	0.7208699344	1	0.4361795145
CO	-0.174842851	0.4361795145	1

MODEL: COUNT = CO * PROBNCM ((LOG_EC50 - LOG_CONC) / SIGMA)

SUMMARY OF NONLINEAR REGRESSION

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OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-0.93749	1.27689	1.02795	0.14028	0.11548

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

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Non-Linear Least Squares Iterative Phase

Dependent Variable COUNT Method: Gauss-Newton

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Lettuce shoot length						
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Iter	LOG_EC25	SIGMA	CO	Weighted SS	Weighted MS	Dependent Variable COUNT
0	-1.721000	0.962000	1.030000	0.148391	0.148391	
1	-1.767012	1.172819	1.022653	0.141094	0.141094	
2	-1.791687	1.256161	1.026753	0.140353	0.140353	
3	-1.797620	1.273595	1.027735	0.140289	0.140289	
4	-1.798571	1.276391	1.027914	0.140278	0.140278	
5	-1.798713	1.276813	1.027941	0.140276	0.140276	
6	-1.798734	1.276875	1.027945	0.140276	0.140276	
7	-1.798737	1.276885	1.027946	0.140276	0.140276	
8	-1.798737	1.276886	1.027946	0.140276	0.140276	
9	-1.798737	1.276886	1.027946	0.140276	0.140276	

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Source	DF	Weighted SS	Weighted MS	Dependent Variable COUNT
Regression	3	10.000000000	3.333333333	
Residual	9	0.140275840	0.015586204	
Uncorrected Total	12	10.140275840		
(Corrected Total)	11	0.432450243		

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Confidence Interval Upper	Asymptotic 95 %
LOG_EC25	-1.798737475	0.28093271275	-2.4342568303	-1.1632181188	
SIGMA	1.276886407	0.59567000219	-0.0706242205	2.6243970344	
CO	1.027946209	0.07272633485	0.8634264102	1.1924660084	

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1	-0.591477885	-0.827211282
SIGMA	-0.591477885	1	0.4361795145
CO	-0.827211282	0.4361795145	1

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

SUMMARY OF NONLINEAR REGRESSION

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OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.79874	1.27689	1.02795	0.14028	0.015895

MODEL: YOUNG = CO * PROBNCM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

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Plot of COUNT*LOG_CONC. Symbol used is '0'.

Plot of PRED*LOG_CONC. Symbol used is '1'.

COUNT

1.1

1.0

0.9 0

 0.8 0

 0.7 0

 0.6 0

 0.5 0

 -2.4 -2.2 -2.0 -1.8 -1.6 -1.4 -1.2

LOG_CONC

NOTE: 1022 obs had missing values. 952 obs hidden.
 lettuce shoot length
 COMPARISON OF MEANS FOR NOEL DETERMINATION
 TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure
 Class Level Information

Class	Levels	Values
DOSE	4	0 0.017 0.043 0.0043

Number of observations in data set = 24

NOTE: Due to missing values, only 12 observations can be used in this analysis.

lettuce shoot length
 COMPARISON OF MEANS FOR NOEL DETERMINATION
 TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Dependent Variable: RESPONSE					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	0.24666667	0.08222222	6.58	0.0149
Error	8	0.10000000	0.01250000		
Corrected Total	11	0.34666667			
R-Square		C.V.	Root MSE	RESPONSE Mean	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	3	0.24666667	0.08222222	6.58	0.0149
Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	3	0.24666667	0.08222222	6.58	0.0149

lettuce shoot length
 COMPARISON OF MEANS FOR NOEL DETERMINATION
 TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Level of DOSE	N	Mean	SD
0	3	1.03333333	0.11547005
0.017	3	0.80000000	0.10000000
0.043	3	0.63333333	0.15275252
0.0043	3	0.86666667	0.05773503

lettuce shoot length
 COMPARISON OF MEANS FOR NOEL DETERMINATION
 TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 8 MSE= 0.0125
 Critical Value of Dunnett's T= 2.416
 Minimum Significant Difference= 0.2206

Comparisons significant at the 0.05 level are indicated by '***'.

DOSE Comparison	Simultaneous		Difference Between Means	Simultaneous	
	Lower Confidence Limit	Upper Confidence Limit		Lower Confidence Limit	Upper Confidence Limit
0.0043 - 0	-0.38726	-0.16667	-0.16667	0.05392	***
0.017 - 0	-0.45392	-0.23333	-0.23333	-0.01274	***
0.043 - 0	-0.62059	-0.40000	-0.40000	-0.17941	***

tomato shoot length

File: tom Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	5.133	5.133	5.233
2	0.017 lb ai/A	3	5.333	5.333	5.233
3	0.032 lb ai/A	3	3.300	3.300	3.311
4	0.043 lb ai/A	3	3.200	3.200	3.311
5	0.090 lb ai/A	3	3.433	3.433	3.311
6	0.34 lb ai/A	3	0.000	0.000	0.000

tomato shoot length

File: tom 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
Form. Con.	5.233				
0.017 lb ai/A	5.233	0.331		1.78	k= 1, v=12
0.032 lb ai/A	3.311	6.037	*	1.87	k= 2, v=12
0.043 lb ai/A	3.311	6.037	*	1.90	k= 3, v=12
0.090 lb ai/A	3.311	6.037	*	1.92	k= 4, v=12
0.34 lb ai/A	0.000	17.006	*	1.93	k= 5, v=12

s = 0.370

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

NOEL = 0.017 lb ai/A

oat shoot length

File: oat

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	33.100	33.100	33.100
2	0.019 lb ai/A	3	31.333	31.333	31.333
3	0.039 lb ai/A	3	26.567	26.567	26.567
4	0.077 lb ai/A	3	23.567	23.567	23.567
5	0.16 lb ai/A	3	20.100	20.100	20.100
6	0.31 lb ai/A	3	18.100	18.100	18.100

oat shoot length

File: oat

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
Form. Con.	33.100				
0.019 lb ai/A	31.333	2.118	*	1.78	k= 1, v=12
0.039 lb ai/A	26.567	7.834	*	1.87	k= 2, v=12
0.077 lb ai/A	23.567	11.431	*	1.90	k= 3, v=12
0.16 lb ai/A	20.100	15.588	*	1.92	k= 4, v=12
0.31 lb ai/A	18.100	17.986	*	1.93	k= 5, v=12

s = 1.021

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

$$NOEL < 0.019 \text{ lb ai/A}, \therefore NOEL = EC_5 - (0.004 \text{ lb ai/A})$$

oat shoot length

Estimated EC Values and Confidence Limits

Point	Conc.	Lower	Upper
		95% Confidence Limits	Confidence Limits
EC 1.00	0.0005	0.0000	0.0030
EC 5.00	0.0035	0.0001	0.0115
EC10.00	0.0100	0.0009	0.0236
EC15.00	0.0202	0.0035	0.0389
EC50.00	0.4045	0.2428	1.4364
EC85.00	8.0929	1.9682	448.1771
EC90.00	16.4414	3.1873	1766.7835
EC95.00	46.9938	6.4974	13512.7871
EC99.00	336.8999	24.6226	615866.9400

$$EC_{25} = 0.059 \text{ } \mu\text{S}/\text{cm}$$

oat shoot length

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OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4	Y5	Y6
1	0.000		33.2	31.5	34.6	.	.	.
2	0.039	-1.40894	27.4	27.2	25.1	.	.	.
3	0.077	-1.11351	24.5	23.3	22.9	.	.	.
4	0.160	-0.79588	20.5	20.4	19.4	.	.	.
5	0.310	-0.50864	18.9	17.5	17.9	.	.	.

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MODEL: COUNT = CO * PROB NORM ((LOG_EC50 - LOG_CONC) / SIGMA)

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Non-Linear Least Squares Iterative Phase				
Dependent Variable COUNT Method: Gauss-Newton				
Iter	LOG_EC50	SIGMA	Weighted SS	CO
0	-0.393000	1.255000	33.100000	0.517299
1	-0.397167	1.263856	33.162339	0.516662
2	-0.397259	1.263406	33.161145	0.516666
3	-0.397257	1.263424	33.161193	0.516666

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	364.30000000	121.43333333
Residual	12	0.51666556	0.04305546
Uncorrected Total	15	364.81666556	
(Corrected Total)	14	16.39726008	

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Confidence Interval Upper	Asymptotic 95 %
LOG_EC50	-0.39725702	0.05857840837	-0.524888592	-0.269623441	
SIGMA	1.26342373	0.12731879633	0.986019499	1.540827970	
CO	33.16119255	0.68842548862	31.661240058	34.661145051	

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1	0.4550435578	-0.508252435
SIGMA	0.4550435578	1	0.3775390194
CO	-0.508252435	0.3775390194	1

MODEL: COUNT = CO * PROB NORM ((LOG_EC50 - LOG_CONC) / SIGMA)

SUMMARY OF NONLINEAR REGRESSION

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OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-0.39726	1.26342	33.1612	0.51667	0.40063

MODEL: YOUNG = CO * PROB NORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

WEIGHTED REGRESSION 14:19 Monday, July 20, 1998

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Non-Linear Least Squares Iterative Phase				
Dependent Variable COUNT Method: Gauss-Newton				
Iter	LOG_EC25	SIGMA	Weighted SS	CO
0	-1.230000	1.255000	33.100000	0.523165
1	-1.249730	1.264136	33.162726	0.516662
2	-1.249409	1.263396	33.161116	0.516666
3	-1.249424	1.263424	33.161194	0.516666

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics

Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	364.29999999	121.43333333
Residual	12	0.51666556	0.04305546
Uncorrected Total	15	364.81666555	
(Corrected Total)	14	16.39725962	

Parameter	Estimate	Asymptotic Std. Error	Confidence Interval Lower	Confidence Interval Upper	Asymptotic 95 %
LOG_EC25	-1.24942392	0.07891678507	-1.421369075	-1.077478761	
SIGMA	1.26342416	0.12731885868	0.986019787	1.540828530	
CO	33.16119372	0.68842550280	31.661241189	34.661146243	

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1	-0.750405012	-0.788094632
SIGMA	-0.750405012	1	0.3775389004
CO	-0.788094632	0.3775389004	1

MODEL: YOUNG = CO * PROB NORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

SUMMARY OF NONLINEAR REGRESSION

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OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.24942	1.26342	33.1612	0.51667	0.056309

MODEL: YOUNG = CO * PROB NORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

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Plot of COUNT*LOG_CONC. Symbol used is 'O'.

Plot of PRED*LOG_CONC. Symbol used is 'I'.

COUNT

35.0

32.5

30.0

27.5

25.0

0

0

...

0

.....

0

.....

0

22.5

20.0

17.5

-1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4

LOG_CONC

NOTE: 925 obs had missing values. 865 obs hidden.

oat shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure
Class Level Information

Class	Levels	Values
DOSE	5	0 0.16 0.31 0.039 0.077

Number of observations in data set = 30

NOTE: Due to missing values, only 15 observations can be used in this analysis.

oat shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Dependent Variable: RESPONSE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	417.5840000	104.3960000	92.93	0.0001
Error	10	11.2333333	1.1233333		
Corrected Total	14	428.8173333			

R-Square	C.V.	Root MSE	RESPONSE Mean
0.973804	4.364017	1.059874	24.28667

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	4	417.5840000	104.3960000	92.93	0.0001
Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	4	417.5840000	104.3960000	92.93	0.0001

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oat shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Level of DOSE	N	Mean	SD
0	3	33.1000000	1.55241747
0.16	3	20.1000000	0.60827625
0.31	3	18.1000000	0.72111026
0.039	3	26.5666667	1.27410099
0.077	3	23.5666667	0.85266640

oat shoot length

COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 10 MSE= 1.123333

Critical Value of Dunnett's T= 2.466

Minimum Significant Difference= 2.1337

Comparisons significant at the 0.05 level are indicated by '****'.

DOSE Comparison	Simultaneous Lower Confidence Limit		Difference Between Means		Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit	Mean	Limit		
0.039 - 0	-8.6670	-6.5333	-6.5333	***		
0.077 - 0	-11.6670	-9.5333	-9.5333	***		
0.16 - 0	-15.1337	-13.0000	-13.0000	***		
0.31 - 0	-17.1337	-15.0000	-15.0000	***		

onion shoot length

File: oni Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	8.667	8.667	8.883
2	0.0012 lb ai/A	3	9.100	9.100	8.883
3	0.0043 lb ai/A	3	6.667	6.667	6.667
4	0.017 lb ai/A	3	4.100	4.100	4.100
5	0.043 lb ai/A	3	3.933	3.933	3.933
6	0.34 lb ai/A	3	0.000	0.000	0.000

onion shoot length

File: oni 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
Form. Con.	8.883				
0.0012 lb ai/A	8.883	0.369		1.78	k= 1, v=12
0.0043 lb ai/A	6.667	3.402	*	1.87	k= 2, v=12
0.017 lb ai/A	4.100	7.769	*	1.90	k= 3, v=12
0.043 lb ai/A	3.933	8.052	*	1.92	k= 4, v=12
0.34 lb ai/A	0.000	14.743	*	1.93	k= 5, v=12

s = 0.720

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

$$NOEL = 0.001 \text{ lb ai/A}$$

ryegrass shoot length

File: rye Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Form. Con.	3	5.933	5.933	7.633
2	0.0012 lb ai/A	3	8.467	8.467	7.633
3	0.0043 lb ai/A	3	8.500	8.500	7.633
4	0.017 lb ai/A	3	6.633	6.633	6.633
5	0.043 lb ai/A	3	4.433	4.433	4.433
6	0.34 lb ai/A	3	3.933	3.933	3.933

ryegrass shoot length

File: rye 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
Form. Con.	7.633				
0.0012 lb ai/A	7.633	2.501	*	1.78	k= 1, v=12
0.0043 lb ai/A	7.633	2.501	*	1.87	k= 2, v=12
0.017 lb ai/A	6.633	1.030		1.90	k= 3, v=12
0.043 lb ai/A	4.433	2.207	*	1.92	k= 4, v=12
0.34 lb ai/A	3.933	2.943	*	1.93	k= 5, v=12

s = 0.832

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

NOEL = 0.017 lb ai/A